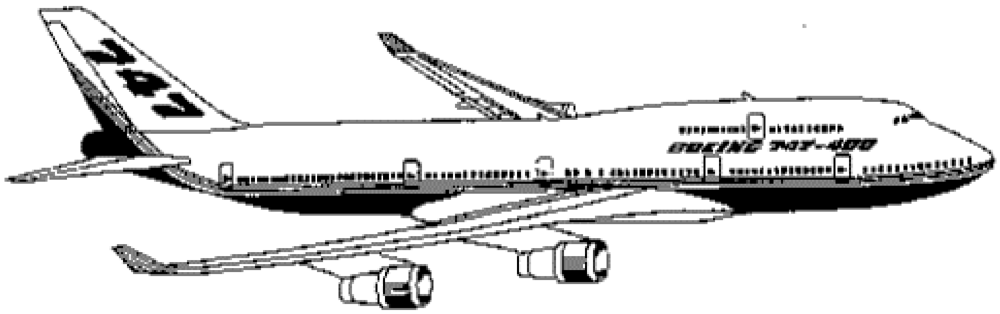
B747-400/PS1 FPLAN
Beta Release - v 1.0b



747

B747-400/PS1 FPLAN

SOFTWARE OPERATIONS MANUAL

REVISION NO: ORIG.

Foreword

Welcome to PS1FPLAN, the semi-automated flight planner for PS1. This flight planner is available for only MS-Excel97. It is tailored for the B747-400 with CF6-80C2B1F engines only. It is compatible with Takeoff Performance Calculator (PS1ATOG) v 1.1, and is released with a new copy of the same. It is imperative that PS1ATOG version released herewith is kept in the same directory as PS1FPLAN, since both programs use the output of each other in their computations.[1]

This program supports LBS and KGS, and supports the following types of flight operations:

- US Domestic FAR 121 Operations
- US FAR 121 International Operations
- US FAR 121 International Re-Dispatch/Re-Release Operations
- ICAO International Fuel Rules [2],[3]
- Up to three Equal Time Points for twin-engine failure/decompression
- No geographic alternate available (also known as "Island Reserve")

The output of the program can be printed out in the flight plan formats of the following airline:

AAL American Airlines[4]

The program supports the following speed schedules:

Constant Mach Cruise - M0.86[5]

A note from the author:

I wrote my first flight planning program back in 1995, a DOS based program in MacroAssembler (MASM) (yes, Assembler). The flight plan output was tailored against United's Unimatic FPF format, which they use for domestic operations, or other operations where Class II navigational information is not required. It was a very rudimentary program, and I no longer have any working copies of it (disk is lost). However, it was fairly accurate when comparing the output to book values. This program has been my most ambitious programming undertaking (why it has taken 6 months to release) When I first wrote PS1ATOG, I did not envision writing a flight planning program for PS1, since it was announced that there would be one released soon. However, I started tinkering with Excel, and some of the great circle trig formulas. If I couldn't get the great circle trig to work just so, then I wouldn't even begin to write FPLAN for obvious reasons. However, I was eventually able to get the great circle trig to work, and the rest is history. When Hardy/Aerowinx decides to update PS1 with configurations for the RB211 and the PW4056/PW4060 powerplants, I will update PS1FPLAN with their performance***, as long as I can get the true Boeing Operations Manual (FAA Regs., not JAA or UK) performance data charts for them***. I was able to get true Boeing data for the B747-400/CF6, in KGs, so writing PS1FPLAN, from a performance accuracy standpoint was a non-issue. While airline-written manuals are OK, I prefer the Boeing books because they include some rudimentary takeoff and landing performance charts, which I would need if I were to update FPLAN/ATOG with the other powerplants. Most, if not all, airline manuals do not include the Boeing versions of these charts, and to update the takeoff performance data, and have accurate cruise data, these charts would be of paramount importance.

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[1] It was attempted to combine the worksheets from the ATOG module to the FPLAN module, however, the program was evidently too large for Excel to handle (several of the listboxes refused to work correctly, it worked very slowly, and caused crashes 90% of the time). Therefore, BOTH the ATOG module and the FPLAN module must be opened in Excel for both of the programs to work correctly.
[2] Country-specific fuel rules can be programmed upon request. Registration MUST be made to take advantage of this.
[3] At this time, a maximum of 50 waypoints per flight plan is imposed for the beta-release version.
[4] This release version only supports flight plans in the AAL format.
[5] The full version will support M.85, LRC, and the Short-Range Cruise Speed Schedule

Once FPLAN is out in use, the initial set of bugs are worked out (I've tried to get rid of most) , and expanded to 120 fixes/flight plan, I intend to port it to other aircraft types, such as the B757, B737-300/-400, B767s, A319/A320, etc. I want to write a B767 flight planner so I can learn/practice the ETOPS Critical Fuel Scenario (I have a Boeing Performance Engineer Course Handbook for ETOPS to draw from), and ETOPS flight planning; and I want to write for the B737/A320/A319 so I can learn and practice Mountain Driftdown (some of the basic portions of the driftdown routines for a B737-300 program have been started by the time you read this). The B737-3 planner will be written only for North American operations, because that is where I have single-engine mountain driftdown information (what United Airlines calls Method I and II). Other than working around the circular reference problem for the preplan computations, flight planning and spreadsheets do actually work fairly well together.

I do envision PS1FPLAN to some day, be able to automatically generate ICAO formatted flight plans, plus completely automatic calculation of the ETP (is in work/research). Another thing I may do is to add additional flight plan output formats in PS1FPLAN. Once I started working the AAL format, I saw how cumbersome that is, and decided that one format is enough. Therefore, FPLAN will support the AAL DECS format for the near future. Granted, AA doesn't fly the 747-400, but their flight plan format is very clean (what one friend and dispatcher calls "eye friendly") and easy to read. Plus, I like the ability to put the navaid name as well. With all of those two-digit NDBs around the world, every little bit helps when you are dead tired after a 12 hour flight and trying to recall what/where CEA is! **If** I do decide to do additional flight plan formats, each version of PS1FPLAN will be tailored to a given airline's flight planning system and formats.

A few people have asked why I am making PS1FPLAN shareware. I figured that, with all of the work that has gone into it, such as the designing, coding, testing, punching in all of the performance data, writing the manual, drawing up all of the stored routes *(and getting them operationally correct),* etc., a reasonable amount would be fair. The initial database I used was a strictly US database, and I have manually added all of the oceanic/overseas (to me) navaids to it. I figure that I have spent at least 2-300+ hours on this program since late november (the manual alone has over 3000 editing minutes in it), so getting a little something in return isn't so bad. I will be using the proceeds from the registration fees to hopefully allow me to pursue getting my FAA license so that I will be maybe be able to do this for real – by getting the FAA Aircraft Dispatcher's license. Therefore, if after the eval period, you decide to keep it, I do ask that you please pay the registration fee. By doing so, you are guaranteed tech support (from me), free lifetime upgrades (to include the other airline tailored versions – in any event all future upgrades will be password/key protected to registered users only), and the feeling you did the right thing. I hope you enjoy it, that it helps you make PS1 the most realistic flight simulator available, without having access to an airline's sim training facility and flight planning mainframe computer system. I have tried to make this program as capable, and the outputs as operationally and mathematically accurate as programming in Excel will permit; without requiring one to have the three to six months training most airlines give their new hire dispatchers.

About me, I am 31, a travel agent, and live in Goshen, Indiana, USA. I am a military veteran, having worked on F15s and F16s in the Air Force. My airline experience includes being a ramp agent in MSP in the winter at Northwest Airlink I (9E), a crew scheduler/controller for Continental Express Airlines in Houston, and a Lead Agent/Ground Security Coordinator at United Express in South Bend. I have visited and spent many an hour at Northwest Airlines Dispatch at Minneapolis (MDD), and United Airlines System Operations Control (OPB) in Chicago, going over the shoulder with dispatchers and other operations control types, seeing how the whole airline flight operation is put together.

THIS PROGRAM IS DEDICATED TO BETH, MY WIFE, FOR HER TOTAL, ROCK SOLID PATIENCE WITH ME DURING THE WRITING AND TESTING OF BOTH PS1FPLAN AND PS1ATOG; TO THE ROCK GROUPS RUSH (DIFFERENT STAGES ROCKS! I WAS THERE IN CHICAGO THAT NIGHT!!!), JOURNEY, YES, AND PINK FLOYD (IN NO ORDER) FOR GIVING ME SOMETHING FANTASTIC TO LISTEN AND AIRDRUM TO WHILE RE-LEARNING THE FINER POINTS OF TRIGONOMETRY - FORGETTING MATH 111 SUCKS; TO RICHARD WAGNER, MOZART, SCHUBERT, HAYDN AND BEETHOVEN, FOR WRITING SOME ABSOLUTELY INCREDIBLE MUSIC TO WRITE EXCEL CODE AND PULL YOUR HAIR OUT TO; TO BOB AND TOM AT WFBQ-95 INDIANAPOLIS (YOU GUYS ROCK!!) FOR MAKING ME LAUGH AT CHICK, AND TO MY AIRLINE FLIGHT OPERATIONS FRIENDS, DG (DC10 F/E AND CREW-ROOM PACKRAT), MK (FLIGHT SCHEDULE DEVELOPER FOR A MAJOR US CARRIER), AND GO, PB, NH, AND MB (FLIGHT DISPATCHERS FOR SEVERAL US AIRLINES), ALL FOR PROVIDING ME WITH A VIRTUAL TON OF FLIGHT AND AIRCRAFT OPERATIONS MANUALS AND MOUNTAINS UPON MOUNTAINS OF REVISIONS, FLIGHT PLANS AND RELEASES, DIRECTION AND GUIDANCE, JEPP MANUAL CHARTS, AND COMPUTER SYSTEM DOWNLOADS. I HAVE LITERALLY A COMPLETE AIRLINE OPERATIONS/DISPATCH LIBRARY (MUCH TO THE FRUSTRATION OF BETH, OH WELL), SANS AIRPLANES, THANKS TO THEM. DOUG SNOW, GOSHEN, IN USA 1999

PS1FPLAN Flight Planning System - v 1.0
DS Software License Agreement

TERMS FOR USE This program and supporting documentation is distributed as SHAREWARE. That means that after a reasonable evaluation period, it must be registered with the author and paid for. A reasonable evaluation period is defined as 30 days from date of downloading. Registration costs 30.00USD[6], and entitles the user to free upgrades through the life of the program - no further upgrade fees ever will need to be paid by the USER. For registration instructions and other registration related information, please see http://takeoff.freeservers.com/register.html. Additionally, the program will work only with MS-Excel97, and is not backwards compatible due to the data structures, several spreadsheet instructions, and the sizes of several databases. This program is designed to allow the USER to make pre-flight calculations for PS1 flight operations (or other B747-400 flight simulators) only. **THIS PROGRAM IS NOT INTENDED FOR USE IN REAL WORLD FLIGHT OPERATIONS. NO WARRANTY FOR FITNESS OF USE IS INTENDED OR IMPLIED.** While every effort has been expended to make this program as realistic, mathematically and operationally accurate as possible, it shall not be used for supporting, in whole or in part, real-world flight operations under any circumstances without the permission of the author. While the aircraft performance data herein emanates from the FAA Approved Boeing Aircraft Operations Manual (Boeing Document D6-30151-4xx), this program is not FAA approved, and no such approval has been or shall be sought by the AUTHOR.

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REFUNDS – Due to the nature of shareware (you pay for it after you evaluate it), there will be no refunds. As with some airline tickets, this program is nonrefundable, with no exceptions.

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[6] Note - I will be using proceeds from the registration fees to pay for tuition at an airline operations school to obtain the FAA aircraft dispatcher license, so, if you decide to keep the program after the 30 day period (or any time before it), I do ask that you ***please*** register it. If you have problems with the program, suggestions, or require any type of tech support, only a paid registration will provide that. With enough paid registrations, I just may be able to do this for real ;-)

[7] Note - in some occasions totals may not add correctly due to rounding.

WARNING:
This program was designed using MS-Excel97. Additionally, it comes preprogrammed with the Excel Autocalc feature turned OFF. It is highly suggested that you leave it OFF while using PS1FPLAN. Due to the extreme complexity of the calculations, structures, and algorithms, if one were to leave it ON while attempting to fill out a setup form, it would take nearly forever to generate a flight plan solution! Nevertheless, if you do wish to have the autocalc feature turned ON, go to the Tools -> Options menu, Calculations tab, and select AutoCalc ON. To generate or rerun a flight plan after all of the information is filled in or in any way modified, type F9.

Update:

For registered users only - if you have a certain route that you would like to see programmed into PS1FPLAN, send an email to routerequest@takeoff.freeservers.com, and within 24 hours I will respond with an Excel97 file containing two worksheets (additional NavAids, and the Stored Route) that you can cut and paste from, and into the databases in PS1FPLAN. I normally check my email no later than 02-03Z each evening. However, this is only applicable for those parts of the world where I have navigational chart coverage (if I don't have it - I'll tell you). While my collection of Jepps is rather extensive, there are areas of the world where I do not have coverage, yet. Limit 3 routes per emailed request. Provide at a minimum the citypair, and any specific route requests or specifics (i.e., Polar route, via R220, avoid Indian airspace, etc.). Your registration number must be provided to use this service.

Note:
It is suggested that this manual be kept in a loose-leaf binder or other "form that is easy to revise." FAR 121.135(a)(2).

Table of Contents

[8] This release only contains the AAL format.

Chapter 0 - Manual Applicability

Background Data

Flight Performance Data for this program has come from many sources. Some sources include the Boeing B747-400 Aircraft Operations Manual, the Aircraft Operating Manual, Vol. I, portions of the B747-400 Flight Handbook, various handouts for B747-400 Systems Training, US FAR 121, US FAA Operations Specifications, the US Airman's Information Manual, and several US Major Airline's Flight Operations Manuals.

Navigation Data comes from various sources too numerous to mention.

Sincere thanks go to Mark Brodbeck for converting the manual to PDF format. Merci!

Chapter 1 - Fuel Rules

§ 1-1. US FAR 121 DOMESTIC RULES (US FAR 121.639, 647)

Per US FAR 121, the following defines the minimum fuel for a US Domestic flight:

- Burnoff to destination
- 45 minutes reserve fuel at normal cruising fuel consumption (NCFC)[9]
- Fuel for one missed approach at destination
- Fuel to most distant alternate, if required.

Additional fuel may be required as necessary considering:

- Fuel for any anticipated delays.
- Any other conditions that may delay the landing of the aircraft.

See § 5-5 for rules and considerations regarding the listing of destination alternate airports.

§ 1-2. US FAR 121 INTERNATIONAL OPERATIONS

The minimum fuel for an international operation (except transborder flights to Canada and Mexico, which are dispatched/released under the domestic rules) consists of the following:

- Fly to and land at the airport to which it is released
- After that, fly for 10% of the total time required to fly from the airport of departure, and the airport to which it was released.
- Thereafter, fly to and land at the most distant alternate, if one is required.
- Thereafter, fly for 30 minutes at 1500ft above the alternate airport (if required), or the destination airport if no alternate is required.
- Any additional fuel to meet ETP requirements.

Exceptions:

- If the flight is scheduled for not more than 6 hours, and the weather forecast indicates that no alternate airport is required, then no alternate airport need be listed.
- When the route flown does not have an available alternate airport for the destination, the total fuel requirements equal trip fuel plus 2 hours fuel at NCFC. This is called "Island Reserve". Note that neither contingency fuel nor the 30-min. international hold fuel is required to be loaded when using Island Reserve. This program will not call for such fuels when ISLD RSV is selected. Only the ISLD RSV fuel need be on board upon arrival. However, additional fuel may be loaded using EXTRA fuel.

See § 5-5 for rules and considerations regarding the listing of destination alternate airports.

§ 1-3. US FAR 121 - PLANNED RERELEASE OPERATIONS

Dispatching with a plan to redispatch while enroute (planned redispatch) is an FAA authorized procedure used in FAR 121 flag operations to minimize the amount of fuel required for compliance with the 10% international enroute fuel reserve requirement.

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[9] NCFC is defined at FL250, ISA+10

A flight dispatched with a plan to redispatch en-route is operating with two flight plans: the first is the original dispatch to the intermediate destination (RD DEST) and the second is the plan from the redispatch fix (RDFIX) to the intended destination. After redispatch, the terms of the redispatch are operative and cannot be changed, except with the concurrence between the Captain and the Dispatcher.

REDISPATCH FIX (RD FIX). The position of the RDFIX is normally planned at a point relatively late in the flight (at least 2/3 of the way to the final destination to lessen the 10% reserve requirement). The RDFIX is selected to optimize the redispatch benefit considering the conditions existing along the route. The RDFIX need not be an ATC designated fix, but must be a fix listed in the flightplan, and be stored in the NAVDATA database.

SHORT-RELEASE DESTINATION (RD DEST). This is the planned landing point if the redispatch is unacceptable. Note, however, that the ATC filed flight plan is from the planned origin airport to the planned destination, and not the RD DEST. If a divert to the RD REST is required, a revised clearance from ATC is required, as well as reprogramming the FMCS – some carriers suggest the RRLS Flight Plan to be stored in the ROUTES 2 section of the FMCS.

SHORT-RELEASE ALTERNATE (RD ALTN). This is the destination alternate airport for the RD DEST. There must be an alternate for the short-release destination if the segment time from the origin to the RD DEST is 6 hours or longer.

REDISPATCH BENEFIT. On long flights, the 10% reserve fuel value can be substantially greater than the amount required to conduct a safe operation; in some cases, the only way a flight may be dispatched nonstop is under re-release except with an extraordinarily light payload; flights such as ORDHKG, LAXHKG, LAXSYD, SYDSFO can only operate as a nonstop operation with re-dispatch. The benefit of redispatch is realized by reducing the 10% reserve fuel required for a straight dispatch to the 10% value required from the point of redispatch to the intended destination. The planned redispatch fuel enroute results in a takeoff fuel load that includes at least the following:

- Fuel burnout to the intended destination
- Fuel for 10% of the flight time from the RDFIX to the intended destination.
- Fuel to the intended destination alternate. (NOTE: If the segment from the RDFIX to the intended destination is less than 6 hours, a destination alternate is only required if the weather is less than those minimums for no-alternate operations.)
- International 30 minute hold.

The following example of a B767-300ER operation between LGWDFW illustrates the benefit of redispatching in flag operations:

```
         ARPT     FUEL TIME DIST          FUEL TIME DIST
DEPT     LGW
TAXI             00960 0020              00960 0020
RDFIX    DBQ
FUBO     DBQ    098809 0838 3750   DBQ  098809 0838 3750
----------------------------------------------------------------
DEST     ORD    002170 0014 0127   DFW  013475 0147 0664
E/RSV            08088 0052              01710 0011
RSV              05000 0030              05000 0030
ADD                                      00000
1ST ALTN MKE     02870 0014 0062   DAL   01435 0007 0008 FL030
2ND ALTN                           OKC   07175 0035 0155 FL240
HOLD                                     00000 0000
MEL/CDL          00000                   00000
                ------                  ------
                           PLN RRLS     027360
TOTAL    ORD    117897            DFW   126169

RLS FUEL LGW                            127000
```

Or the same flight, using a straight-release:

```
         ARPT     FUEL  TIME DIST
DEPT     LGW
TAXI             00960  0020
-----------------------------------
DEST     DFW    112284  1025 4414
E/RSV            09798  0103
RSV              05000  0030
1ST ALTN DAL     01435  0007 0008 FL030
2ND ALTN OKC     07175  0035 0155 FL240
HOLD             00000  0000
MEL/CDL          00000
                ------
RLS FUEL LGW    135217
```

As you can see, there is an 8217 lb. Difference in the minimum release fuel between the Re-release example and the straight-release example. This difference can equal more payload, less fuel uplift, or a lighter takeoff weight on a weight-restricted runway.

Paragraph B44, US FAR 121 Operations Specifications (OpSpecs), Flag Air Carriers:

"B44. **Planned Redispatch or Rerelease Enroute** (1/11/88). The certificate holder is authorized to conduct "planned redispatch" or "planned rerelease enroute" operations only within the areas of enroute operation where this paragraph is referenced in para. B50 of these operations specifications. The certificate holder shall conduct all planned redispatch or rerelease enroute operations in accordance with the provisions of this paragraph, and shall conduct no other planned redispatch or rerelease procedures outside the United States.

a) *Planned Redispatch or Rerelease Enroute Authorization*. The certificate holder is authorized to conduct planned redispatch or rerelease enroute operations under FAR 121.631(c) provided all requirements of these operations specifications and the appropriate FAR's, applicable to original dispatch or flight release, including weather, terminal and enroute facilities, and fuel supply requirements are met at the time of redispatch or rerelease. For the purpose of these operations specifications, a redispatch or rerelease enroute operation is a flight which is reinitiated at a predetermined redispatch or rerelease position in-flight, rather than from a departure airport.

b) *Special Limitations and Provisions.* The certificate holder shall not conduct planned redispatch or rerelease enroute operations unless all of the following conditions are met.

1) Special operational analyses (which include alternate airports, the fuel required, the routes to be flown, and the estimated times enroute) must be prepared for the route of flight from the departure airport to the destination airport specified in the original dispatch or flight release, and for the route(s) of flight from the planned departure airport to the destination airport(s) specified in the planned redispatch or rerelease.

2) The operational analyses specified in subparagraph b(1) above shall both be provided to both the pilot-in-command and the dispatcher (or the person designated to exercise operational control for supplemental operations).

3) Any planned redispatch or rerelease point must be specified in the original dispatch or release and in the required operational analyses.

4) Any redispatch or rerelease point must be a position common to the routes specified by the operational analyses required by subparagraph b(1).

5) The provisions of FAR 121.601(a) or FAR 121.603(a), as applicable, must be met when designating destination and alternate airports in the planned redispatch or rerelease.

6) Within two hours prior to the flights arrival at the designated redispatch or rerelease point, and prior to executing the redispatch or rerelease, the pilot-in-command must be provided with the additional information concerning weather conditions, ground facilities, and services at the destination and alternate airports required by FAR 121.601(c) or FAR 121.603(b), as applicable. If the route of flight to be used to the new destination airport is different from the planned route, the new route of flight must be specified.

7) Upon reaching any redispatch or rerelease point specified in a dispatch or release, the certificate holder shall operate the flight as dispatched or released unless the pilot in command receives and explicitly accepts the redispatch or rerelease to the new destination airport. The certificate holder shall not authorize the flight to proceed to a new destination airport, unless the pilot in command of that flight forwards a message through an aeronautical communications service specifically stating concurrence with the redispatch or rerelease.

8) The certificate holder shall not conduct planned redispatch or rerelease enroute operations using fuel supplies less than the fuel supply required by the basic provisions of FAR 121.645, without a deviation.

§ 1-3. ICAO Fuel Rules.

The ICAO specifies that the following minimum fuel shall be carried on an air-carrier flight:

- Fuel to destination
- Fuel to most distant alternate
- Fuel to hold for 30 minutes at 1500ft over the alternate airport, or the destination airport if no alternate airport is required.
- Fuel to meet ETP requirements if required.

Most European countries have requirements which exceed the ICAO rules, and are used in this program. Therefore, this program reflects the rules for most European countries, which exceeds the ICAO requirements. To use these rules, however, select ICAO in the Rules listbox on the FLIGHT SETUP screen.

- Fuel to destination
- 5% Enroute Reserve. In PS1FPLAN, this fuel amount is calculated based on the estimated landing weight, plus 7500 lbs.
- Fuel to most distant alternate
- Fuel to hold for 30 minutes at 1500ft over the alternate airport, or the destination airport if no alternate airport is required.
- Fuel to meet ETP requirements if required.

§ 1-5. US Fuel Rules Overview

US FAR 121 Fuel Requirements	US Flag Operations, International flights. (Hawaiian Islands are considered international), FAR 121.621	Flag Operations, Flight Subject to Re-release/re-dispatch procedures (OpSpecs para. B44)	US Flag Operations No Alternate Available (also called Island Reserve)	US Domestic Operations, FAR 121.639
Trip Fuel	Fuel burnoff to destination, plus one missed approach*	Fuel burnoff to destination, plus one missed approach*	Fuel burnoff to destination, plus one missed approach*	Fuel burnoff to destination, plus one missed approach*
IFR Reserve	10% of the Total Trip Time. Calculated at the weight at the Top-Of-Descent over the Destination.	10% of the trip time from the re-release point to the planned destination	2 hours reserve at Normal Cruising Fuel Consumption**	45 minutes at Normal Cruising Fuel Consumption*
Alternate Airport for Destination Fuel Planning	Fuel to the most distant alternate, if an alternate is required. In PS1FPLAN, a minimum of 15 minutes alternate burnoff is hardcoded into the program (Approx. 7400 lbs)	An alternate is not required if the enroute time for either segment, pre-redispatch or post-redispatch is less than 6 hours. However, if any segment (pre/post redispatch) is more than 6 hours, then an alternate is required for that segment. In PS1FPLAN, a minimum of 15 minutes alternate burnoff is hardcoded into the program (Approx. 7400 lbs)	Alternate Airport Geographically Not Available.	Fuel to the most distant alternate, if an alternate is required. In PS1FPLAN, a minimum of 15 minutes alternate burnoff is hardcoded into the program (Approx. 7400 lbs)
Destination Alternate Requirements	At least one alternate must be named for each destination. However, if the flight is less than 6 hours, and the WX is forecast to be at or above the following minima, an alternate airport is not required. Ceiling minimum of 1500ft above the lowest circling MDA, if a circling approach is <u>required and authorized</u> for that airport; or, a ceiling of at least 1500ft above the lowest published instrument minimum, or 2000 ft above the airport elevation, whichever is greater. The visibility will be at least 3 miles, or 2 miles more than the lowest applicable visibility minimum for the approach to be used.		Alternate Airport is Geographically Not Available.	An alternate airport is required if, for one hour before/after the ETA, the weather (WX) is forecast to be below 2000ft ceilings, 3 mi. visibility (the 1-2-3 rule). Additionally, if the WX is marginal at one alternate, an additional alternate is mandatory. Note also, some airlines require an alternate for ANY airport with only one landing runway (e.g., SAN)
Contingency Fuel	30 Minutes fuel holding at 1,500ft above the alternate airport, or destination if no alternate required.	30 Minutes fuel holding at 1,500ft above the alternate airport, or destination if no alternate required.	No regulatory requirement.	Fuel required for any anticipated delays. If none, a good number to plan is 30 mins. See the Hold Fuel Model, § 1-6.

<table>
<tr><th>US FAR 121 Fuel Requirements</th><th>US Flag Operations, International,</th><th>Flag Operations, Flight Subject to Re-release/re-dispatch procedures (para. B44)</th><th>US No Alternate Available (e.g., such as operations to TXKF/BDA)</th><th>US Domestic Operations, Domestic Air Carriers</th></tr>
<tr><td>Alternate Airport for Takeoff</td><td colspan="4">Required if the forecast/actual weather conditions at the time of takeoff are below CAT I landing minimums (or higher if the Captain doesn't meet the 100-hour criteria under FAR 121.652, see § 5-4). For the B747 (Classic through -400) the takeoff alternate is limited to any airport meeting alternate criteria that is within 2 hours flight time, with an engine inoperative (since you can not return to the airport of departure since it is below CAT I landing minimums). For the B747-400, this is 850NM. Any time takeoff is contemplated using lower than standard minimums (or the captains high-minimums if required), a takeoff alternate must be planned. This alternate airport must meet alternate airport criteria, and be listed on the dispatch release, in the RLS RMKS section.</td></tr>
<tr><td>Equal-Time-Point Planning</td><td colspan="3">Required if the flight will be more than 90 minutes from an alternate airport at any point along the route of flight. See ETP Planning (§ 2-3) for more information. Any airport chosen for an ETP alternate must meet alternate criteria. Diversion fuel equals diversion burnoff fuel, and a 15 min. hold at 1,500ft above the divert alternate. This hold fuel has already been computed in the ETP burnoff fuel calculated by the program.</td><td>Equal Time Points are not planned for domestic operations, since domestic operations shall not exceed the 90 minute rule.</td></tr>
<tr><td>Minimum Fuel On Board for Arrival</td><td colspan="4">While not a regulatory requirement (subject to change with the new, impending FAA Fuel Policy Advisory Circular), the US carriers use a minimum of 30-35,000 lbs. For the B747-400. This program will display a caution at/less than 25000 lbs. of landing fuel.</td></tr>
<tr><td colspan="5">* Missed approach fuel has been taken into account in the descent fuel.
** NCFC is defined as FL250, ISA+10C, at planned landing weight.</td></tr>
</table>

§ 1-6. THE HOLD FUEL MODEL

The Hold Fuel Model is one US carriers' answer to the question, "how much contingency fuel is enough for this flight?" Setup for their major domestic airports, it gives the statistical best level of contingency fuel. If at least this amount is boarded, then there is statistically less than 1 in several million that a flight will have to divert for fuel should enroute/terminal holds commence to that airport. See the sample below:

Time(Z) Class	1	2	3	4	5
0600-1259	20	20	23	30	34
1300-1630	19	23	28	35	38
1631-2130	22	37	37	37	41
2131-2259	26	28	28	30	34
2300-0045	35	35	35	65	65
0046-0245	25	28	33	44	44
0246-0559	29	32	32	42	42

Forecast Weather Classification *(classifications are the same for all station tables)*

	1	2	3	4	5
Ceiling (ft)	3000+	2000-3000	1000-2000	500-1000	-500
Visibility (mi)	5+	3-5	1-3	1/2 - 1	- 1/2
TRW in vic.	NO	NO	NO	NO	YES

The table is divided by ETA (in GMT) along the left, and weather class along the top. For example, if our B747 was arriving at 2252Z, with a forecast of `15 OVC 2` (class 2 weather), **at least** 28 minutes of contingency fuel should be boarded. As another example, if our B747 was planned to arrive at 0023Z, and the weather is forecast to be `10 OVC 1RW/-TRW PROB60 5 OVC 1/2 TRW AFT 00Z`, our minimum contingency fuel boarded should be **at least** 65 minutes. Additionally, if our B747 was planned to arrive at 1631Z, and the weather is severe VFR, minimum contingency should be **at least** 22 minutes.[10]

Hold Fuel Models have been calculated for DEN, ORD, SFO, LAX, SEA, IAD, JFK, & EWR. Other stations have been prepared, but are not authorized for the B747, and therefore not shown. (i.e., LGA).

[10] The amounts given are guidelines, and may not be applicable in all situations. These tables do not lessen the requirement for careful flight planning, or interfere on the PIC authority under FAR 91.3

§1-6(a) HOLD FUEL MODEL DESTINATION STATION TABLES

KORD - Chicago O Hare

Time(Z) Class	1	2	3	4	5
0500-0730	25	25	25	27	48
0731-1259	17	19	20	23	43
1300-1530	17	21	26	46	46
1531-1730	21	21	34	36	48
1731-1959	22	29	29	29	48
2000-2359	22	26	27	36	45
0000-0459	32	32	33	33	57

KDEN - Denver

Time(Z) Class	1	2	3	4	5
0600-1259	20	20	23	30	34
1300-1630	19	23	28	35	38
1631-2130	22	37	37	37	41
2131-2259	26	28	28	30	34
2300-0045	35	35	35	65	65
0046-0245	25	28	33	44	44
0246-0559	29	32	32	42	42

KSFO - San Francisco

Time(Z) Class	1	2	3	4	5
0000-0759	39	36	47	47	50
0800-1530	27	27	27	27	34
1531-2359	36	38	43	45	45

KLAX - Los Angeles

Time(Z) Class	1	2	3	4	5
0700-1300	17	17	18	22	22
1301-1930	22	24	24	24	24
1931-2230	22	22	29	29	29
2231-0659	23	23	23	29	29

KSEA - Seattle/Tacoma

Time(Z) Class	1	2	3	4	5
0700-1530	19	19	19	19	23
1531-2115	19	23	23	26	34
2116-0259	15	22	22	22	27
0300-0659	20	27	27	27	27

KIAD - Washington/Dulles

Time(Z) Class	1	2	3	4	5
0400-1000	35	35	35	35	41
1001-1300	24	27	28	31	41
1301-1600	24	27	28	31	49
1601-1730	35	40	40	45	45
1731-0359	32	37	39	42	55

KJFK - New York Kennedy Int'l

Time(Z) Class	1	2	3	4	5
0400-1000	20	20	37	53	53
1001-1230	20	23	54	54	54
1231-2359	27	33	43	77	77
0000-0359	30	30	52	53	53

KEWR - Newark

Time(Z) Class	1	2	3	4	5
0400-1000	30	44	44	46	46
1001-1530	18	30	35	46	46
1531-2059	24	37	52	57	57
2100-0059	31	47	53	67	67
0100-0359	27	40	40	46	46

§ 1-7. TYPES OF EXTRA FUEL

Most airlines recognize several types of extra fuel beyond that minimum required by regulations. PS1FPLAN can list one type of extra fuel and display it on the flight plan and flight release. Those types of extra fuel are:

TANKER	Fuel carried for cost savings or operational considerations, such as fuel shortage at the destination, extraordinarily high fuel cost, etc.
TOPOFF	Fuel not required, but strongly desired by the dispatcher for operational reasons (e.g., weather, ATC delays) which have a high probability of developing. ***A flight may be delayed for TOPOFF fuel.***
MEL ADD	Fuel required to meet Minimum Equipment List requirements, such as inoperative boost pumps, etc.
CAPT ADD	Additional fuel desired by the captain.
EXTRA	Fuel not required, but desired by the dispatcher for operational reasons (e.g., weather, ATC delays) which may or may not develop. Fuel is only boarded if load permits and no delay is taken. ***Delays solely to board fuel declared as EXTRA on the flight release are not authorized.***

Additional fuel, if desired, may be selected at Flight Setup J14, and the amount entered at Flight Setup K14.

Chapter 2 - Flight Setup Screens

The various flight setup screens are where the information needed for PS1FPLAN are entered. These screens, shown in normal order used, are as follows:

- Flight Setup Screen
- Data Entry Screen (for entry of winds and temps aloft, and selection of flight levels).
- ETP Setup Screen (if ETP planning is required)
- RD DEST Setup Screen (If redispatch operations are required)

Since some of the screens are fairly complex (just like actual airline flight planning) a series of flight planning checklists have been devised to insure that you do not leave any necessary piece of information out of a flight plan solution. These checklists are located in Chapter 8 - Flight Planning Worksheet Checklists.

§ 2-1. Flight Setup Screen

The flight setup screen is the first screen that you use during any flight planning solution. This page is where all of the basic flight planning information is entered, as well as operating rules selections are made. The version of the PS1ATOG module that is released with this program gets its information from this page as well - the attached version of the load manifest portion no longer operates as a standalone program. However, the Airport Analysis Module continues to operate as a stand-alone portion within PS1FPLAN.

Each section of each screen is handled separately.

§2-1a - Flight Data

FLIGHT	UAL897	**FROM**	LAX	**TO**	NRT
RTE DIST	4933	**ICAO**	KLAX	**ICAO**	RJAA
ALTN-	HND		**SRC ALT**	OPT	**FPALT**
SHIP	8419				

This is the Flight Data section of the FLIGHT SETUP screen. There are 6 entries that may be made in this section. Those areas are indicated by the white boxes in the picture above.

FLIGHT	Carrier code and flight number.
FROM	Origin Airport, in 3 letter IATA code. The 4 letter ICAO code will be displayed below if the airport is listed in the AIRPORTS database.
TO	Same as above.
ALTN	Up to two alternate airports may be entered. If only one is entered, it should be entered in the left box.
SHIP	Aircraft ship number, fleet number, nose number, or registration.
RTE DIST	The calculated distance along the route, in NM.
SRC ALT	For routes shorter than 300NM, the optimum short-range cruise altitude will be displayed here. For routes longer than 300NM, OPT will be displayed.

§ 2-1b - Payload Data

PAYLOAD DATA	
F PAX	18
C PAX	84
Y PAX	320
CARGO	38971
CALC PAYLD	114931
DISP PAYLD	115000

This section contains places to enter a calculated payload, or a total planning dispatch payload.

F PAX	Total number of passengers in the First Class cabins
C PAX	Total number of passengers in the Business Class cabins
Y PAX	Total number of passengers in the Coach Class cabins
CARGO	Total weight carried in the cargo bins, bulk bins, containerized cargo bins, etc.
CALC PAYLD	Calculated payload. If the unit of measure is LBS, each passenger is assumed to weigh 180 LBS. If the unit of measure is KGS, than each passenger is assumed to weigh 85 KGS. Halfweights for children are not supported.
DISP PAYLD	Even though one may have a calculated payload, one may also enter a dispatch payload for the program to calculate flight data on instead of the calculated payload. In order for it to count, DISP PAYLD > CALC PAYLD.

§ 2-1c. Weights Breakdown

FLT PLANNING WTS		LIMIT	XTOG OVERRIDE
OEW	401550		
PAYLD	115000		
ZFW	**516550**	**535000**	
RLS FU	286631		**XTOG-L**
PLND TOG	**800181**	**901561**	**870610**
LDG WT	559571	748303	
	LIM XTOG	870610	

This section contains all of the flight planning weights, and a summary of the various takeoff and landing performance limits.

OEW	Operating Empty Weight
PAYLD	The higher of the calculated or dispatch payloads.
ZFW and LIMIT	The calculated zero fuel weight, and structural zero fuel weight limit. This weight equals the OEW + PAYLD.
RLS FU	Final release fuel as calculated or entered in the fuel breakdown ladder.
PLND TOG and LIMIT	Planned takeoff gross weight, and the maximum weight for takeoff considering the smallest of either the takeoff field length limit OR climb limit (as calculated by the ATOG module). XTOG-L indicates the maximum takeoff weight based on landing, which equals the maximum structural landing weight at the destination, plus the weight of the trip burnoff fuel.
LDG WT and LIMIT	Planned landing weight, plus the smallest of the landing field length limit OR the landing climb limit weights as calculated by the ATOG module.
LIM XTOG	Limiting takeoff weight. Smallest of any of the above limits. In this example, the takeoff weight limit is based on the maximum takeoff weight for the runway.
XTOG OVERRIDE	If you wish to limit the takeoff weight to a manually computed maximum (such as in the case of the fuel AD 98-25-52), enter that manually computed value in this cell. It will become limiting if it is the most restrictive takeoff performance limit.

§ 2-1d. Fuel Ladder.

NONSTOP FUEL ADVISORY				**RERELEASE PLANNING**	
	FUEL	TIME	DIST	RRLS PLND	076911
BURN	240610	1028	4933	RRLS RQRD	066279
ALTN-HND	007400	0015	0032	INITIAL RQRD	**286631**
INTL HOLD	009923	**0030**	**CONT TIME**		
INTL RESV	003517	0011	35		
ADNL FUEL	011550	EXTRA			
TAXI	003000	0020	**< - TAXI TM**		
MIN-INIT RLS	**286631**	**ETP ADD**			
ARVL FUEL	43021				
DX OVRD		**DX OVRD BELOW MIN RELS**			

NOTE: While this screen example demonstrates US FAR 121 redispatch, the discussion is applicable to all types of operations.

BURN	Final burnoff to destination, followed by the estimated enroute time, and route distance to the destination.
ALTN-HND	Alternate data to the most distant alternate for the destination airport.
INTL HOLD	For all operations other than US FAR 121 domestic operations, this indicates the 30 minute hold fuel. For US FAR 121 domestic operations, this indicates the contingency time and fuel as entered under the label CONT TIME.
INTL RESV	For all operations other than US FAR 121 domestic operations, this indicates the required fuel to meet the percentage rules for enroute reserve for international operations. For US FAR 121 domestic operations, this is titled RESV, and indicates the fuel required for the 45 min. domestic reserve.
ADNL FUEL	For all operations other than US FAR 121 domestic operations, this indicates the amount of contingency fuel as indicated in minutes under the label CONT TIME. For US FAR 121 domestic operations, it carriers over the amounts shown in the cell to the right of the cell marked EXTRA shown above.
TAXI	Fuel for start-up, taxi, and takeoff at the origin airport. May be varied by entering an estimated taxi time in the cell to the right, and to the left of the <- TAXI TM cell. The burnoff is based on the average taxi fuel flow.
MIN-INIT RLS	For US FAR 121 rerelease operations, this amount indicates the minimum amount to meet the FAR 121 requirements for the initial dispatch to the short-release destination. In all other operations, this is titled "MIN FUEL" and this amount indicates the minimum calculated fuel to meet all the regulatory minimum release requirements.

NONSTOP FUEL ADVISORY				RERELEASE PLANNING	
	FUEL	TIME	DIST	RRLS PLND	076911
BURN	240610	1028	4933	RRLS RQRD	066279
ALTN-HND	007400	0015	0032	INITIAL RQRD	**286631**
INTL HOLD	009923	**0030**	**CONT TIME**		
INTL RESV	003517	0011	35		
ADNL FUEL	011550	EXTRA			
TAXI	003000	0020	**< - TAXI TM**		
MIN-INIT RLS	**286631**	**ETP ADD**			
ARVL FUEL	43021				
DX OVRD		**DX OVRD BELOW MIN RELS**			

ARVL FUEL	Calculated fuel upon arrival at the destination. The program will display a caution to the immediate right if the estimated arrival fuel is less than 25000 lbs. (or metric equivalent).
DX OVRD	By entering a higher minimum fuel in this cell, it becomes the final release fuel for the flight. If this amount exceeds the MIN-INIT RLS or the MIN FUEL (as applicable), the reminder prompt "DX OVRD BELOW MIN RLS" (as shown in the above sample) will disappear.
Displayed only when US FAR 121 Rerelease (US RERLS) is selected:	
RRLS PLND	The estimated fuel on board at the rerelease fix.
RRLS RQRD	The minimum fuel on board at the rerelease fix to meet final release requirements to the planned, final destination.
INITIAL RQRD	The minimum fuel on board at block-out to meet the regulatory requirements to the initial dispatch destination.
Displayed at all times:	
EXTRA	A listbox-selectable label of any additional desired fuel to be shown on the flight release. The amount is entered to the right of this listbox. For a discussion of the various types, see § 1-7, SOM.
ETP ADD	If an additional fuel amount is required to meet ETP requirements, it may be entered here. Note that if USDOM is selected as the operating rules, any amount entered here is ignored.

§ 2-1e. Altitude Data and Mode Control

LAX	**TO**	NRT		**T-FLPN**	M86
KLAX	**ICAO**	RJAA		**STEPCLB**	STEP
SRC ALT	OPT	**FPALT**	350	**OPTWGT**	654.9

This section of the FLIGHT SETUP screen allows for control of the various altitude controls.

SRC ALT	For routes shorter than 300NM, the optimum short-range cruise altitude will be displayed here. For routes longer than 300NM, OPT will be displayed.
T-FLPN	Type of flight plan speed to be used - in this beta release it equals only M086, indicating that only the cruise mach speed schedule of .86M is loaded. In the final release, it will also indicate LRC for long-range cruise, and M85 for Mach .85 cruise.
STEPCLB	The program has three types of cruise altitude controls (STEP/MAN/NONE). When cell I4 is set to NONE, the climb and cruise data will be based on the altitude in cell G5 (performance data for levels below FL270 is not currently supported in this beta release). When cell I4 is set to STEP, the program will command an initial cruise altitude based on the estimated takeoff weight, and then command step climbs throughout the flight when the next best flight level (NBFL) is at least 4,000ft higher than the current altitude, while conforming to hemispheric altitude rules. *(Metric levels are not supported.*) By running a flight plan solution in both STEP and NONE mode, you can see the penalty for staying at a lower altitude when the optimum higher is much higher. If you wish to control the altitude manually (such as when planning for a 2,000ft step climb enroute, when operating on routes where nonstandard altitudes apply, such as along the oceanic routes) set cell I4 to MAN, and then enter the desired altitude for each fix in cell F*x* on the DATA ENTRY worksheet (MAN FL column).
FPALT	When the altitude control is set to NONE, enter the cruise altitude here. Note that the legality of the altitude with respect to enroute IFR altitude is not checked.
OPTWGT	Displays the optimum cruise weight for the altitude in the FPALT cell, at M86 cruise speed.

§2-1f. Route Selection and ATC Text

ROUTE SELECTION	BUCKET	01J	RTE CODE	LAXNRT01J	ARVL FUEL	43021	
					DX OVRD		DX OVRD BELOW MIN RELS
FLT PLAN TEXT	KLAX VTU2 RZS DCT SNS DCT BOARS DCT AMAKR DCT GUTTS DCT KLARK DCT BEGUN DCT 49N140W 54N150W 57N160W OGGOE R580 OATIS OTR3 GOC DCT RJAA						

BUCKET	A listbox containing all of the various types of routes programmed in PS1FPLAN. For a discussion of the various types of routes, see § 3-2, SOM.
FLT PLAN TEXT	The flight plan text that will be filed with ATC.
RTE CODE	The FMS Route code for the flight. It is this code that is matched against in the STORED ROUTES database.

§ 2-1g - Takeoff and Landing Data (TOLD)

TAKEOFF WEATHER			LAX	ELEV	126
OAT-C	17		NRT	ELEV	135
ALTM SET	30.21	IN HG			
TAKEOFF PARAMETERS			**FLAPS**		10
LENGTH	12091	FT	**R/W HDG**		249
SLOPE	LEVEL	**SPD**	**R/W IDENT**		**25R**
WIND DIR	280	18	**PACKS**		ON

It is in this section that the necessary data for takeoff is entered so a runway limit and climb limit gross weight may be calculated by the ATOG module.

OAT-C	Takeoff outside air temperature, in deg. C. If the temperature is at or below 10C, the nacelle anti-ice correction is applied to the calculate maximum weights. Additionally, the notation " NORM WGTS BASED ON NAC A/I ON" will appear at the bottom of the load manifest, below the landing weights data.
ALTM SET	Altimeter setting. To the right is a listbox with the selectable units for altimeter setting, IN HG or MB/HPA.
LAX ELEV 126	Field Elevation at the origin airport, carried from the NavData database.
NRT ELEV 135	Field Elevation at the destination airport, carried from the NavData database.
FLAPS	Listbox selectable Flaps 10 or Flaps 20 for takeoff.
R/W IDENT	Enter the runway ident. NOTE - Do not enter leading zeros for the ident as is the practice in some parts of the world. The program matches the 4 letter ICAO ident with the runway ident in the database, and brings all of that data up to this screen, and then sends it to the ATOG module to generate the ATOG weights. If the runway is an intersection takeoff based on taxiway ident, enter the taxiway ident forming the intersection with a dash (e.g., T/W T10 at KORD for RWY 32L = 32L-T10).
LENGTH	Runway length for the runway to be used, from the RUNWAYS database.
FT or M	Selectable listbox for the units of measure for the runway length.
WIND DIR	Two cells for entry of the wind direction, and speed. For takeoff winds with gusts, use all of the basic speed value plus 1/2 the gusts (max 15 kts gust correction.) E.G., RWY 27 Winds 27015G25 Enter 270 for wind direction, and 27 kts wind. Enter "WINDS CORRECTED FOR GUSTS" in the release remarks.
RWY HDG	Magnetic heading of the runway to be used; used to calculate the headwind/tailwind components for takeoff.
PACKS	Listbox selectable PACKS ON or OFF for takeoff. If OFF, applies several weight corrections to generate the final takeoff weights for PACKS OFF performance.

LANDING PARAMETERS - FLAPS 30 - ZERO WIND WGTS			
LENGTH	10662	FT	WET
OAT-C	14	**R/W IDENT**	**34**

There are three entry boxes to enter the various landing data.

R/W IDENT	The identifier of the runway planned for landing. See the note regarding the takeoff runway for details concerning the leading zero.
LENGTH	The length of the runway identified at the R/W IDENT cell. Matches from the RUNWAYS database. If no match is found, returns #N/A; uses the same length units of measure (FT or M) as indicated for takeoff data.
OAT-C	Forecast outside air temperature at the destination at the ETA - used to determine the maximum weight for an engine-out go around in the landing configuration. If the landing OAT is at or below 10C, corrections for engine-anti-ice are automatically made by the ATOG module to the landing climb limits.
WET or DRY	Applies WET or DRY landing performance. For a discussion of WET vs. DRY performance, see § 7-7 SOM.

§ 2-1h. Release Remarks

RLS RMKS	CWT SPEC OPS ** RTE COMPLIES WITH NOPAC TRACK L - WHLSUP TIME OF 2015Z TO CROSS BOARS FL310/FL2147Z - 10 MIN DEVIATION RULE APPLIES - MAX PYLD 115.0 - NO BP8/9/10

A section where flight plan remarks may be entered, such as those shown above. The text will wrap around. Where the triangle is along the bottom of the box on the screen, is the limit of how many characters may be entered. Any remarks entered in this cell are carried over to the Flight Release portion of the flight plan, as well as the RELEASE REMARKS section of the Load Manifest.

The release remarks state, "CWT SPEC OPS ** RTE COMPLIES WITH NOPAC TRACK L - WHLSUP TIME OF 2015Z TO CROSS BOARS FL310/2147Z - 10 MIN DEVIATION RULE APPLIES - MAX PYLD 115.0 - NO BP8/9/10".

§ 2-1i. ETP Setup

ETP AIRPORT PAIRS - SEE ETP DATA PAGE					
PAIR 1	SEA	ANC	**PAIR 3**		
PAIR 2	ANC	CTS	**ETP REQD**	Y	
ETP 1 AF	116450D	**ETP 2 AF**	032280	**ETP 3 AF**	#N/A

This section is where the airport identifiers are entered which form the ETP airport pairs. There are provisions for the entry of up to 3 airport pairs. When the computation of an ETP is required, select on the ETP REQD listbox Y, this enables the listing of the ETP alternates on the flight release.

In this example, SFO-ANC form the airports creating one ETP, and ANC-CTS form the other airport pair. Very few routes require three ETP airport pairs, but provisions have been made for 3 ETPs.

ETP x AF - The planned arrival fuel at the most distant ETP alternate airport (in terms of fuel). If a D is displayed after the estimated fuel on arrival at the ETP alternate airport (e.g., "138734D") , that indicates that fuel dumping will be required to meet maximum structural landing limits at the alternate airport. The amount that will be required to be dumped is available on the ETP Flight Plan.

§ 2-1j. Redispatch Setup

FAR 121 SHORT-RELEASE DATA - SEE SRD SETUP PAGE			
RDFIX	OPULO	RD DEST	CTS
RD ALTN	HKD	FMSRC	OPULOCTS99R

In this section is where the necessary fixes are designated for rerelease operations under US FAR 121 for flag operations. See §§ 1-2,4-4 SOM for a complete discussion on US FAR 121 rerelease operations.

RDFIX	The redispatch fix where the redispatch occurs along the route of the flight.
RD DEST	This is the destination of the flight if the redispatch is unacceptable.
RD ALTN	This is the alternate airport for the RD DEST.
FMSRC	This is the FMS route code for the RD DEST diversion route. It is this route code that is matched against in the STORED ROUTES database.

§ 2-1k. Miscellaneous Controls

UNITS	LB	RULES	US RERLS	RLS NBR	1

ETD-Z	1930
ETA-Z	0235
Z-DATE	17-May-99

The miscellaneous controls control such items as operating rules selection, units of measure, etc.

UNITS	Listbox selectable selection of the units of measure for weight. LBS or KGs. All weight/burnoff calculations are made/presented based on this selection.
RULES	Listbox selection of the operating rules for the flight to be flight planned under. Options are: ICAO — Flight to be planned based on ICAO rules. See § 1-4. ISLD RSV — Flight to be planned in accordance with the fuel planning rules where no alternate is geographically available. See § 1-2. US RERLS — Flight to be dispatched under US FAR 121 redispatch operations, see §§1-3, 2-1j, 2-2, 4-4. USDOM — Flight to be dispatched under US FAR 121 domestic operations. See §1-1. USINTL — Flight to be dispatched under US FAR 121 international straight-release operations.
RLS NBR	Listbox selected release number, 1 through 10. Used to indicate subsequent versions of releases if desired.
ETD-Z	Estimated Time of Departure, in GMT. Copied over to the flight release. Entered in the format hh:mm.
ETA-Z	Estimated Time of Arrival, in GMT. Copied over to the flight release. Entered in the format hh:mm.

§ 2-2 US Short-Release Dispatch Setup

PS1 RE-RELEASE/RE-DISPATCH PLANNING				US RERLS			
FROM	LAX	**TO**	NRT	**ALTN**	HND	**FMSRC**	LAXNRT01J
RDFIX	OPULO	**RD DEST**	CTS	**RD ALTN**	HKD		
DIVERSION ROUTE DESCRIPTION						**DFMSRC**	OPULOCTS99R
DIVERT ROUTE		OPULO.R580.ONEMU..NANNO.OTR1.NOSLY..OBE..RJCC					
DIVERT FIX LIST							
	FIX-IDENT	FL	W-DIR	W-SPD	TEMP		
FIX 1	OPULO-JP	350	300	25	-57		
FIX 2	ONEMU-JP	350	300	25	-58		
FIX 3	NANNO-JP	350	300	25	-58		
FIX 4	NOSLY-JP	350	300	25	-58		
FIX 5	OBE-JP	350	270	95	-59		
FIX 6	RJCC	350	270	95	-59		
FIX 7	0	350	270	95	-59		
FIX 8	0	350	270	95	-59		
FIX 9	0	350	270	95	-59		
FIX 10	0	390	270	90	-59		

This screen contains the data entry fields for the entry of the winds and temperatures aloft for the post-redispatch diversion route to the short-release destination.

DIVERT ROUTE	An ATC text description of the route to be flown in a post-redispatch diversion to the original destination.
FIX-IDENT	The lookup_value for each fix that will be overflown during the redispatch diversion.
FL	Cruise flight level for each fix. Note that the flight plan altitude for the first fix if this route is the planned flight plan altitude over that fix from the nonstop flight plan.
W-DIR	Wind direction, in degrees true.
W-SPD	Wind speed, in kts.
TEMP	Outside air temperature, in deg. C.

NOTE:

Diversion performance is predicated at M.86.
There is a current limit of 10 listed fixes for the diversion route.

§ 2-3. ETP Setup and Explanation

ETP SETUP	**FROM**	LAX	**TO**	NRT	**FMSRC** LAXNRT01J
PAIR 1	SEA ANC	**PAIR 2**	ANC CTS	**PAIR 3**	

	PAIR 1			**PAIR 2**			**PAIR 3**		
	WIND DIR	**SPD**	**TEMP**	**WIND DIR**	**SPD**	**TEMP**	**WIND DIR**	**SPD**	**TEMP**
WINDS CONTINUE	310	22	-12	240	32	-12			
BACK WINDS	200	25	-13	290	34	-14			

APPARENT ETP LOCATION

	PAIR 1	PAIR 2	PAIR 3
DIST OUT	640	1360	#N/A
LAT	N4955.0	N5255.0	
LONG	W14140.0	E16935.0	

FIX PRIOR TO ETP LOCATION

IDENT	49N40	OPAKE	

This screen is the screen where the necessary data for the computation of the ETP. The data on the top is simply repeating the basic flight information from the FLIGHT SETUP screen.

WINDS CONTINUE and BACK WINDS	Select a point midway between each alternate airport, and enter the winds, and temperature for FL140. Further select a 1/2-way between each alternate airport and the midpoint selected above. WINDS CONTINUE are the winds from the midpoint to the alternate airport ahead. BACK WINDS are the winds from the midpoint to the alternate airport BEHIND you.
TEMP	Enter the temperatures aloft at FL140.
LAT and LONG	Following the instructions in this section, plot the coordinates of the ETP and enter those coordinates in this section.
FIX PRIOR TO ETP LOCATION	For proper fuel calculations, enter the FIX IDENT (lookup_value) for the fix IMMEDIATELY PRIOR to the Equal Time Point. *(The lookup_value is the first column in the NAVDATA database*), this lookup_value may be determined on the DATA ENTRY screen. The program will internally determine the leg distance from this fix to the ETP, and determine the time and burn to the ETP from this fix, and then an accumulated value which will be passed to the ETP FLIGHT PLAN screen.

NOTE:
To facilitate the computation of the ETP, it is suggested that you procure a high-scale plotting chart for the region; determine the direct straight-line distance between selected alternate airport pairs, and plot a line perpendicular to the direct line at 1/2 the distance, and label the 1/2 distance line between the alternate airports with the amount of the 1/2 distance between the alternates. This will make plotting the ETPs easier.

Equal Time Points (ETP) are required for a flight if any portion of the flight will be more than 90 minutes away from an enroute alternate airport at any phase in the flight. While a flight from KEF-LHR may not require the computation of an ETP, a flight from JFK-LHR will require such. As of this release, ETPs are calculated internally, however, they do require some manual chart work.

The first step in ETP calculation is determining the airports to be used for ETP airports. Under US FAR 121, any airport listed as a Regular, Alternate, or Refueling in the carrier's operations specifications para. C70 is authorized for use. Here, however, you may use any alternate airport, it is suggested to have at least a current Runway Analysis for Landing.

The steps in determining the ETP are:

- Determine the airport pair to be used for the computation of the ETP.
- Determine the winds aloft and temperature 1/4 of the way from the airport FROM to the airport TO (these are the BACK WINDS). Determine the winds aloft and the temperature 3/4 of the way from the airport FROM to the airport TO (these are the OUT WINDS). Use FL140 winds aloft information.
- Enter these winds on the ETP SETUP screen.
- The ETP setup screen will return a DISTANCE OUT. PLOT this distance on the direct path between each alternate airport. If you have a plotting chart marked with the 1/2 distance between the airport pair, determine the offset this ETP location is from the 1/2 distance line (preceding away/heading to), and plot the ETP.
- Draw a line perpendicular to the direct alternate path. Where this line intersects the route of flight is the ETP which is entered in the APPARENT ETP LOCATION.
- Enter the lookup_value (not the fix IDENT) of the fix immediately prior to the ETP. This provides distance data for the total fuel burnoff, as well as other purposes.

Some commonly used ETP airport pairs are[11]:

Region	Commonly used ETP Airport Pairs
US-EUROPE	CYQX-EINN CYYT-LPLA/LPLA-EINN CYQX-EGPF CYQX-BIKF/BIKF-EINN
EUROPE-CARIBBEAN	LPLA-TXKF
US WEST COAST - AUSTRALIA, NEW ZEALAND	KLAX-PHNL / PHNL-NFNN / NFNN-YSSY or NFNN-NZAA (3rd pair not required, but suggested)
NORTH PACIFIC ROUTES	PANC-RJCC or RJCH PANC-RJAA
US WEST COAST-HAWAII	KLAX-PHNL / KLAX-PHOG KSFO-PHNL / KSFO-PHOG KSEA-PHNL / KSEA-PHOG
US WEST COAST - ASIA	KLAX - PHNL (south route) PHNL-PGUM (south route) KSFO-PANC / PANC - RJCC or RJCH
AUSTRALIA - JAPAN	AYPY-PGUM

Equal Time Point Planning Factors

The following is the assumed B747-400 ETP Scenario:

- Anti-Ice ON
- ISA + 15C
- Arrival at ETP Airport with a minimum of 0+15 minutes fuel remaining.
- Cruise at FL140. Note that there is no credit given for 2 engine driftdown, an immediate drop and level off at FL140 is assumed.
- Cruise at FL140 until Oxygen is depleted, followed by descent to FL100.
- Note: 3.9 Hours of O_2 at minimum dispatch pressure with all bottles onboard. I.E., - Diverts over 3+54 require remainder of cruise at FL100.
- Diverts less than 3+53 use FL140 for entire cruise portion.

For an explanation of the ETP data blocks on the flight plan, see the following page.

[11] This list is by no means exhaustive.

Below are sample ETP data blocks for a flight from KLAX-YSSY, using the stored FMS

NFNN-YSSY. We shall examine each ETP data block line-by-line. The ETP data blocks are best added on the flight plan after the data line for the arrival airport.

```
ETP FOR    KLAX     PHKO   N2029.0   W13540.0   TIME     0245
BURNOFF TO ETP     072789   ETPWT     754871  ETPFOB   277211
BURNOFF FM ETP     087006 DVRT TM     0256   TL BURN   159795 LDGWT      630000
MAX LDG   630000   DUMP    037865     DESC      331      CRZ      340    ARLVFU  152340
FL140    ARPT       LAT      LONG    DIST-NM  TMP DEV    TC       TH       GS
TO DIV1  KLAX     N3356.6  W11824.5    1221      06      045      043      429
TO DIV2  PHKO     N1939.3  W15601.5    1147      09      271      271      379
FUEL DUMP IS REQUIRED

ETP FOR    PHKO     NFNN   S0208.0   W16450.0   TIME     0710
BURNOFF TO ETP     177923   ETPWT    649737   ETPFOB   172077
BURNOFF FM ETP     081005 DVRT TM     0314   TL BURN   258929 LDGWT      568731
MAX LDG   630000   DUMP    000000     DESC      311      CRZ      340    ARVLFU  091071
FL140    ARPT       LAT      LONG    DIST-NM  TMP DEV    TC       TH       GS
TO DIV1  PHKO    N1939.3  W15601.5    1406      08      021      018      415
TO DIV2  NFNN    S1747.1  E17725.2    1405      14      227      230      455


ETP FOR    NFNN     YSSY   S2620.0   E16628.0   TIME     1135
BURNOFF TO ETP     268527   ETPWT     559133  ETPFOB   081473
BURNOFF FM ETP     046627 DVRT TM     0200   TL BURN   315154 LDGWT      512506
MAX LDG   630000   DUMP    000000     DESC      292      CRZ      340    ARVLFU  034846
FL140    ARPT       LAT      LONG    DIST-NM  TMP DEV    TC       TH       GS
TO DIV1  NFNN    S1747.1  E17725.2    0795      11      052      054      427
TO DIV2  YSSY    S3357.1  E15111.3    0914      09      236      235      430
```

```
ETP FOR    KLAX     PHKO   N2029.0   W13540.0   TIME     0245
```

Airport pairing for which this ETP data block applies to. Followed by the actual ETP location that you plotted, followed by total flight time after takeoff to ETP, in hours and minutes.

```
BURNOFF TO ETP     072789 ETPWT       754871 ETP FOB 277211
```

Total burnoff from takeoff to the ETP, followed by the estimated weight at the ETP, as well as the estimated Fuel On Board at the ETP. This weight is based on the actual PTOG from the FLIGHT SETUP screen, and the load manifest from the PS1ATOG module.

```
087006 DVRT TM          TL BURN   159795          630000
```

The burnoff on the ETP segment from the ETP to either diversion airport, followed by

weight at either diversion airport.

```
MAX LDG          DUMP    037865          331      CRZ          ARLVFU  152340
```

dumped to meet ***maximum structural landing limits***
driftdown speed (KIAS), the optimum cruise speed in the diversion (KIAS), and the estimated arrival fuel.

```
ARPT      LAT            DIST-NM  TMP DEV          TH      GS
KLAX    N3356.6           1221      06             043     429
PHKO    N1939.3           1147      09             271     379
```

The planned altitude for the diversion to meet the Assumed ETP Scenario. This block will indicate EITHER FL140 or FL100. Therefore, if the DVRT TM is more than 3+53,

planned altitude for the diversion.

Following this line is a navigation line to each ETP alternate airport, assuming a direct

diversion airport pair, fuel dump will be required to meet maximum structural landing limits.

airports would be as follows:

From takeoff until - - -	Your alternate airport would be
02+45	
07+10	PHKO
	NFNN
11+36 until landing	

This means that from 2 hours 46 minutes until 7 hours 9 minutes after takeoff, your planned diversion alternate airport would be Kailua-Kona (PHKO). Until 11+35 minutes

11+36, you proceed to Sydney (YSSY).

ETP Planning Notes:

- When planning an Atlantic crossing for a short-over-water flight (e.g., JFK-LHR, IAD-LHR), or where extended overland flight is not required prior to the oceanic crossing, a large quantity of additional fuel may be required to meet ETP requirements if only a coast-out and coast-in alternate is used (e.g., CYYT-EINN) versus using a mid-ocean alternate (CYYT-LPLA-EINN). Use of only coast-out and coast-in alternates may increase ETP fuel requirements by nearly 40,000 lbs. Over the North Atlantic.
- ***The alternate airport selected must meet alternate airport weather minima***.
- The planned landing weight at the alternate airport ***MUST MEET wet landing criteria in the Airport Analysis*** from the PS1ATOG module.
- Always use FL140 winds and temperatures for the ETP SETUP screen.
- If less than 0 lbs./kgs of fuel will be on board upon arrival at the alternate airport, Excel will display a negative amount in the ARVLFU cell. Therefore, you need to carry additional fuel to meet ETP requirements. Enter an additional amount to carry in the ADD cell on the FLIGHT SETUP screen, or via a higher MIN FUEL amount in the DX OVRD cell on the FLIGHT SETUP screen.

FIX	DIST	MC	TYPE CRZ	NO STEP	MAN FL	USED FL	NBFL	WIND DATA ENTRY DIR	SPD	OAT	OPTFL	1.3G BU	CRZ MCH	LRC MK
KLAX								310	22	-22				
RZS	76	283	STEP	350	330	310	310	200	45	-52	320		M860	M.852
SNS	157	309	STEP	350	330	310	310	200	45	-52	320		M860	M.852
BOARS	119	307	STEP	350	330	310	310	200	49	-52	320		M860	M.852

The flight data entry screen is used to enter winds and temperatures aloft data, control cruise altitude (when MAN altitude control is used), and verify route data when errors occur.

modes. They are for reference purposes, and serve no other purpose on this worksheet.

FIX	When a route is first loaded, the program matches the route code in the STORED ROUTES database, and copies those fixes in the fix list to this sheet, so it is imperative that it be correct.
DIST	Distance, in NM, between each fix.
MC	Initial magnetic course between each fix. If a fix is not loaded, or does not match in the NAVDATA database, it will be indicated on this worksheet with #N/A in this cell.
TYPE CRZ	Type of altitude control from the FLIGHT SETUP screen. Note that only one type of altitude control may be used for each flight plan solution.
NO STEP	When NONE is the altitude control used, this is the altitude from the FPALT cell on the FLIGHT SETUP screen which is used as the cruise altitude for the flight. When any other type of altitude control is used, has no effect.
MAN FL	When MAN is the altitude control used, you enter the altitude for each fix overflown along the flight in this column. When any other type of altitude control is used, any data here has no effect.
USED FL	Regardless of altitude control used, this shows the altitude used for that fix. In the example above, 350 is used until the Red Table VOR (DBL), where a step climb to FL390 is planned.

NBFL		When either MAN or NONE altitude control is used, this cell shows the Next Best Flight Level for cruise (corrected for hemispheric IFR altitude rules).
WIND DATA ENTRY	**DIR**	The winds direction aloft over each fix is entered here. Limits upon entry are 000 deg., to 359 deg.
	SPD	Winds aloft wind speed.
	OAT	Winds aloft outside static air temperature.
OPTFL		This cell shows the optimum cruise FL for weight over each fix.
1.3G BUF		If OVWT shows opposite any fix in this column, the estimated inflight weight at that fix exceeds the maximum cruise altitude capability for maneuvering with a 1.3 G buffet margin. Therefore, you must select a lower altitude for this fix, or loss of control at altitude may occur if moderate or greater turbulence is encountered. The best way to avoid this problem is to always fly close to or lower than the OPTFL for the weight. This may be ignored, however, during the initial climbout after taking off with very heavy weights.
CRZ MACH		The selected cruise mach mode for the flight plan.
LRC MK		(When LRC is enabled) this column indicates the LRC mach for each fix.

ISA TEMPS	
FL	ISA
260	-37
270	-38
280	-40
290	-42
300	-44
310	-46
320	-48
330	-50
340	-52
350	-54
360	-57
370	-57
380	-57
390	-57
400	-57
410	-57
420	-57

This chart shows the standard atmosphere temperatures for each altitude that has cruise data programmed. It is displayed to the right of the LRC MK column.

§ 2-5. Routes Menu.

STORED ROUTES DISPLAY	**From** LAX **To** NRT		**ROUTE REMAI**
LAXNRT			
0xJ ROUTES - PREFERRED ROUTES			
01J	**LAXNRT01J**	KLAX VTU2 RZS DCT SNS DCT BOARS DCT AMAKR DCT GUTTS DCT KLARK DCT BEGUN DCT 49N140W 54N150W 57N160W OGGOE R580 OATIS OTR3 GOC DCT RJAA	
02J	**LAXNRT02J**	#N/A	#N/A
03J	**LAXNRT03J**	#N/A	#N/A
0xC ROUTES - ALTERNATE ROUTES			
01C	**LAXNRT01C**	#N/A	#N/A
02C	**LAXNRT02C**	#N/A	#N/A
03C	**LAXNRT03C**	#N/A	#N/A
US National Route Program - For US Domestic Citypairs Only			
01N	**LAXNRT01N**	#N/A	#N/A
02N	**LAXNRT02N**	#N/A	#N/A
US SWAP Routes (Severe Weather Avoidance Program)			
20S	**LAXNRT20S**	#N/A	#N/A
21S	**LAXNRT21S**	#N/A	#N/A
22S	**LAXNRT22S**	#N/A	#N/A

This chart shows all of the programmed stored routes for a given citypair. This sheet is informational only, in that no functions are carried out on this sheet. The ATC TEXT of the flight plan is displayed in the large, center, column. The column along the right side is the ROUTE REMARKS from the STORED ROUTES database.

§ 2-6. How to Print the Flight Plan Output

If the flight plan is a straight forward flight plan, with no ETPs, no rerelease plan, simply highlight with the mouse the area of the active legs of the flight plan on the FLIGHT PLAN worksheet, and then select File -> Print Area -> Set Print Area, and then print. For the load plan in the ATOG module, simply go to the correct manifest (LBs or KGs), and then print the worksheet.

If there is more than one section to the flight plan, such as any or all of the following: Flight Plan, ETP Flight Plan, Re-release flight plan, simply highlight with the mouse each active area of each type of plan, copy each to the PRINT WORKSHEET, and then print the PRINT WORKSHEET. Be sure to delete all of the text from the PRINT WORKSHEET after printing. It is also suggested to unmerge any merged cells after this to insure that Excel won't have any problem printing out subsequent flight plans; simply select all the cells (Ctrl+A), then select Format Cells ->, Alignment Tab, and then unselect "Merge cells."

The page setup is defaulted to US size paper, 1/2 in. margins, in landscape format. The defaulted font is 10 pt New Courier for all sections of the flight plan and load manifests. The load manifests are set to default to portrait format, but may be changed to landscape format. Selecting A4 size paper is possible.

Chapter 3 - Database Conventions

§ 3-1. NavData database structure.

The navdata table has a maximum entry limit of 65536 entries. Each record contains 9 entries, which are:

Field	Field Title
1	Lookup_value
2	NavAid IDENT
3	Name
4	Type
5	Lat
6	Long
7	Variation
8	Frequency
9	Elevation

Lookup_value. Each entry has a unique lookup value. This lookup value is a code made up of the location identifier (LOCID) and the country code[12]. Since the original database was a US database, most, but not all navaids in the US and Canada do not have a country code. The country code is a two-letter code indicating what country each navaid belongs to. It is this value, the lookup_value that is entered into the STORED ROUTES database fix list which the program looks up when it is generating a flight plan. For those US navaids which are duplicates, such as many NDBs, LOMs, etc., It is suggested that one use the IDENT of the center the navaid resides in, e.g., Pully NDB (IDENT=IN) outside Indianapolis is listed as IN-KZID, since it is in Indianapolis Center airspace.

Examples of lookup_value fields are:

NIPPI-JP	NIPPI Intersection, along route R220, in the Tokyo FIR
OKC-JP	Okayama VOR, in western Japan.
OKC	Oklahoma City VOR, in the US
5950N	N5900.0 W05000.0
UHMA	ICAO Code for Anadyr, Eastern Siberia

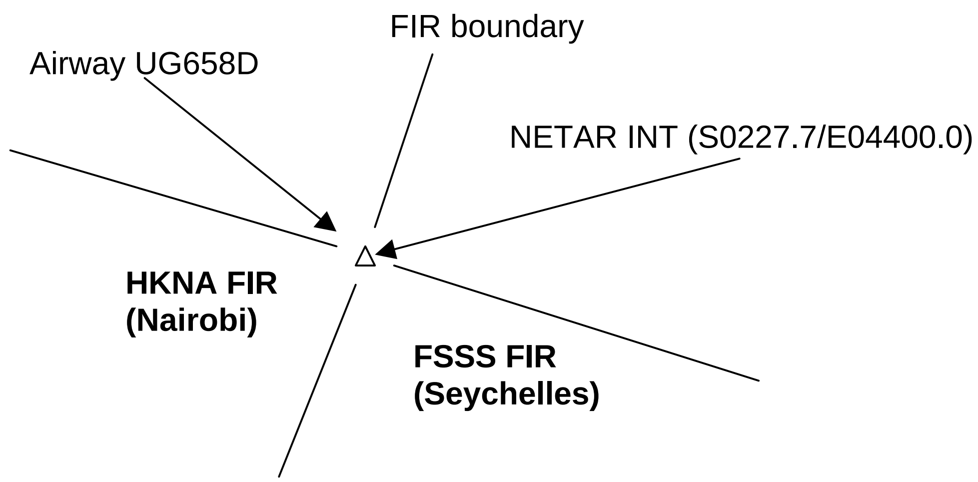
While not currently programmed, other values could be for these examples:

NIPPI-RTJG	A hybrid of the intersection, followed by the FIR identifier
OKC-RTJG	Same
OKC-KZFW	Oklahoma City VOR, in Fort Worth Center airspace
5950N	N5900.0 W05000.0

[12] The Country Code is contained in the CC table, which is discussed in § 3-3.

NOTE:
For fixes named of simply latitude/longitude (e.g., 5950N) no country code need be applied, unless you have two named fixes within close proximity to each other, but both based off the same cardinal degrees of latitude and longitude. Furthermore, for routes you program in yourself, it is irrelevant as to what code you use to identify the correct fix, as long you use the same code in the STORED ROUTES database fix list for that route to identify the correct fix. Additionally, all ICAO identifiers are by definition unique, and therefore no country code is applied to them as well.

For fixes which identify crossing from one area (such as a FIR) into another, I attempted to use the country code for the country on the east/south side. For example,



In the example above, the lookup_value for NETAR, would be NETAR-SY.

CAUTION:
Do not use the lookup_values TOC or TOD. These are reserved for the TOP OF CLIMB and TOP OF DESCENT and could cause erroneous calculations if used.

Navaid IDENT. This field simply contains the IDENT for each navaid. For long-name intersections that have an identifier (e.g., NOHARA INT (MYC VOR 078/30 DME, off Miyakojima Island) NHR is the coded identifier on the chart, and is what is programmed. For locations of latitude/longitude (e.g., 5550N) it is the abbreviations of latitude/longitude (e.g., 5550N).

FMS and PS1FPLAN IDENT for Unnamed Oceanic Control Area Reporting Points, LAT/LONG. Positions in the northern hemisphere use the letters N and E while positions in the southern hemisphere use the letters S and W. For longitude, only the last two digits of the three digit value are used. Placement of the designator in the five character set indicates whether the first longitude digit is 0 or 1. The letter is the last character if the longitude is less than 100 and is the third character if the longitude is 100 or greater.

N is used for north latitude, west longitude. E is used for north latitude, east longitude. S is used for south latitude, east longitude. W is used for south latitude, west longitude.

Examples: 50N 040W becomes 5040N
75N 170W becomes 75N70
50N 020E becomes 5020E
06N 110E becomes 06E10
52S 075W becomes 5275W
07S 120W becomes 07W20
50S 020W becomes 5020S
06S 110E becomes 06S10

For fix locations delineated by fix/radial/distance, a different system is used. If the distance to the forming navaid is 99NM or less, the navaid identifier is placed first, followed by the distance. If the distance is more than 100NM, the last two digits of the distance are used and placed ahead of the navaid identifier.

NAVAID	Distance	IDENT
INW	18NM	INW18
CSN	106NM	06CSN
TCS	89NM	TCS89

NOTE:
For locations designated on enroute charts with such an identifier as shown above, the charted identifier will be used.

Navaid NAME. For all locations, this is the actual name of the Navaid (e.g., MC GRATH, CRAZY WOMAN, LONDON, SKOPJE etc.). For airport names, the actual name of the airport is used.

Navaid TYPE. This is a code of the type of navaid. Examples are:

A	Airport
I	Any named intersection
N	NDB
V	VOR
T	Terminal VOR
O	Oceanic Fix, defined only by degrees latitude/longitude

Latitude. Degrees and minutes of latitude in the format N3300.0, S1532.4, N8959.9.

Longitude. Degrees and minutes of longitude in the format W12145.4, E12554.3, W05431.2, E00000.1. Since the great circle equation has problems calculating distance where the lat/long of a fix directly lies on 180W, use fix values such as E18000.1, W18000.1.

Magnetic Variation. Whole degrees of magnetic variation, in the format 3.0W, 12.0E, 32.0W. Values with zero variation are entered as 0, omitting the E or W.

Frequency. This is simply the frequency of the navaid. For lat/long fixes, airports, and intersections, this is left blank.

Elevation. (Airports only) This is the field elevation for the airport. For fields below sea level, 0 is used. This value is what is passed to the takeoff calculator, therefore, it needs to be accurate. At the time of release, all preprogrammed airports had a valid field elevation.

§ 3-2. STORED ROUTES DATABASE

The stored routes file is where all of the programmed route data resides. There is an Excel limit of 65536 unique route entries. The data structure in this database is as follows:

Field	Title
1	FMS ROUTE CODE
2	Origin Airport, in 4-letter ICAO Code format
3	Destination Airport, in 4-letter ICAO Code format
4	Route Type Code
5	Route Remarks
6	Preferred Route Identifier
7	ATC Flight Plan Text
8-58	Fix List

FMS ROUTE CODE. This is the FMS Route Code. This code is a combination of the origin, destination (3-letter IATA codes) and the Route Type Code (e.g., ORDLAX01J, NOGALCTS99R, LAXHKG01J, etc.) It is this code that is generated from the FLIGHT SETUP screen and searched on in the database to generate the flight plan. If there is not an exact match on the FMS ROUTE CODE or on every fix's lookup_value in the fix list and in the NavData database, Excel with return #N/A in the RTE DIST cell on the FLIGHT SETUP screen, and in other cells in the FLIGHT SETUP screen.

Origin Airport. The origin airport, in 4-letter ICAO code.

Destination Airport. The destination airport, in 4-letter ICAO code.

Route Type Code. This code identifies the type of route the route is. Some examples are:

01J	Preferred Route between the city pair. If there is only one route programmed, it will be the 01J route, and will be coded as such. Also used for US Domestic routes that are based off the FAA Domestic Preferred Routes.
02J and 03J	Alternate FAA Preferred Routes
01N	Primary US NRP Compliant Route
02N and 03N	Alternate US NRP Compliant Routes
02C, 03C, 04C	Other Routes
99R	Route for a post-redispatch diversion to the short-release destination if the redispatch is unacceptable. This is NOT a code programmed into the FMCS, and is used for PS1FPLAN route database identification purposes only.
2xS	US SWAP Routes (Severe Weather Avoidance Program) between selected major terminals. Some are programmed are from KORD and KDEN.

NOTE:
It is imperative to use the TAB key when advancing in the Stored Routes database, to preclude inserting any blank characters in the database, Excel will not match on a blank character.

Route Remarks. Any remarks about the route may be entered here, such as MAX PYLD remarks, altitudes, enroute alternates, or any other remark - the remarks do not copy to the flight plan.

Preferred Route Identifier. For routes that are an 01J, preferred route, a "P" is entered here - primarily used for filtering purposes. Does not have any other function. Carried over from a previous database format. All rerelease routes (99R) are indicated with an R, all SWAP routes are indicated with an S, and all NRP routes are with an N.

ATC TEXT. This is the flight plan as would be filed for a real-world flight. In this version of PS1FPLAN, automatic generation of the ICAO flight plan format is not yet supported. Therefore, the US domestic format is used for US Domestic/transborder flights, and the ICAO format for international routes. See the examples below to learn how to decode:

```
BOS..MHT..CAM.J547.SYR.J63.TVC.J522.GRB.EAU1.MSP
```

Depart BOS, direct Manchester VOR (MHT), direct Cambridge VOR (CAM), then via J Route 547 to Syracuse VOR (SYR), J Route 63 to Traverse City VOR (TVC), J Route 522 to Green Bay VOR (GRB), Eau Claire One Arrival into MSP. In the FAA ATC TEXT format, as they do in real world operations, the 2 dots between each route element indicate to the FAA computers that a DIRECT route is planned, whereas a single dot indicates a filed flight plan following a published airway route.

```
KLAX PRCH7 FICKY B581 NN A579 SY YSSY
```

Depart Los Angles, via the Perch 7 Departure, FICKY transition, Blue Route 581 to Nadi VOR (NN), then Amber Route 579 to Sydney VOR (SY), then to the Sydney Airport.

```
KSFO GAP3 BEBOP R464 CKH039117 DCT JOELE DCT PHNL
```

Depart San Francisco via the GAPP 3 departure, BEBOP transition, R Route 464 to a fix delineated by fix/radial/distance off the Koko Head VOR (CKH) 039 radial 117 DME, direct JOELE intersection, direct Honolulu.

```
RJAA HME DCT KCC DCT CUE DCT OKC V28 IWC DCT UBE DGC V28 FUE A593 VYK DALUE
ZBAA
```

Depart Tokyo Narita, direct Haneda (HME) VOR, direct Nagoya (KCC) VOR, direct Otsu VOR (CUE), direct Okayama VOR (OKC), V route 28 to Kuga VOR (IWC), direct Ube VOR, direct Fukuoka VOR (DGC) V route 28 to Fukue VOR (FUE), A route 593 to Dawangzhuang VOR (VYK), direct DALUE intersection, direct Beijing Capital Airport. Note that the first portion of this route follows the Narita Reversal Departure, runway 34.

And a route that complies with the US National Route Program (NRP)[13]:

```
KMSP..ONL..GLL052040..DBL262018..JNC121013..HVE198045..BCE205066..BLD.J60.
CIVET.CIVET1.LAX   :NRP  (DIR RTE ONL-BLD)
```

[13] For further information on the US NRP, see FAA Advisory Circular AC 90-91A (5/13/96). The route need not be a direct route between start-end fixes like the sample, just any route that complies with FAA AC 90-91A.

Depart Minneapolis, direct O'Neill VOR (ONL), direct a fix delineated by fix/radial/distance off the Gill VOR (GLL), 052 radial 40 DME, direct a fix delineated by fix/radial/distance off the Red Table VOR (DBL) 262 radial 18 DME, direct a fix delineated by fix/radial/distance off the Junction VOR (JNC) 121 radial 13 DME, direct a fix delineated by fix/radial/distance off the Hanksville VOR (HVE) 198 radial 45 DME, direct a fix delineated by fix/radial/distance off the Bryce Canyon VOR (BCE) 205 radial 66 DME, DIRECT Boulder City VOR (BLD), J route 60 CIVET intersection, Civet1 arrival into Los Angeles. The :NRP remark indicates to the FAA computers an NRP compliant route has been planned. The notation in () indicates what navaids form the direct route (e.g., a direct route from Oneill VOR (ONL) to Boulder VOR (BLD)). Most, but not all routes that are NRP compliant are based on direct routes.

```
KMSP ABR J90 MWH J34 HQM C1418H SEDAR A331 ZIGIE V7 JOELE DCT PHNL
```

Depart Minneapolis, proceed DIRECT Aberdeen VOR (ABR), via J route 90 to Moses Lake VOR (MWH), J route 34 to Hoquiam VOR (HQM), via Control Route 1418H to SEDAR Intersection, Pacific A route 331 to ZIGIE Intersection, Victor 7 JOELE Intersection, direct Honolulu.

```
KLAX VTU2RZS J88 PYE J143 ENI DCT GENCO 42N130W 44N140W 45N150W 47N160W
48N170W 49N180 45N170E 43N165E 42N160E RIPKI OTR12 VACKY UR1 PQ DCT KEC A1
ELATO VHHH
```

Depart Los Angeles, via the Ventura 2 departure, San Marcus VOR (RZS) transition, J route 88 to Point Reyes VOR (PYE), J route 143 to Mendocino VOR (ENI), direct GENCO intersection, direct 42N 130W, direct 44N 140W, direct 45N 150W, direct 47N 160W, direct 48N 170W, direct 49N 180, direct 45N 170E, direct 43N 165E, direct 42N 160E, direct RIPKI intersection, Oceanic Transition Route 12 to VACKY intersection, Upper Red route 1 to Tateyama NDB (PQ), direct Kushimoto VOR (KEC), Route A1 to ELATO intersection, direct Hong Kong Chep Lap Kok.[14]

```
BOS..LUCOS.SEY067.SEY.SEY253.RIFLE(SEY253055).J174.SWL..LYH..VXV..GQO..
HLI.HOLL7.MEM
```

Depart Boston, direct LUCOS intersection, the via the Sandy Point VOR (SEY) 067 inbound radial to Sandy Point VOR, then via Sandy point radial 253 to RIFLE intersection (the SEY 253/55 DME), then via J Route 174 to Snow Hill VOR (SWL), direct Lynchburg VOR (LYH), direct Volunteer VOR (VXV), direct Choo Choo VOR (GQO), direct Holly Springs VOR (HLI), then via the Holli7 Arrival, to Memphis.

```
KORD..GIJ.J146.J34.DJB..ACO.V337.CUTTA.KPIT
```

Depart Chicago O'Hare, direct Gipper VOR (GIJ), then via J Route 146 to an unnamed intersection with J Route 34 to Dryer VOR (DJB), direct Akron VOR (ACO), Victor route 337 to CUTTA intersection, direct Pittsburgh.[15]

[14] Note that when overwater, DCT is not shown, for a direct route between the set fixes is assumed.
[15] With airway intersections at unnamed fixes, manual determination of the LAT/LONG at the point of intersection is required, as well as designating your own fix name in the NAVDATA database.

```
KJFK BETTE2 ACK KANNI N45A COLOR TRAKW GIPER UN516 CRK UR37 NORLA UR37 EXMOR
UR14 GIBSO EPM1E EGLL
```

Depart JFK, via the BETTE2 departure, Nantucket VOR (ACK) transition, direct KANNI intersection, North American Route 45A to COLOR, North Atlantic Track W to GIPER Intersection, airway UN516 to Cork VOR (CRK), airway UR37 to NORLA intersection, airway UR37 to EXMOR intersection, airway UR14 to GIBSO, then the EPM1E arrival into London Heathrow.

FIX5-FIX70. The next is the FIXLIST. Each compulsory reporting point, or a point in the flight where a turn is made should be listed next. The values listed in the FIXLIST are the Lookup_values discussed on page 3-1, in flight plan order. Note that, in the beta release, a 70-fix limit is imposed. When the final version is released, there will be capacity for 120 fixes.

OCEANIC VARIABLE TRACK SYSTEMS NOTE:

The programmed stored routes for transatlantic flights are based on the NAT Tracks as effective on the 12-2-98 (track message 337-98). The Coast-Out and Coast-In routings for these flights are based on the UK Contingency Routing Scheme (as applicable), the most recent (at the time of this writing) North American Routes, and the Permanent Preferred Routes for North Atlantic Traffic within France, Ireland, and the UK. Pacific Routes are based on the most recent NOPAC routes, NOPAC OTS message from Oakland Oceanic, and the most recent revisions to the CEPAC airspace. Since the tracks change on a daily basis, if you wished to fly current tracks, the STORED ROUTE must be revised to reflect the current data. For more information on the North Atlantic Track Systems see the North Atlantic Airspace Operations Manual, 7th. Edition. Routes from the US West Coast to the South Pacific are based on charted or published routes, and the DOTS (Dynamic Ocean Track System) tracks (when/where applicable).

US ROUTES NOTE:

US Domestic Routes Programmed are based on the US FAA Preferred Routes, TEC Routes (Tower Enroute Control), NRP compliant routes that I designed, or the best available route for the city pair.

ROUTE PROGRAMMING NOTE:

When designing and programming routes, the best advice is to omit in your fix list all fixes which would be encountered below 10,000 for both takeoff and departure climb, as well as descent and landing. Due to Excel programming considerations, the top of climb MUST occur within 4 fixes from the departure airport or erroneous results may occur in the fight plan solution (see CH. 9, "Cautions, Causes, and Cures.".) During these phases of flight, you should be paying close attention to the PFD and ND anyway, and not the computer flight plan. Some immediate fixes such as those encountered in some of the European Departure and Arrival Procedures, such as at EHAM and EDDF, may be safely omitted. Over a 5,000 NM flight, they do not have much operational significance, and for the purpose PS1FPLAN serves, they may be omitted from a flight plan solution.

§ 3-3. Country Codes

The Country Codes table is a simple two-column format. This column contains the codes used to define the various countries whose navaid data is programmed in the NavData file. Informational only, serves no other purpose, and is not linked to any worksheet within the program.

§ 3-4. Airports

Table 3-4 is another simple two column table which contains a translation table between the 3-letter ATA airport codes, and the 4-letter ICAO codes. Upon release, all airports defined with an "A" navaid type in the navaid database are listed in the Airports database.

Any airports you install in the navaid database, if not previously programmed, must be listed in the Airports database for them to be recognized. Externally, 3-letter codes are used in the program on the flight plan output, however, 4-letter codes are used to match each individual airport in the navaid database.

§ 3-5. Runway Database

To avoid repeatedly entering runway data to generate a weight solution, a runways database was added. There are 7 entries per each runway entry. Each runway entry contains the following data fields:

Runway Identifier	Each runway is identified by the 4-letter ICAO code, and the runway identifier (omit leading zero). Therefore, runway 27L at KORD is entered as KORD27L, runway 27 at CDG is entered as LFPG27, runway 25L at intersection J8 (published intersection takeoff) at Hong Kong is entered as VHHH25L-J8.
Runway length available for takeoff, in feet.	Self-explanatory
Runway length available for takeoff, in meters.	Self-explanatory. Is a calculated value.
Runway slope, in percent.	Some facility directories and charts include exact runway slope data, however, PS1ATOG is only programmed to account for slopes -2.0%, -1.0%, LEVEL, +1.0%, +2.0%; i.e., round to the nearest whole percentage. Other values will cause an error.
Runway heading	Runway heading, in degrees magnetic. This is to calculate the takeoff wind components. If an exact heading is not available, round to the nearest 10 degrees using the runway identifier.
Landing Distance Available, in feet.	The shortest of the following: runway length, or length available for landing beyond a displaced threshold. Do not use distances indicated on some charts called "landing beyond glide slope."
Landing Distance Available, in meters.	Same as above.

Chapter 4 - How to Read the Flight Plan

§ 4-1 Dispatch Release

(domestic or international using straight release, no redispatch or rerelease)

```
------- PS1FPLAN DISPATCH RELEASE -------
RLS IFR    UAL17    8951   JFK TO LHR
FU BURN    133259   RLS FU   167000   763259  XTOG            ALTN     EGKK     FL30
MAX TOW BASED ON  LANDING LIMIT
DSP RMKS:

RELS FUEL ANALYSIS:
            ARPT       FUEL      TIME     DIST
TAXI         JFK       2500

FU BURN      LHR     133259      0556     3085
-----------------------------------------------------------------------------------

INTL RESV             12284      0036
ADD                   00000
ALTN        EGKK      08798      0015     0021  FL30
INTL HOLD             09923      0030
MEL/CDL               00000
                     ------
MIN FUEL     JFK     166763
RELS FUEL    JFK     167000 LB


DISP      SNOW, DK
CAPTAIN   DAVIS, AJ
PLND RMP   647160   PAYLD   080107
 PLND TKOF  644660
AUZD CAPT
SIGNATURE            . . . . . . . . . . . . . . . . . . . . . . . . .
RELEASE TIME     11/15/98  14:19
```

The first part of the printed flight plan is the flight release. The flight summarizes important aspects of the flight, and sets for the authorization for the flight, as well as the special conditions of the flight. US FAR 121 sets forth certain minimum information to be included on a domestic/flag operations flight release:

- Trip number/date
- Aircraft number
- Origin and Destination airports, and any and all alternates
- Statement of Type of Operation (i.e., VFR or IFR)
- Minimum Fuel Supply

```
RLS IFR     UAL17     8951      JFK       LHR
FU BURN    133259   RLS FU   167000   763259  XTOG             ALTN     EGKK     FL30
```

The first two lines of any flight release contain, from left to right,
Statement of Type of Operation (all flights are released under IFR)

Line 1: Airline and Flight Number
Aircraft Number (ship number or registration)
Origin Airport
Destination Airport

Line 2: Fuel Burnoff, followed by the Minimum Fuel Required for Departure.
Maximum Takeoff Weight (Release XTOG)
Most distant destination alternate (4 letter ICAO code), followed by most optimum altitude for cruise to the destination alternate, based on distance to the alternate and direction.

> ***NOTE:***
> *Planning factors for the Release XTOG are based on a Max N1 takeoff.*
> *For alternate thrust settings (ATM, TO-1, TO-2) see the Final Load Plan.*

```
MAX TOW BASED ON  LANDING LIMIT  T19 R26L F10 A30.01 IN HG
DSP RMKS:
```

The next line shows the limiting factor (either Takeoff or Landing) for the Release XTOG. This weight is the MOST restrictive of any of the following:

- Maximum Field Length Limit Weight
- Maximum Climb Limit Weight
- Maximum Takeoff Weight for Landing at Destination at Maximum Landing Weight
- Maximum Structural Takeoff Weight.

The coded data after the limit type is the ATOG planning factors for the takeoff.

T19	Temperature 19C
R26L	Runway 26L
F10	Flaps 10
A30.01	Altimeter Setting, followed by the units of altimeter measure.

The second line is the Dispatch Release Remarks. Any free text remarks you so desire may be entered here, 2 lines maximum.

If a no packs takeoff is planned, the following text will be displayed below the maximum weight planning factors on the flight release:

XTOG LIMIT WEIGHT BASED ON **** ALL PACKS OFF *******

The second portion of the flight release is the fuel breakdown ladder. This section indicates exactly how the Minimum Fuel for Release was calculated, as well as the actual Release Fuel for your flight.

```
             ARPT       FUEL      TIME     DIST
TAXI          JFK       2500

FU BURN       LHR     133259      0556     3085
-----------------------------------------------

INTL RESV              12284      0036
ADD                    00237
ALTN         EGKK      08798      0015     0021  FL30
INTL HOLD              09923      0030
MEL/CDL                00000
                      ------
MIN FUEL      JFK     166763
RLS FUEL      JFK     167000 LB
```

Starting from the top

TAXI JFK 2500

Taxi burnoff at the origin airport. Based on a basic value multiplied by the estimated taxi time entered at Flight Setup J15.

FU BURN LHR 133259 0556 3085

Actual planned fuel burn to destination, followed by ETE, and route distance.

INTL RESV 12284 0036

For straight-release international operations, this will show INTL RESV, followed by the time (in minutes), and the fuel quantity to meet the enroute reserve requirements. For domestic operations, this line will show:

RESV 15500 0045 or something to that effect, depending on actual computed fuel reserves. The title RESV shall be displayed.

For flights dispatched under 2 hr. Island Reserves, this line shall show:

ISLD RESV 41350 0200

ALTN EGKK 07400 0015 0021 FL30

The most distant alternate, followed by the computed fuel burn to the alternate, time to the alternate, and distance to the alternate. FL30 indicates the most optimum altitude for the flight from the destination to the alternate airport. This altitude (corrected for hemispheric altitude rules) is based on p. 23.10.43 (Short Distance Cruise Altitude) of the Boeing B-747-400/CF6 AOM.

NOTE:

The minimum amount of fuel carried for any alternate is 15 mins., i.e., if the actual flight time between the destination and alternates is only for example 7 mins (such as at JFK - EWR, LHR-LGW, MIA-FLL or other two-city airports), no less than 15 mins. fuel will be carried for the alternate. This minimum alternate fuel equals 7400 lbs. (3356 kgs.) for the B747-400, and can not be overridden in the program.

INTL HOLD 09923 0030

For international flights, this line will indicate the 30 minute hold requirement of FAR 121. For US domestic operations, the text will be "CONT", and will indicate the amount of contingency fuel entered into the FLIGHT SETUP screen.

MEL/CDL 00000

MIN FUEL JFK 166763

This fuel is the minimum amount of fuel required to meet all FAR requirements for dispatch.

RLS FUEL JFK 167000 LB

This fuel is the minimum fuel on board to meet all requirements, PLUS, any additional amount entered into the DX OVRD cell on the FLIGHT SETUP screen. Following this is the UNITS used, LB or KGs.

```
DISP      SNOW, DK

PLND RMP   647160   PAYLD   080107
```

The next section shows:
The name of the dispatcher as entered on the FLIGHT SETUP worksheet.
Planned Ramp Weight, followed by the planning payload.
Planning factors for TAKEOFF, i.e., 3 packs, Temp (deg. C), runway, Flaps 20, the altimeter setting, and the units of altimeter measure.

```
AUZD CAPT          . . . . . . . . . . . . . . . . . . . . . . . . .
SIGNATURE
RELEASE TIME     11/15/98  14:19
```

A place for the captain to sign the release, followed by the date and time of release generation. US domestic releases are valid for only one hour from scheduled departure time, whereas international releases are valid for 6 hours from scheduled departure time.

§ 4-2 Dispatch Release Using Redispatch/Rerelease

```
------- PS1FPLAN DISPATCH RELEASE -------
RLS IFR        UAL895      8594    ORD TO PEK SUBJ INFLT RERLS ONTO HKG OVER DW PEK ALTN DLC
FU BURN        351077     RLS FU    383000    XTOG   875000    ALTN      NONE
MAX TOW BASED ON:      TAKEOFF LIMIT      ATOG-T: T09 R32L F20 A30.01 IN HG

RELEASE      MAX PYLD 68.0 - NO OMC/CJA/BP8-10 - OVERFLT PERMIT 363-0008 - FPF COMPLIES WITH
REMARKS:     OVERLAND ROUTE – IF RERTED CALL CHIDD ASAP - HI MINS CAPT

RELS FUEL ANALYSIS:
INIT RLS        ARPT          FUEL     TIME     DIST          FINAL          FUEL     TIME    DIST
TAXI            ORD           3000                                           3000
RDFIX           DW
FU BURN         DW          299769     1300     5667             DW        299769     1300    5667
-----------------------------------------------------------------------------------------------
RLS DEST        PEK         013839     0047     0329            HKG        051308     0252    1461
INTL RESV                   028481     0123                                005015     0017
CONT+ETP                    008250     0025                                008250     0025
ALTN            DLC         012266     0043     0238  FL330       0        000000     0000    0000
INTL HOLD                   009923     0030                                009923     0030
ETP ADD                     000000                                         000000
                            ------                                         ------
MIN FUEL        ORD         375528                  RERLS REQUIRED         074496
RELS FUEL       ORD         383000 LB               RERLS PLANNED          083831
                                                    RERLS EXTRA            009335
ETP/SUITABLE ENROUTE ALTERNATES


DISP         SNOW, DK
CAPT         ANDERSON, AR
PLND RAMP        854653   PAYLD    068000
PLND TKOF        851653

AUZD CAPT SIGNATURE                 . . . . . . . . . . . . . . . . . . . . . . . . .

                           ORD       HKG
SKED DEP-ARR GMT           1745      1040   FPF DATE/TIME      26Dec0857          RLS NBR    1
```

As you can see, there are some important differences between a nonstop dispatch release and a dispatch release using redispatch. The sample redispatch release above is for a flight from ORD to HKG.

```
RLS IFR        UAL895      8594    ORD TO PEK SUBJ INFLT RERLS ONTO HKG OVER DW PEK ALTN DLC
FU BURN        351077     RLS FU      383000      XTOG    875000    ALTN       NONE
```

Most of the information in these two lines are the same as in the nonstop release, however, the text SUBJ INFLT RERLS ONTO is added; the redispatch point is substituted for the planned destination, and the planned final destination is placed at the end. This example means, ORD to DW (an NDB, NE of Beijing), subject to inflight rerelease onto HKG. This makes the DW NDB the rerelease fix (RDFIX).

The fuel burn, min fuel, destination alternate, and maximum takeoff gross weight and limiting factor is the same as on a nonstop release.

The next major difference in a re-release flight plan is the release fuel analysis. There are two separate analyses in a rerelease, from the origin airport to the RD DEST (the left column), and from the RDFIX to the planned landing destination (the right column).

RELS FUEL ANALYSIS:				
INIT RLS	ARPT	FUEL	TIME	DIST
TAXI	ORD	3000		
RDFIX	DW			
FU BURN	DW	299769	1300	5667
RLS DEST	PEK	013839	0047	0329
INTL RESV		028481	0123	
CONT		008250	0025	
ALTN	DLC	012266	0043	0238
INTL HOLD		009923	0030	
ETP ADD		000000		

MIN FUEL	ORD	375528		
RELS FUEL	ORD	383000 LB		

The left column for the sample shows the fuel analysis from ORD to PEK. Note that the 10% reserve requirement is based on ***the total flight time from ORD to PEK***. Note also that, if the flight time for this portion is over 6 hours, a destination alternate must be listed; in this example it is Dalian. The absolute minimum fuel for departure must meet the MIN FUEL amount in this column, since the flight is originally released to PEK, but releasing with just this amount rarely guarantees that the flight will be dispatchable all the way to the planned final destination upon arrival at the RDFIX. The contingency time amount entered on the FLIGHT SETUP screen is copied to both the pre-rerelease column, and the post-rerelease column, and is used in both fuel planning scenarios.

	FINAL	FUEL	TIME	DIST
		3000		
	DW	299769	1300	5667
	HKG	051308	0252	1461
		005015	0017	
		008250	0025	
	0	000000	0000	0000
		009923	0030	
		000000		

RERLS REQUIRED		074496		
RERLS PLANNED		083831		
RERLS EXTRA		009335		

The right column below the line shows the fuel analysis after the RDFIX point. Note that the 10% reserve requirement is based on the flight time from the RDFIX to the planned destination. Given the example above, 74496 lbs. Must be onboard the aircraft to pass the RDFIX and continue onto HKG. Based on the flight plan and planned total fuel at takeoff, 83831 lbs. Are forecast to be onboard at the RDFIX, with 9335 lbs. Being the difference between the RQRD and PLND amounts. Note also that there is no alternate airport planned for HKG. This is legal as long as the weather and field conditions supports a no-alternate operation, and the flight time from the RDFIX to the planned destination is less than 6 hours. If the flight time from the RDFIX to the planned final destination is over 6 hours, a destination alternate must be listed regardless of the weather, field conditions, etc.

Now, what can happen to permit redispatch onto the planned destination, if the planned fuel over the RDFIX will not permit a nonstop operation?

- Remove the destination alternate, if the weather permits, and if the segment time from the RDFIX to the planned destination is less than 6 hours.
- Lower the contingency fuel requirement. Note that the FARs do not require contingency fuel for all operations – only for “anticipated delays.”
- Replan the flight, with the actual takeoff weight, and updated winds.

If the above will not permit a nonstop operation, a fuel stop must be made. The flight may not proceed beyond the RDFIX to the final destination with less than the minimum fuel stated in the original or in the revised flight release.

§ 4-3. The Computer Flight Plan
(applicable to all types of operations)

Refer to the sample flight plan portion below.

```
NONSTOP FLIGHT PLAN
-FPL IFR   NWA995   6308   MSP TO LAX
           FUBO   075681   RLS FU   124000        ALTN:  SFO  FL350
                                                  TOP OF DNT 116NM PRIOR TO LAX
NWA995   B/B74F/G   MSP    P1740    0505   310    FMSRTE: MSPLAX01N
KMSP..ONL..GLL052040..DBL262018..JNC121013..HVE198045..BCE205066..BLD.J60.CIVET.
CIVET1.LAX  :NRP   (DIR RTE ONL-BLD)

TO                   LAT      LONG     TC   TH    GS    TDV       SD     ST    SB
IDENT     FL         WIND     WCMP     MC   MCH   TAS    I        TLDR   TTLT  FREM

MINNEAPOLIS - STP  N4453.1  W09312.9                                            0030
KMSP               31022                                         1344           1210
-----------------------------------------------------------------------------------
O'NEILL            N4228.2  W09841.2   241  242   447            0278   0043  0226
ONL            310 25054        -053   233        500            1066   0043  0984
-----------------------------------------------------------------------------------
GLL052040          N4047.9  W10346.6   248  248   407   -2       0249   0038  0142
GLL40          310 25096        -096   237  M860  503            0817   0120  0842
-----------------------------------------------------------------------------------
```
(legs of the flight plan have been deleted for space)
```
-----------------------------------------------------------------------------------
LOS ANGELES INTL   N3356.6  W11824.5   264  265   458   8        0051   0007  0022
KLAX           350 28048        -046   250  M860  504            0000   0311  0453
-----------------------------------------------------------------------------------
```

This flight plan segment is for the MSPLAX01N route. Starting from the first line…

```
-FPL IFR   NWA995   6308   MSP TO LAX
           FUBO   075681   RLS FU   124000
```

A restatement of the type of operation from the flight release, IFR, followed by flight number, ship number or registration, origin, TO destination. The second line is the fuel burnout, followed by the planned release fuel.

```
NWA995   B/B74F/G   MSP    P1740    0505    310
KMSP..ONL..GLL052040..DBL262018..JNC121013..HVE198045..BCE205066..BLD.J60.CIV
ET.CIVET1.LAX  :NRP   (DIR RTE ONL-BLD)
```

Below this is the FMS route code of the flight plan route used, and the FAA domestic flight plan for the flight. The first line of the flight plan is the aircraft callsign (Northwest Flight 995), type of aircraft for ATC separation purposes (B/B74F/G= both a heavy aircraft and TCAS equipped, B747-400, with a glass cockpit). Departing MSP at 1740Z, planned cruise TAS is 505 KTAS, and cruising at FL310. The second line is the FPL TEXT (flight plan text) of that stored route. See § 3-2.

```
TO                  LAT      LONG     TC   TH    GS    TDV        SD      ST    SB
IDENT     FL        WIND     WCMP     MC  MCH   TAS              TLDR    TTLT  FREM
```

Flight plan column headers. For the top line, they are:

TO	Name of the fix, airport, or nav aid.
LAT	Latitude of the fix, in FMS format.
LONG	Longitude of the fix, in FMS format.
TC	True Course
TH	True Heading (TC corrected for wind drift angle)(place the FMS NAV switch in TRUE to fly this heading. If flying in NORM, and the heading reference is MAG, determine the heading correction between TC and TH, and apply this correction value to the MC to determine the correct MH to fly.
GS	Average Ground Speed
TDV	Temperature Deviation from standard
SD	Segment Distance
ST	Segment Time
SB	Segment Burnoff
Line 2:	
IDENT	FMS IDENT of the navaid, airport, or fix.
FL	Flight Level
WIND	Wind direction and speed. Note that the leading zero is omitted by Excel for wind directions between 010 and 090 degrees (e.g., for winds of 050 at 35 kts, 5035 will be displayed). This will hopefully be fixed in a subsequent release.
WCMP	Wind component. Headwinds will be displayed by negative amounts.
MC	Magnetic Course. True course corrected for local magnetic variation.
MCH	Mach Number
TAS	True Air Speed
TLDR	Total Distance Remaining.
TTLT	Total Time from takeoff to the fix.
FREM	Estimated fuel remaining over the fix.

For the first line of a flight plan, the departure airport, most all data fields will be omitted except winds aloft, total trip distance, taxi burnoff, and computed total fuel on board at takeoff.

Even though the climb data is not specifically indicated (i.e., no specific top of climb leg is inserted), the climb data (time, distance, and fuel) is taken into account, and is incorporated into the leg distance, time, and fuels for the legs for the segments where the aircraft is climbing. For this sample, the ETE between KMSP and ONL VOR is 43 mins., with a resultant fuel burn of 22600 lbs. This includes the total segment of the flight in climb, as well as the cruise segment from the top of climb, to the ONL VOR. If the total segment distance is used for climb, the initial cruise altitude will be displayed as CLB. Note, however, that if there is no cruise distance for a given leg (i.e., you are climbing the entire length of the segment), the program will not display the true airspeed/groundspeed datablocks for those segments where the aircraft is climbing.

§ 4-4. Redispatch Flight Plan

The redispatch flight plan follows the same format, and is inserted after the ETP datablocks, if applicable. There are several differences between the nonstop flight plan and the redispatch flight plan.

The redispatch flight plan only encompasses the segment of the flight from the RDFIX to the RD DEST. The first line of the redispatch flight plan recaps the RDFIX, RD DEST, SRA, and the release number. The second line shows the flight number, and the ship/nose number of the flight.

The third section of the redispatch flight plan provides a place for the crewmembers to copy down the rerelease message while enroute. Immediately below that is the line REDISPATCH FLPN, which is a recap of the ATC TEXT for the re-release diversion to the short-release destination (it is this route which should be requested from ATC should a diversion become necessary). In this example, after the DW NDB, fly airway A596 to the LR NDB, and then the A05 arrival into ZBAA.

```
------- PS1FPLAN REDISPATCH FLIGHT PLAN -------
UAL9810    9419           SFO TO PEK SUBJ RERLS ONTO HKG OVER DW PEK ALTN DLC

REDISPATCH MESSAGE - ------  RLSD FR ------------ TO ------- SHIP --------

          TIME ----- BURN ----- RDSP FUEL ----- FL ----  ALTN ------------

          WEATHER: OPEN -- OPNL -- INST -- DISPATCHER ------------ RDA/RDU

          REMARKS:
REDISPATCH FLPN:          DW A596 LR A05 ZBAA

TO                 LAT       LONG        TC     TH      GS     TDV     SD     ST      SB
IDENT          FL  WIND      WCMP        MC     MCH     TAS           TLDR   TLTT    FREM

TONGLIAO         N4329.7    E12210.6
DW            370 35025                                                0329           1006
--------------------------------------------------------------------------------
GOUBEIKOU        N4038.0    E11705.0   235    237     481     -1      0284   0035    0120
LR            370 30025          -011  241   M860     492             0045   0035    0885
--------------------------------------------------------------------------------
HUAIROU          N4017.0    E11632.0   230    233     482     -2      0033   0004    0014
OB            370 30025          -009  227   M860     491             0012   0039    0871
--------------------------------------------------------------------------------
BEIJING          N4005.1    E11635.1   169    171     507     -2      0012   0001    0005
ZBAA          370 30025           016  166   M860     491             0000   0041    0867
----------------------------------------------------------------------------------
```

Note that there is a current 10-fix limit for the redispatch flight plan.

§ 5-1. Standard Takeoff Minimums
(US Domestic)

Runway Visual Range (RVR)	**Visibility (if RVR is unavailable)**	**Minimum Required Visual Aids for Takeoff**
Standard Minimums, 4-engines **RVR 24** (Use next lower block if RVR is less than standard)	**Standard:** **1/2 Mile**	No visual aids required
Touchdown Zone (TDZ) **RVR 1600** (Midfield (MID) and Rollout are advisory, if reported. MID RVR may be substituted for touchdown zone if it is unavailable)	**1/4 Mile**	High Intensity Runway Lights (HIRL) **OR** Runway Centerline Lights (RCL) **OR** Runway Centerline Markings (RCLM) **OR** Adequate Vis. Ref: If none of the above visual aids are available, takeoff with 1/4 mile visibility may be made if other runway markings or lighting provide pilots with adequate visual reference to continuously identify the takeoff surface and maintain directional control throughout the takeoff run.
Touchdown (TDZ) RVR 1200 And Rollout RVR 1000 Mid RVR substituted for TDZ or Rollout RVR if either is unavailable, otherwise Mid RVR is advisory only. Use next lower block if RVR is less than 1200	**RVR Required**	Runway Centerline Lights
Touchdown Zone RVR 600, *and* Mid RVR 600, *and* Rollout RVR 600 (All three RVRs are controlling. If one of three installed transmissometers has failed, takeoff is authorized providing the other two RVRs are reporting AT LEAST 600. If only TDZ RVR and Rollout are installed, both must be reporting at least 600)	**RVR Required**	Runway Centerline Lights **AND** Runway Centerline Markings

§ 5-2. Standard Landing Minima

RVR	Transmissometer Requirements					ILS - Minimum Equipment	Edge Lights	Approach Lights	Runway Lights and Markings
4000 or 3/4	RVR IS NOT REQUIRED BUT, IF REPORTED, IS CONTROLLING FOR THE RUNWAY.					LOC, GS, OM (1)	RL or MIRL or HIRL (night only)	N/R (required for night operations)	N/R (required for night operations)
2400 or 1/2							RL or MIRL or HIRL	ALSF-I or -II or SSALR or MALSR	Precision Runway Markings or CL
1800 or 1/2									CL and TDZL
1600	Nbr	Req.	TDZ	MID	R/O		HIRL	ALSF I or II	
	1	1	1600	Advisory only if reported					
	2	1	1600						
	3	1	1600						
1200	2	2	1200	Either MID or R/O Must Report Advisory Only (2)					
	3	2	1200						
700	3	3	700	700	Adv			ALSF I or II (SF N/R for CAT III)	CL and TDZL. Precision Runway or ALL Weather Markings
600	3	3	600	600	Adv				
300	3	3 (3)	300	300	300				

Notes - (1) Allowable substitutes for the OM if shown on the approach plate for CAT I, II, or III approaches include Radar FIX, NDB, DME Fix, or VOR.

Descent below the OM, when identified only by a fan marker, will not begin until both aural and visual signals are received and verified.

§ 5-3. CAT I, CAT II, and CAT III Operations

(Minimum Equipment Required for Low Weather Minimums Operations)

Equipment/System	CAT I	CAT II	CAT III
AC Electric Power Source	-	-	(a)
AFDS Annunciators	N/R	2	2
Antiskid	N/R	N/R	Required
Autobrakes or IRS GS	N/R	N/R	Required
Autoland Status Annunciators	N/R	2	2
Autopilots	1 AP or 1FD	2 CMD	3 CMD
Autothrottle	N/R	N/R	1
EIU's	1	2	2
Flight Directory Displays	1AP or 1FD	N/R	N/A
G/A Attitude Guidance	N/R	N/R	Required
Hydraulic Systems	-	4	4
ILS Deviations	1	2	2
IRSs (in NAV mode)	2	2	3
Marker Beacon Receiver	N/R	(d)	N/R
PFDs	1 (PF)	2	2
RA Readouts with DH	N/R	2	2
Reversers	N/R	N/R	3
Rollout Guidance	N/R	N/R	Required
Rudder Ratio System	(b)(c)	1 (b)(c)	1 (b)(c)
Windshield Wipers	N/R	2	2

NOTES:

- Autoland is required for approaches below CAT I (basic ILS) minimums.
- Autoland is prohibited where there is a runway restriction or airplane equipment is inoperative.
- Additional equipment may be required for dispatch and may be used for the approach if available.

(a) Bus Tie Breakers 1, 2, and 3 must be operative. DC Bus Isolation Relays 1, 2, and 3 must be operative.
(d) 10 kt crosswind limit with the rudder ratio system inoperative.
(d) 5 kt crosswind limitation with the rudder ratio system and an engine inoperative
(d) Required if charted approach minimums require marker beacon.

§ 5-4. High Minimums Operations (US FAR 121.652)

Until acquiring 100 hours in the PIC seat position of a new type of aircraft, scheduling and operational restrictions apply as described below. Time accrued during the IOE portion of training can not be used to meet the 100HR rule.

Captains are restricted to higher visibility and DH/MDA minimums. Approach minimums must be increased by 1/2 mile and DH or MDA must be increased by 100 feet. If the visibility for the approach is expressed as an RVR value, the following chart applies:

CHARTED RVR MINIMUMS	RVR MINIMUMS FOR CAPTAINS WITH LESS THAN 100HRS IN TYPE
RVR 1800	RVR 4500
RVR 2000	RVR 4500
RVR 2400	RVR 5000
RVR 4000	RVR 6000
RVR 5000	RVR 6000

Equipment failures, lack of qualification or adverse winds which cause minimums to increase for all other captains from RVR 24 to RVR 40 ***do not cause additional penalties*** to be applied to a "High-Minimums Captain". Under such conditions, a "High-Minimums" captain's landing minimums remain at RVR 50 or 1 mile visibility.

No increase in takeoff minimums is required, however a takeoff alternate must be listed if the weather is below the high-minimums captains landing minimums. This is one reason the high-minimums captain must notify dispatch prior to signing every flight release.

First officers flying with a high-minimums captain are subject to the same restrictions, regardless of actual time in type.

§ 5-5. Alternate Airports

AUTHORIZED AIRPORTS FOR DESTINATION. US FAR 121.631(a). A certificate holder may specify any regular, refueling, or provisional airport, authorized for the type of aircraft, as a destination for the purpose of original dispatch or release.

DESTINATION CHANGE (FAR 121.631(c)). No person may change an original destination or alternate airport that is specified in the original dispatch or flight release to another airport while the aircraft is enroute unless the airport is authorized for that type of aircraft and the appropriate requirements of FAR 121.593 through 121.661 and 121.173 are met at the time of redispatch or amendment to the flight release.

AIRPORT WEATHER MINIMUMS. When US Operations Specifications are binding, the certificate holder is authorized to derive alternate airport weather minimums from the following table. In no case shall the certificate holder use an alternate airport weather minimum lower than any applicable minimum derived from this table. *In determining alternate airport minimums, the certificate holder shall not use any airport which is not authorized for use as an alternate airport.*

APPROACH FACILITY CONFIGURATION	**Alternate Airport IFR Weather Minimums**	
	Ceiling	**Visibility**
For airports with at least one operational navigational facility providing a straight-in non-precision approach procedure, or Category I precision approach, or, when applicable, a circling maneuver from an instrument approach procedure.	Add 400 ft to the DH or MDA, as applicable.	Add 1 SM or 1600m to the landing minimums.
For airports with at least two operational navigation facilities, each providing a straight-in approach procedure to different, suitable runways. (Note - special rules apply to ETOPS operations.)	Add 200 ft to the DH or MDA to the higher of the two approaches used.	Add 1/2 SM or 800m to the higher authorized landing minimum of the two approaches used.

The following conditions are evaluated when determining alternate airports for dispatch:

1. An alternate airport for destination is required for all domestic flights under IFR to regular, provisional or refueling airports except under the following conditions:

   For a period at least 1 hour before and 1 hour after the ETA at the destination airport, the appropriate weather reports and forecasts, or any combination thereof, indicate the ceiling will be at least 2000ft above the airport elevation and the visibility will be at least three miles.

   The above forecast requirements apply only to dispatch or redispatch. Once a flight is enroute to its destination, it may continue without an alternate regardless of weather changes at the destination, as long as, in the opinion of the captain and the dispatcher, the flight can be completed safely. If there is any question as to safe completion of the flight (including landing minimums, excepted ATC hold, etc.,) an alternate should be assigned or the flight otherwise redispatched.

Two alternates are required when weather at both destination and the first alternate is forecast to be "marginal." "Marginal" is defined as meaning below 1,000ft ceiling and/or below two miles visibility.

2. At least one alternate airport must be named for each airport of destination, including intermediate stops, with certain exceptions:

Exception 1: If the flight is scheduled for more than six hours and, for at least one hour before and one hour after the estimated time of arrival at the destination airport, the appropriate weather reports or forecasts, or any combination thereof, indicate the following:

A ceiling of at least 1500ft above the lowest circling MDA, if a circling approach is *required and authorized* for that airport.

A ceiling of at least 1500ft, above the lowest published instrument approach minimum of 2000ft above the airport elevation, whichever is greater.

The visibility at that destination will be at least 3 miles, or 2 miles more than lowest applicable visibility minimums for the approach to be used.

Exception 2: When the route does not have an available alternate for the destination, the reserve requirements are calculated to equal two hours of fuel at normal cruising fuel consumption.

Unlike domestic operations, there is never a regulatory requirement for a second alternate for international operations, however a second alternate can be listed any time the captain or dispatcher feel it is appropriate.

WIND - an alternate is required whenever weight will prevent landing on the runway that the probable wind would require. Thus, in a crosswind situation, we may dispatch a flight with maximum landing weight for the longest runway, provided an alternate is listed for the crosswind on that wind.

BRAKING ACTION - An alternate for destination is required when braking action at the destination is reported to be poor or nil. Such listed alternate must not itself be expected to have poor or nil braking action.

SINGLE RUNWAY AIRPORTS - When dispatched to an airport without a second runway (such as at SAN), the aircraft must be planned to have sufficient fuel to fly to a suitable contingency airport consuming no more than 50% of the fuel expected to be on board on arrival at the destination airport. Weather conditions at the contingency airport must meet the same requirements as a destination airport when dispatched without an alternate.

ATA EXEMPTION 3585

ATA exemption 3585 authorizes US operators to dispatch US domestic flights when the conditional remarks reflect weather below normal dispatch minimums. If the conditional remarks in the forecast for the destination and/or first alternate are below the minimums at the ETA, dispatch under the provisions of Ex. 3585 is authorized, provided:

- The main body of the forecast must be at or above the landing minimums or alternate minimums for the alternate airport.
- Use of conditional words in the remarks section of the METAR and TAF indicate that the airports are forecast to be not less than the applicable authorized weather minimum values as follows:

  With respect to the destination airport, the visibility must not be less than one half the lowest weather minimum visibility value established for the instrument approach to be used;

  With respect to the first alternate airport, the forecast weather conditions must not be less than one-half of the weather minimum ceiling and visibility values specified for that airport.

- The main body and conditional remarks for ceiling and visibility must be at or above minimums for the second alternate airport.
- A second alternate is always required.
- Each BECMG TAF that is deteriorating must be considered valid at the first minute of the becoming period. In addition, each BECMG TAF that is "improving" will not be valid until the last minute of the becoming period of the TAF.
- Exemption 3585 is **not authorized** for international operations.

§ 5-6 Weather Restrictions on Release Authority

The regulations state that a flight may not be released to an airport "unless appropriate weather reports or forecasts, or any combination thereof, indicate that the weather reports or forecasts will be at or above the authorized minimums at the estimated time of arrival at the airport to which dispatched or released."

Note that, for clarification, most US domestic airports do not have ceiling minimums for departure, visibility is the controlling factor concerning weather requirements for dispatch, except at those few airports which do have ceiling minimums for dispatch.[16]

The ceiling and visibility values in the main body of the latest weather report control for VFR and IFR takeoffs and landings and for Instrument Approach Procedures on all runways of an airport. However, if the latest weather report, including an oral report from the control tower, contains an RVV or RVR for a particular runway of an airport, that specified value controls for VFR and IFR landings, takeoffs, and straight-in approaches for that runway.

Most airports are equipped with runway visual range (RVR) measuring devices. RVR minimums can exist although the prevailing visibility is below minimums.

The following table should be used to convert RVR to Visibility in SM, or visibility in meters.

RVR (FEET)	Visibility (SM)	Meters
1600	1/4	500
2400	1/2	720
3200	5/8	960
4000	3/4	1200
4500	7/8	1400
5000	1	1500
6000	1-1/4	1800

[16] Such airports would hardly ever see any widebody aircraft, let alone a B747-400.

§ 7-1. Introduction to PS1ATOG Module

This portion is designed to assist the user with pre-flight takeoff calculations. All data contained herein comes straight from the B747-400 FAA Approved Operations Manual for the CF6-80C2B1F engine/airframe combination. This Excel file, however, is ***NOT FAA APPROVED, AND SHOULD NOT IN ANY CASE BE USED FOR REAL-WORLD FLIGHT OPERATIONS, in that case please refer to the Boeing FAA Airplane Flight Manual, or the Boeing Aircraft Operations Manual***. All possible conditions that affect the takeoff calculations have been taken into account (given programming considerations), such as runway slope, Vmcg and Vrmin calculations, runway clutter (for inclement operations), winds, brakes deactivated, etc. have been taken into account[17]. The program flow is simple. You enter all of the takeoff and landing parameters onto the Flight Setup worksheet. Excel does the math and computes all of the takeoff parameters (V-speeds, max weights, takeoff power settings, etc) based on your entered information. All of the data-sheets and worksheets have been hidden/protected to protect the data structures therein. The only user definable entries are on the Flight Setup and Airport Analysis Setup page. This program will make subtle reminders if you attempt a solution with configuration errors (such as Nacelle Anti-Ice OFF when temp is below 10C), or have too many passengers in the given cabins. There are two versions of the LM worksheet, one for pounds and one for kilos. Please use the correct version. This program does NOT compute weight and balance, nor stab trim settings, nor handle nonstandard fuel distributions.

[17] However, tire speed and brake energy limits have not been taken into account.

§ 7-2. ATOG Flight Setup Screen

A. PROGRAM USE

Open the file 744ATOG.xls in MS-Excel. Open the Flight Setup worksheet.

B747-400/PS1 TAKEOFF PERFORMANCE CALCULATOR - Ver. 1.0.1						**UNITS**	Lb
Flight	UAL1	**FROM**	KLAX	**TO**	VHHH		

Flight Airline code and flight number.

From Origination, 3 or 4 letter code is fine.

To Destination, 3 or 4 letter code is fine.

UNITS Lb or Kg listbox. Select desired units. NOTE: Use the appropriate Weight Data Record worksheet (Pounds or Kgs). Each Load Manifest worksheet is customized for its own units.

Flight	UAL855	
TAKEOFF	RCTP	
OAT C	32	
FLAPS	10	
PACKS	OFF	
ELEV	0.107	
LENGTH	12008	FT
NAI	OFF	
WIND DIR	90	
SPD	12	
RUNWAY DIR	53	**RNWY**
X-WIND	-7.2	
H-WIND	9.6	
ALT SETTING	30.07	IN HG

Flight Airline Carrier Code and Flight Number

Takeoff Departure city carried over.

OAT C Outside Air Temperature, in deg. C. NOTE: temps below 0C should use 0C.

FLAPS Select Takeoff Flaps

PACKS Select A/C Packs ON or OFF. At the current time, 2 PACKS ON takeoff is not supported.

ELEV Field Elevation, in thousands of feet. (e.g., 677’ field elevation, enter .677)

LENGTH Field Length. Using the listbox to the right, select the appropriate units of measure, either feet or meters. Note that this unit of measure is also carried over to the landing length.

NAI ON or OFF. Note that if the OAT is below 10C, NAI MUST be ON per the Airplane Flight Manual. If the OAT is below 10C, NAI ON will be automatically selected.

WIND DIR Wind direction.

SPD Wind Speed

RUNWAY DIR Runway True Heading, and **RNWY** label (i.e., 4L)

X-WIND Computed crosswind. Negative values indicate a left crosswind.

H-WIND Computed headwind. Negative values indicate a tailwind. NOTE: 10kts MAX tailwind.

ALT SETTING Altimeter Setting in in./Hg. Use the listbox immediately to the right to select Millibars/Hectopascals. IN HG is the default setting.

LANDING	RJAA
CONDS	WET
FLAPS	30
NAI	OFF
ELEV	0.429
LENGTH	13123
OAT	12
RNWY	34R
LOADDATA	
F PAX	15
C PAX	55
Y PAX	245
CARGO	31.5

LANDING Landing city carried over.

CONDS Landing conditions, WET or DRY. Most airlines normally plan on using WET conditions unless DRY conditions and performance are required, and no rain is forecast. ALSO, anytime a landing is planned to be made in instrument conditions (defined as weather below RVR 40 or 3/4 mile vis), WET must be used.

FLAPS Planned landing flaps.

NAI Nacelle anti-ice OFF or ON. NOTE: if landing temperature is forecast to be below 10C at ETA, plan NAI ON.

ELEV Field Elevation, in thousands. In the example, the landing field elevation is 429ft ASL. If the field is below SL, enter 0.000.

LENGTH Landing field length.

OAT Planned arrival temperature, in deg. C.

RNWY Planned arrival runway.

LOAD DATA

F PAX Number of F class passengers

C PAX Number of C class passengers

Y PAX Number of Y class passengers

CARGO Planned cargo weight, in thousands of pounds or kilograms.

WARNINGS/MISCONFIGURATIONS -
These are the following misconfigurations the program is designed to detect.

- Maximum Operating Temperature, 50C at SL.
- Maximum Takeoff Field Elevation, 10,000' ASL. The program is only programmed with departure V-speeds, and Takeoff N1 up to 10,000'.
- Minimum Field Length Required, 5900ft.
- If OAT is below 10C and NAI is not ON.
- Maximum Tailwind Limit, 10 kts. While some international carriers use 15kts max tailwind, all US carriers use 10 kts, therefore, 10kts is what the program supports. According to the US FAA Operations Specifications (OpSpecs), they will issue an additional OpSpecs if over 10 kts tailwind authorization is sought, provided special crew training is given.
- Minimum Takeoff Field Length for Runway Clutter
- Anti-Skid Inoperative with Runway Clutter
- Anti-Skid Inoperative Minimum Field Length, 12,000'
- Departure Fuel below 50,000 lbs. Airplane Flight Manual requires a minimum of FAR 121 fuel required or 50,000 lbs. onboard for departure.

FLIGHT WGTS	
PAYLD	74.8
DISP FUEL	386.0
BURNOFF	351.5
PLND FOA	34.5
PTOG	858.4
PLW	506.9
TAXI FUEL	2.5
PZFW	474.9

PAYLD Total payload

DISP FUEL Fuel on board at gate departure from your flight plan.

BURNOFF Fuel burnoff from your flight plan.

PLND FOA Planned fuel on board upon arrival.

PTOG Planned takeoff gross weight, this is based on a 400000lb empty weight, or 181430 kgs.

PLW Planned landing weight

TAXI FUEL Taxi fuel burnoff on departure.

PZFW Planned Zero Fuel Weight

TAKEOFF - Flaps 10	
Field Limit	889.3
Climb Limit	950.0
XTOG	889.3

Field Limit This weight is the maximum weight at which the aircraft can accelerate to the V1 decision speed, lose the critical engine, abort the takeoff, and remain on the runway following a maximum effort stop.

Climb Limit This weight is the maximum weight at which the aircraft, after losing the critical engine just prior to V1, can maintain a given climb gradient in the second segment (that portion of the takeoff from 35' AGL until the Obstacle Clearance Level-Off Height). In real operations, this weight can/is also adjusted for obstacle clearance as well. However, in the B757 FAA AFM (which I have) the chart explanations for the obstacle clearance section is 23 pages long alone, so actual obstacle clearance with an engine loss on takeoff in PS1 is your responsibility. Note that the Boeing B747-400 AOM does provide for a quick, rough, obstacle clearance solution, but according to the text, *"The charts are intended for use only when an airport analysis is not available. Detailed analysis for the specific case from the Airplane Flight Manual may result in a less restrictive weight, and can account for A/C packs off*." (B-747-400/CF6 AOM, p. 23.10.04)

XTOG Lesser of the two weights above.

LANDING - Flaps 25		DRY	
Field Limit	715.9	324.7	KGS
Climb Limit	948.2	430.0	KGS
XLW	715.9	324.7	KGS
XTOG-L	981.5		

DRY WET or DRY as selected previously. *Note that, unless actual landing weights are near maximum and the additional performance is required, most US airlines **always plan** on using WET weights for landing. Additionally, when landing is planned under RVR 4000 or 3/4 mile visibility, WET weights are **always** used regardless of actual weather (wet or dry).*

Field Limit This weight is the maximum weight at which one could land at, and stop, using every foot of the runway. This is assumed based on crossing the threshold at 50'AGL, at the Vref speed. This is a ZERO WIND WEIGHT.

Climb Limit There are two types of climbs available - the approach climb, and the landing climb. The difference in the climbs is the flaps/gear configuration. The approach climb is simply the maximum weight at which a go-around could be safely made (assuming loss of critical engine) in the approach configuration (i.e., intermediate flaps setting). A landing climb is a go-around (assuming loss of critical engine) in the landing configuration (gear down/flaps at landing setting). This weight is the most restrictive of the two. Normally, landing climb is the most limiting, due to the additional flaps/gear drag.

XLW Lesser of the two weights.

XTOG-L Maximum takeoff weight based on landing. This weight is the maximum weight one could takeoff at, and land at maximum structural landing weight, plus the weight of the trip burnoff fuel.

AIRCRAFT/RUNWAY CONDITIONS		
AUTO SPOILERS	OPNL	
TKOF RNWY CLUTTER	NORM	
RNWY SLOPE	LEVEL	ROUND TO NEAREST
ANTI-SKID	OPNL	

These entries show specific performance-limiting conditions that are available.

AUTO SPOILERS AUTO or MAN.

CLUTTER NORMAL, LEVEL 1, or LEVEL 2. See the table below.

	Use Normal Weights	Level 1 Clutter	Level 2 Clutter	**Takeoff NOT Authorized**
Slush	Up to 1/8 in.	1/8 to 1/4 in.	1/4 to 1/2 in.	Over 1/2 inch.
Wet Snow	Up to 1/4 in.	1/4 to 1/2 in.	1/2 to 1 in.	Over 1 inch.

Dry Snow	Up to 1 in.	1 to 2 in.	2 to 4 in.	Over 4 ins.
Standing Water	Up to 1/8 in.	1/8 to 1/4 in.	1/4 to 1/2 in.	Over 1/2 inch

RNWY SLOPE Select runway slope. This makes minor adjustments to the field limit, as well as adjusts V1.

ANTI-SKID If Anti-Skid is INOP (ASI), minimum departure field length is 12,000'. Plus, if ASI, NO clutter operations are authorized, autospeedbrakes is inoperative as well.

§ 7-3 SAMPLE LOAD MANIFEST

The Load Manifest (LM) is the worksheet on which all of the single-flight-related performance information of the program is displayed. There are two versions of the LM, one for Lbs. and the other for Kgs. The user needs not enter ANY data on the LM page. It is being copied from various worksheets in the program.

```
FLT        UAL2     KLAX     KJFK      LBS
FINAL               LOAD MANIFEST
PAX CONFIG 16FC/64CC/292YC

    400053 OEW 744 SHIP PS1/CF6-80C2B1F

      2160        12 F PAX
      4860        27 C PAX
     27900       155 Y PAX

     35000           TOTAL
                     CARGO

    469973 ZERO FUEL WEIGHT
           535000 STRUCT ZERO FUEL WEIGHT LIMIT

    175000 FUEL (NORMAL DISTRIBUTION)
      2000 LESS TAXI FUEL

    642973 ACTUAL TAKEOFF WEIGHT
***************************************************************
KLAX       TAKEOFF WEATHER             FLD ELEV      126 FT
        14 DEG/ALT     30.04 IN HG
WINDS           290       15

    764700 MAX TAKEOFF WT THIS FLIGHT                   FLAPS    COND
           LIMITED BY MAX STRUCT LDG WGT AT     KJFK     25       WET
           PLUS TRIP BURNOFF FUEL        134700

    875000 MAX STRUCTURAL TAKEOFF WEIGHT
******************************************************************
KLAX       24L-E8       9572 FT            HW 11           XW -10
 RWY COND   FLP/N1  CLB LMT   FLD LMT     V1       VR       V2     TKOF N1  SEL TMP
  NORMAL    10/MAX   947872    807038     130      146      161     104.2     ---
  NORMAL    10/TO1   896054    782783     133      133      161     102.2     ---
  NORMAL    10/TO2   801239    733171     137      137      161      98.4     ---
 ASMD TMP   10/SEL  ASMD WT    663973     136      152      161     103.1     54
 *OPT V1*   10/MAX   947872    807038    LO V1     126     HI V1     130      ---
*LEVEL 1*   10/MAX   947872    744038     126      146      161     104.2     ---
*LEVEL 2*   10/MAX   947872    702838     126      146      161     104.2     ---
***ASI***   10/MAX   OVRWGT    OVRWGT     ---      ---      ---      ---      ---
******************************************************************
KLAX       24L-E8       9572 FT            HW 11           XW -10
 RWY COND   FLP/N1  CLB LMT   FLD LMT     V1       VR       V2     TKOF N1  SEL TMP
  NORMAL    20/MAX   945694    835589     126      138      155     104.2     ---
  NORMAL    20/TO1   893876    811334     128      128      155     102.2     ---
  NORMAL    20/TO2   799061    761721     132      132      155      98.4     ---
 ASMD TMP   20/SEL  ASMD WT    663973     132      144      155     103.1     54
 *OPT V1*   20/MAX   945694    835589    LO V1     126     HI V1     126      ---
```

```
 *LEVEL 1*  20/MAX   945694    772589     126      138      155     104.2     ---
 *LEVEL 2*  20/MAX   945694    731389     126      138      155     104.2     ---
 ***ASI***  20/MAX   OVRWGT    OVRWGT     ---      ---      ---      ---      ---
******************************************************************
KJFK      13L         9010 FT        PLND LWT   508273         WET
                   RWY ZERO WND WGTS
   COND     FLAPS   CLB LMT   FLD LMT           PLN OAT        9 DEG C
  NORMAL      25     948150    654102
 ***ASI***    25     OVRWGT    OVRWGT           MAX STRUCT LDG WGT
  NORMAL      30     815850    694961             630000
 ***ASI***    30     OVRWGT    OVRWGT
******************************************************************
DEPARTURE NOTES
WEIGHTS BASED ON ALL PACKS ON

FLT       UAL2     FINAL
```

```
FLT       UAL2     KLAX     KJFK      LBS
FINAL              LOAD MANIFEST
```

Flight UAL2 from KLAX to KJFK, units in Lbs.

```
    400053 OEW 744 SHIP PS1/CF6-80C2B1F

      2880        16 F PAX
     11520        64 C PAX
     50400       280 Y PAX

     10000           TOTAL CARGO

    474853 ZERO FUEL WEIGHT
            535000 STRUCT ZERO FUEL WEIGHT LIMIT

    386000 FUEL (NORMAL DISTRIBUTION)
      2500 LESS TAXI FUEL

    858353 ACTUAL TAKEOFF WEIGHT
```

This portion gives the weight breakdown for all portions which make up the Actual Takeoff Weight.

```
    400053 OEW 744 SHIP PS1
```

The operating empty weight

```
      2880        16 F PAX
     11520        64 C PAX
     50400       280 Y PAX
```

The weight and passenger count in each cabin, F, C, and Y.

```
10000        TOTAL CARGO
```

Pounds of total cargo planned to be loaded into the cargo pits.

```
    474853 ZERO FUEL WEIGHT
            535000 STRUCT ZERO FUEL WEIGHT LIMIT
```

Total Zero Fuel Weight (the sum of the above) followed by the Maximum Zero Fuel Weight limit.

```
    386000 FUEL (NORMAL DISTRIBUTION)
      2500 LESS TAXI FUEL

    858353 ACTUAL TAKEOFF WEIGHT
```

Fuel on board at pushback, followed by taxi fuel, and the actual takeoff weight. All of the V-speeds to follow are based on this weight.

```
KLAX       TAKEOFF WEATHER            FLD ELEV      126 FT
        24 DEG/ALT    30.04 IN HG
WINDS           250       15

    875000 MAX TAKEOFF WT THIS FLIGHT                   FLAPS    COND
           LIMITED BY MAX STRUCT LDG WGT AT     VHHH    25       DRY
           PLUS TRIP BURNOFF FUEL        351500

    875000 MAX STRUCTURAL TAKEOFF WEIGHT
```

```
KLAX TAKEOFF WEATHER  FLD ELEV 126 FT
```

A recitation of the weather upon departure follows, including the actual field elevation.

```
24 DEG/ALT 30.04 IN HG.
```

The OAT is 24C, altimeter setting is 29.92 IN HG. If MB/HPA is selected from the Flight Setup page, the entered altimeter setting will be displayed here, followed by MB/HPA.

```
WINDS 250   15
```

Wind direction and speed.

```
    875000 MAX TAKEOFF WT THIS FLIGHT                   FLAPS    COND
           LIMITED BY MAX STRUCT LDG WGT AT     VHHH    25       DRY
           PLUS TRIP BURNOFF FUEL        351500
```

Maximum takeoff weight of the flight based on landing at the destination, where a maximum landing weight landing could be planned. This weight is computed by adding the maximum structural landing weight to the estimated fuel burnoff (excluding departure taxi fuel).

```
875000   MAXIMUM STRUCTURAL TAKEOFF WEIGHT
```

Self-explanatory. Note, if an XTOG Override Weight has been entered on the Flight Setup screen, that weight will carry over to here, and the MAXIMUM STRUCTURAL TAKEOFF WEIGHT LIMIT text will be replaced by the text "MAX TAKEOFF WEIGHT WITH DISPATCHER OVERRIDE."

§ 7-4. DEPARTURE WEIGHTS ANALYSIS

An analysis of the maximum operating weights for the departure runway for various normal and irregular conditions at the planned temperature. Along the top line is the runway length (ft.) followed by the headwind (HW) and crosswind (XW). Tailwinds are shown as NEGATIVE headwind amounts.

KLAX	24L-E8	9572 FT		HW 11		XW -10		
RWY COND	FLP/N1	CLB LMT	FLD LMT	V1	VR	V2	TKOF N1	SEL TMP
NORMAL	10/MAX	947872	807038	130	146	161	104.2	---
NORMAL	10/TO1	896054	782783	133	133	161	102.2	---
NORMAL	10/TO2	801239	733171	137	137	161	98.4	---
ASMD TMP	10/SEL	ASMD WT	663973	136	152	161	103.1	54
OPT V1	10/MAX	947872	807038	LO V1	126	HI V1	130	---
LEVEL 1	10/MAX	947872	744038	126	146	161	104.2	---
LEVEL 2	10/MAX	947872	702838	126	146	161	104.2	---
ASI	10/MAX	OVRWGT	OVRWGT	---	---	---	---	---

The far left column includes all of the possible configurations possible for this runway/flaps setting. The data under the FLP/N1 column indicates all of the reduced thrust takeoffs which are possible for this runway. 10/MAX means Flaps 10, MAX N1, 10/TO1 means flaps 10, TO-1, etc.

NORMAL - 10/MAX Use when the runway is either dry or wet.

NORMAL - 10/TO1 Flaps 10, TO-1 derate selected.

NORMAL - 10/TO2 Flaps 10, TO-2 derate selected.

ASMD TMP - 10/SEL Flaps 10, Assumed Temperature Method

OPT V1 - 10/MAX Optional V1, Flaps 10, MAX N1. See the next page for a discussion of Optional V1.

LEVEL1 Use when Level 1 clutter exists.

LEVEL 2 Use when Level 2 clutter exists.

ASI Use when the Anti-Skid is Inoperative.

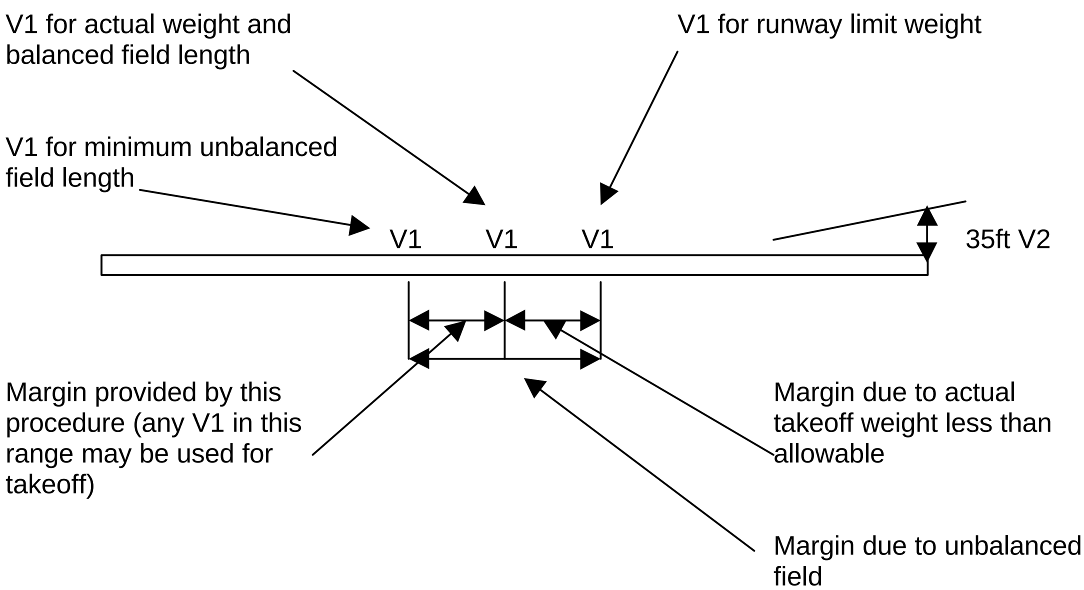
RWY COND	FLP/N1	CLB LMT	FLD LMT	V1	VR	V2	TKOF N1
WET/DRY	10/MAX	950000	889258	158	174	186	105.9
LEVEL 1	10/MAX	OVRWGT	OVRWGT	---	---	---	---

In the example shown, with a flaps 10/MAX N1 takeoff, the V1 speed is 158 kts., Vr is 174 kts., and V2 is 186 kts. The maximum takeoff N1 is 105.9%. The climb limit weight is 950,000[18] lbs., and the Field Length Limit Weight is 889,258 lbs. note that all limits are over the maximum structural takeoff weight limit, which therefore becomes the most limiting factor. If the actual takeoff gross weight exceeds any weight limitation for a given runway/configuration condition, OVRWGT will be shown in the weight limits columns, and the V-speed and N1 entries are blanked out.

[18] Note that in the Boeing 747-400 AOM, most of the charts top out at 950,000lbs. This aircraft is overpowered, almost as much as a B757!

§ 7-5 OPTIONAL V1 FOR TAKEOFF

The V-speeds contained in the FMC and that are programmed herein are based on the balanced-field concept. This concept produces a very safe operation, but seldom takes advantage of the entire length of an available runway. When operating at takeoff weights well less of the maximum field length limit, additional stopping distance is provided. Using an unbalanced field length can further increase this stopping distance.



A procedure has been programmed into the spreadsheet for computing a more realistic V1 when the runway is wet, but does not meet the Level 1 or 2 criteria.

EBBR	2	9790 FT		HW 10		XW 0	
RWY COND	FLP/N1	CLB LMT	FLD LMT	V1	VR	V2	TKOF N1
NORMAL	20/MAX	435632	390910	147	164	176	102.2
NORMAL	20/TO1	OVRWGT	OVRWGT	---	---	---	---
NORMAL	20/TO2	OVRWGT	OVRWGT	---	---	---	---
OPT V1	20/MAX	435632	390910	LO V1	139	HI V1	147

In the example above (weights are in KGs), the OPT V1 line indicates that ANY V1 speed between 139 KIAS and 147 KIAS may be used, based on the captain's assessment of the existing conditions. However, only ONE V1 speed may be used for the takeoff, and that speed must be entered into the FMC CDU TAKEOFF REF page prior to taxi. Vr and V2 are calculated and entered normally based on the actual takeoff weight. Note also that, when using Optional V1, MAX N1 is to be used, i.e., NO reduced thrust takeoffs.

CAUTION:

Optional V1 is to be used ONLY when the runway is slippery, but does not meet Level 1 criteria. When the runway is dry and normal braking action is expected, takeoff speeds must be calculated in the normal manner. When there is clutter on the runway meeting Level 1 or Level 2 conditions, the appropriate Level 1 or Level 2 limitations and V-speeds must be used and observed.

§ 7-6. DERATED THRUST TAKEOFFS

PS1 and the B747-400 FMCS supports three types of reduced thrust takeoffs. The Assumed Temperature Method, and two types of percentage thrust derates, TO-1 and TO-2. TO-1 provides a 5% derate from MAX N1, and TO-2 provides a 15% derate from MAX N1. This is done to conserve engine life. This is what one major US carrier has to say on the subject of reduced thrust takeoffs.

REDUCED THRUST

Why does reduced thrust work?

The positive effect of reduced thrust is so dramatic that engine manufacturers base their guarantee and warranty programs on a "Severity Factor" determined by careful monitoring of the average number of reduced thrust takeoffs, and magnitude of thrust reduction, at each airline. Their analyses show that while completion of the takeoff run at reduced thrust may actually use slightly more fuel than at maximum thrust, the positive tradeoffs, that is, reduction in the potential for engine failure, and reduction in overall engine operating cost, are far more significant. As a rule of thumb, an average thrust reduction of 1% provides a 5% reduction in operating cost, with a like effect on engine failure rate. The reason reduced thrust is so beneficial is that it minimizes the effect of four of the most significant factors in engine deterioration and/or failure: "Tip Clang & Splatter," "Creep," "Inter–Granular Oxidation (IGO)," and "Thermal Stress."

Tip Clang & Splatter are functions of the centrifugal forces on engine components at high RPM. The blades on the compressor rotor can contact the compressor case. This results in damage to the blade tips, making the compressor less efficient, and in molten metal "splattering" on components farther back in the engine. This causes reduced efficiency of the airfoils in the compressor and turbines (similar to ice on a wing). It can also plug the internal cooling ports in the turbine blades of modern engines, and can, and in fact has, resulted in catastrophic engine failure on a commercial airplane.

Creep describes the metallurgical effect of the centrifugal forces which stretch the components resulting in unrecoverable and progressive deformation.

Inter–Granular Oxidation (IGO) describes the oxidation (deterioration) which takes place between the grains of the metal of the components. A significant factor is temperature.

Thermal Stress describes the action which takes place within a piece of metal when it is heated or cooled. It is most severe in the turbine section where the blades and buckets are subject to the blow torch effect of the combustor. The center portion of the blade is heated faster than the ends when power is added, and the opposite is true when power is reduced. The effect is most dramatic when setting takeoff thrust, then reducing to climb power. The impact is similar to repeatedly bending a piece of sheet metal.

Does reduced thrust sacrifice required safety margins?

The FARs require that all takeoff flight path criteria be met at the thrust set for takeoff. If reduced thrust is set for takeoff, all flight path criteria can be met at that reduced thrust. Increasing to maximum thrust would provide for increased margins. Before learning how to estimate reduced thrust takeoff margin lets review some basic takeoff performance information.

Most takeoffs are made with excess runway and/or climb performance available; i.e., actual weight is less than runway or performance limit weight. This excess margin can be used in a number of ways:

1. Compensate for inoperative equipment (Antiskid Inop.)
2. Compensate for runway conditions (Cluttered Runway & Optional V1)
3. Reduced Thrust

Inoperative equipment and less than optimum runway conditions have specific MMEL procedures that make takeoff margins readily apparent. Simply look at the difference between the procedurally calculated limit weight and the actual weight of the airplane.

The N1/ATOG reduced thrust calculation provides a weight margin (21,000 lbs. for B747-400/PS1)[19] to allow for a weight increase above planned. However, simply comparing actual weight to ASMD ATOG does not give an accurate picture of real margins, because the ASMD ATOG corresponds to the ASMD TEMP, not actual ambient conditions.

True Airspeed Effect
Reduced thrust provides a margin of safety which is often overlooked due to True Airspeed (TAS) Effects. Given the fact that the actual temperature is lower than the assumed temperature, true air speed (and therefore ground speed) is actually lower as well. What this means is that it will take a shorter time and distance to reach V1 at the lower actual temperature than at the higher assumed temperature. This effect along with improved engine and aerodynamic performance can be looked at as an added safety margin since credit is not taken for it while calculating the required parameters for a reduced thrust takeoff.

There are two methods which can be used to approximate the actual margins available when making a reduced thrust takeoff. One method approximates margin in terms of weight, the other in terms of excess available runway.

Estimating Reduced Thrust Margins
To estimate the excess runway available, take the difference between the ASMD Temperature and the Actual Temperature and multiply by 15 (15 feet per degree F). This indicates approximately how much less runway is used (in feet, without using reverse thrust) for Accelerate – Stop (or Accelerate – Go) at actual ambient conditions versus ASMD TEMP conditions, using Reduced Thrust corresponding to ASMD TEMP.

The following example uses a 737–300. The relationships are true for all airplanes:
Conditions:

ACTUAL TEMP	60°F
ASMD TEMP	120°F
ACTUAL RUNWAY LIMIT WEIGHT	130.0
ASMD TMP LIMIT	100.0
ACTUAL WEIGHT	99.0

Estimated runway margin
120 – 60 = 60
60 X 15 = 900 feet
900 feet (without reverse thrust)

In this case, the Accelerate–Stop (or Go) could be performed in 900 ft less at actual temperature because of the true airspeed effect and the greater net thrust produced at ambient temperature.

It is important to remember that this is an approximation that works for all airplane, airport, and temperature combinations. It is generally conservative. For example, excess runway can vary from about 14 feet per degree F, to almost 25 feet per degree F, depending on airplane type, ambient temperature, and pressure altitude. This procedure may **not** be used to **determine** any ATOG weight. Its only purpose is to provide the flight crew with a rule of thumb assessment of the performance capabilities of their airplane when deciding whether or not to use Reduced Thrust. In the above example, it was assumed that the ASMD TEMP for 120°F was based on the FAR field length (accelerate–go/accelerate–stop) part of the runway limit weight equation. This, of course, represents the "worst case scenario" regarding the amount of excess runway margin available. That is to say, if these numbers are in fact limited by the FAR field length, there would still be at least 900 feet of additional runway margin available. However, this may not be the case. The assumed temperature and weight for a given takeoff not only considers the FAR field length, but it must also consider the other factors that would normally go into a runway limit weight such as obstacle limit criteria. Additionally, **performance** limit criteria must also be met. The ASMD ATOG/TEMP is based on whichever factor is the most restrictive. This means that the excess runway

[19] 21,000 lbs is NWA's weight pad and is programmed in this program. UAL uses a 10,000 lb. weight pad.

available in the above example may be far in excess of 900 feet, since the ASMD ATOG of 100.0 may in fact be based on a performance limit weight, **not** a runway limit weight.

With the above in mind on why reduced thrust takeoffs are good, lets examine their use with 744/PS1. The B747-400 FMCS has three reduced thrust settings, ATM (SEL TEMP on the TAKEOFF REF page), plus TO-1 (5% reduction in thrust), and TO-2 (15% reduction in thrust).[20] Each method is supported in this program, as long as the planned takeoff gross weight is lower than the most restrictive performance limit (runway field length or climb limit).

KLAX	25R	8500 FT		HW 6		XW -10		
RWY COND	FLP/N1	CLB LMT	FLD LMT	V1	VR	V2	TKOF N1	SEL TMP
NORMAL	10/MAX	947140	743241	133	149	165	106.5	---
NORMAL	10/TO1	895323	721191	137	150	166	104.6	---
NORMAL	10/TO2	OVRWGT	OVRWGT	---	---	---	---	---
ATM	10/SEL	ASMD WT	707513	134	150	165	105.6	40

Note that the FLAPS column now indicates which reduced thrust setting is applicable. TO1 and TO2 are self-explanatory. SEL is ATM. Line 1 is Flaps 10, maximum thrust. Line 2 is Flaps 10, TO-1. Line 3 is Flaps 10, TO-2, and line 4 is for ATM. Note also that one additional column has been included, SEL TMP. It is this temperature which is inserted at LS1L on the CDU THRUST LIM page. In the example above, the assumed temperature is 40C, with a resultant takeoff N1 of 105.6. The ASMD WT is the most restrictive weight limit and equals the actual takeoff gross weight, plus a 21,000 lb. safety pad. Note that ATM is NOT AUTH when the SEL TEMP is within 5 C of the actual temperature; if the 21,000 lb. safety pad can not be met; with any tailwind, or if the runway is cluttered. The ATM line will be blanked out with any tailwind or if any of those limiting factors are present.

Note that the takeoff V-speeds are slightly different for each of the derates. This is due to Vmca requirements when operating at reduced thrust, due to the lessened adverse yaw on engine failure due to the lower thrust.

[20] Note, however, that some US carriers, prohibit the use of TO-2. Page 4.11.4 of the NWA B747-400 AOM, Vol. I, says "CAUTION: TO-2 thrust is not authorized."

§ 7-7. LANDING WEIGHTS ANALYSIS

```
VHHH       07R        12467 FT        PLND LWT   505253         WET
                   RWY ZERO WND WGTS
   COND      FLAPS   CLB LMT   FLD LMT          PLN OAT       25 DEG C
  NORMAL      25     948150    749768            MAX STRUCT LDG WGT
 ***ASI***    25     OVRWGT    OVRWGT             630000
  NORMAL      30     793800    749768
 ***ASI***    30     OVRWGT    OVRWGT
*******************************************************************
```

Landing at VHHH (Hong Kong), on Runway 07R, with a length of 12467ft., with wet conditions. Note that all landing weights given are based on ZERO WIND. The conditional analysis is presented in the same format as the takeoff weights analysis. The estimated landing weight is 505,253 lbs. The planned OAT at the time of landing is 25 Deg. C., from the Flight Setup page.

NORMAL These weights are for everyday, normal configuration use.

*****ASI***** These weights are for use for planned landing with ANTI-SKID inop.

§ 7-8. AIRPORT ANALYSIS

This section of the program will enable the user to generate Airport Analysis pages for the airports which he flies through on a regular basis. This section refers to the same internal data-sheets for the performance information as the load manifest section. At the current time, only 6 runways may be entered on each page. If your airport has more than 6, simply run one page at a time, through the Airport Analysis Setup (AA Setup) screen. After you have ran your numbers from the AA Setup screen, use the MS-Excel print function to print out the worksheet - you now have the beginnings of your very own Operating Gross Weights Manual! There are 7 total visible worksheets for Airport Analysis, Flaps 10 Takeoff (MAX N1, TO-1, and TO-2), Flaps 20 Takeoff (MAX N1, TO-1, and TO-2), and Landing Analysis. Note that the weights presented DO NOT take obstacle clearance into account. The reason for this is that to generate obstacle clearance data, you would need obstruction charts for your various airports, and the programming for obstacles, in MS-Excel97 is nearly impossible. . Note that the Boeing B747-400 AOM does provide for a quick, rough, obstacle clearance solution, but according to the text*, "The charts are intended for use only when an airport analysis is not available. Detailed analysis for the specific case from the Airplane Flight Manual may result in a less restrictive weight, and can account for A/C packs off*." (B-747-400/CF6 AOM, p. 23.10.04).

All airport analysis solutions start with the Airport Analysis Setup page. See the example shown below.

AIRPORT ANALYSIS SETUP

STATION	KMSP			ELEV	841		WGTS	Lb
				DATE	Oct-24/98		ALT STG	IN HG
NAME	MINNEAPOLIS - ST.PAUL INT'L						LENGTH	FT
	1	2	3	4	5	6		
Rwy ID	4	12L	12R	22	30L	30R		
Length	11006	8200	10000	11006	10000	8200		
Slope	LEVEL	LEVEL	LEVEL	LEVEL	LEVEL	LEVEL		

DISPLACED THRESHOLD, PRESENCE AND LANDING LENGTH AVAILABLE FM THRESHOLD

DISP THR	YES	NO	NO	YES	NO	NO
FM THRSH	9456			10018		

This page allows you to enter all of the runways, lengths, units, and so on, for up to 6 runways. If your airport has more than 6 runways, or more than 6 with intersection takeoffs, just simply run the first analysis, print it out, and then re-run the analysis for the remainder. This screen is pretty much self-explanatory. Note that you may also enter your desired units of measure, such as:

Feet or Meters
Pounds or Kilos
In. HG or Millibars/Hectopascals

You simply enter all of the runway identifiers, lengths, and slopes in the appropriate boxes. If there is a displaced threshold, select YES at DISP THR, and in the FM THRSH section enter the length available (in either FT or M) from the threshold. There are several comments on the worksheet that the user should pay close attention to as well. This technique also works to suppress landing information for intersection takeoffs, runways not valid for landing, or to determine LAHSO arrival capability. [21]

[21] LAHSO means Land and Hold Short Operations, and is applicable only in the US.

B747-400/PS1 OPERATING GROSS WEIGHTS - LANDING **UNITS** Lb
CF6-80C2B1F **ALTSTG** IN HG

STN **LFPO** ELEV **283**
PARIS ORLY

RWY	**02L**	**7**	**8**	**20R**	**25**	**26**
	7874	10991	10892	7874	11975	9465
		THRESH				THRESH
FLAPS 25 LANDING - ZERO WIND LIMITS						
WET	592.7	744.0	740.1	592.7	746.9	672.2
AGSI	549.1	723.1	718.3	549.1	746.7	647.6
DRY	651.7	746.9	746.9	651.7	746.9	738.1
AGSI	623.5	746.9	746.9	623.5	746.9	710.7
HEADWIND/TAILWIND CORRECTIONS - FLAPS 25						
HW+LB/KT	1.458	1.554	1.548	1.458	1.599	1.474
TW-LB/KT	-5.632	-5.849	-5.844	-5.632	-6.113	-5.745
FLAPS 30 LANDING - ZERO WIND LIMITS						
WET	630.5	746.9	746.9	630.5	746.9	719.2
AGSI	550.0	723.6	718.8	550.0	746.7	648.2
DRY	694.7	746.9	746.9	694.7	746.9	746.9
AGSI	624.1	746.9	746.9	624.1	746.9	711.3
HEADWIND/TAILWIND CORRECTIONS - FLAPS 30						
HW+LB/KT	1.458	1.554	1.548	1.458	1.599	1.474
TW-LB/KT	-5.632	-5.849	-5.844	-5.632	-6.113	-5.745
ANTI-SKID INOPERATIVE - FLAPS 25						
WET	N/A	N/A	N/A	N/A	N/A	N/A
DRY	N/A	N/A	N/A	N/A	N/A	N/A
HW+LB/KT	0.000	0.000	0.000	0.000	0.000	0.000
TW-LB/KT	0.000	0.000	0.000	0.000	0.000	0.000
ANTI-SKID INOPERATIVE - FLAPS 30						
WET	N/A	N/A	N/A	N/A	N/A	N/A
DRY	N/A	N/A	N/A	N/A	487.4	N/A
HW+LB/KT	0.000	0.000	0.000	0.000	3.846	0.000
TW-LB/KT	0.000	0.000	0.000	0.000	0.000	0.000

EOGA LANDING Oct-22/98
LAND AT 630.0/285.6 UP TO 60C

LFPO LANDING

There are 7 total worksheets for airport analysis, one landing sheet, and 6 takeoff sheets for the various flaps settings and derated takeoffs. The above example is a landing sheet. All weights in the analysis are in thousands of either pounds or kilos. Each runway that has a landing distance entered on the Airport Analysis Setup page will have a column on this page. For example, when landing on R/W 02L at LFPO, with flaps 30, and a WET runway, the maximum zero wind weight limit is 630,500 lbs. When the runway is dry 694,700 is the maximum LENGTH limit. The AGSI entry means AUTO GROUND SPOILERS INOPERATIVE. The AGSI shortens the actual landing length available by up to 520 ft. These weights are a ZERO WIND WEIGHT, and may be further corrected by the amounts shown immediately below, under the HEADWINDS/TAILWINDS CORRECTIONS - FLAPS section. These amounts are in thousands as well. To determine actual wind correction, multiply the wind component by the amount shown. Note that tailwinds have much more of a negative correction than a headwind has a positive correction.

The THRESH under the length available indicates that the landing length available has been shortened by a displaced threshold from the Airport Analysis Setup screen.

Note that you can not safely land at LFPO with the anti-skid inoperative (ASI) with FLAPS 25. R/W 25 and FLAPS 30 is the only authorized runway with ASI, provided that the runway is DRY. No tailwind correction is given, because a tailwind landing with ASI on R/W 30 is unauthorized.

CAUTION:

Occasionally, you will get a wind correction amount when the runway limit for ASI shows N/A. This is due to a programming consideration. The runway limits programmed in are for sea level, and are mathematically corrected for elevations above SL. What this means is that if your runway was at SL (or close to it), you would be legal, however, due to the field elevation, it no longer is a legal runway. This should only occur at airports with elevations above 3,000 MSL. These weights should be ignored.

The last entry on the landing performance page is an EOGA LANDING entry. This entry indicates that one can execute a missed approach with an engine out and flaps 15 at maximum structural landing weight up to the temperature shown, and is applicable to both pounds and kilos. Only field elevations at 10,000 MSL require a temperature correction for EOGA performance.

B747-400/PS1 OPERATING GROSS WEIGHTS **UNITS** Lb
CF6-80C2B1F - 3 PACKS ON **ALTSTG** IN HG
MAX T/O

STN **KMSP** ELEV **841** FLAPS **10**
MINNEAPOLIS - ST.PAUL INT'L

RNWY	**4**	**12L**	**12R**	**22**	**30L**	**30R**	
LENGTH	11006	8200	10000	11006	10000	8200	
OAT-C							CLBLMT
0	787.9	744.7	814.0	814.6	814.0	744.7	950.0
2	786.6	741.9	811.3	812.0	811.3	741.9	950.0
4	785.2	739.1	808.7	809.3	808.7	739.1	950.0
6	783.8	736.4	806.0	806.7	806.0	736.4	950.0
8	782.4	733.0	802.5	803.2	802.5	733.0	950.0
10	781.1	730.8	800.8	801.5	800.8	730.8	950.0
12	778.5	729.3	798.5	799.3	798.5	729.3	950.0
14	775.8	727.7	796.3	797.0	796.3	727.7	950.0
16	773.2	726.2	794.1	794.8	794.1	726.2	950.0
18	770.8	725.6	794.1	794.7	794.1	725.6	950.0
20	767.9	723.1	789.7	790.4	789.7	723.1	950.0
22	766.2	720.8	787.5	788.2	787.5	720.8	950.0
24	764.5	718.6	785.3	785.9	785.3	718.6	950.0
26	762.8	716.3	783.1	783.7	783.1	716.3	950.0
28	761.1	714.1	780.9	781.5	780.9	714.1	950.0
***************************ANTI-ICE BLEEDS ON***							
0	782.6	739.4	808.7	809.3	808.7	739.4	944.7
2	781.3	736.6	806.0	806.7	806.0	736.6	944.7
4	779.9	733.9	803.4	804.1	803.4	733.9	944.7
6	778.6	731.1	800.8	801.4	800.8	731.1	944.7
8	777.1	727.7	797.2	797.9	797.2	727.7	944.7
10	775.8	725.5	795.5	796.2	795.5	725.5	944.7
+KT/HW	1.474	1.436	1.490	1.491	1.490	1.436	
-KT/TW	-5.705	-5.620	-5.620	-5.790	-5.790	-5.620	
QNH -.01	0.275	0.275	0.275	0.275	0.275	0.275	0.307
QNH +.01	0.182	0.182	0.182	0.182	0.182	0.182	0.219
ASI	N/A	N/A	N/A	N/A	N/A	N/A	
1 PACK	+2.4	+2.4	+2.4	+2.4	+2.4	+2.4	+11.0
NO PACKS	+4.4	+4.4	+4.4	+4.4	+4.4	+4.4	+15.4

APT MAX OPR TEMP 53 Oct-24/98

This page is an example of the takeoff analysis sheet. Each flaps/thrust setting combination has its only sheet. Derates TO-1 and TO-2 have that in bold along the top, just above the elevation and flaps setting. Additionally, each takeoff page has the page code in bold/large print down at the bottom, just like the landing analysis page. Each runway that has an entry on the Setup page has a column on this page. The far right column is the CLB LMT, or Climb Limit.

At the bottom of the page contain all of the weight corrections available. From the top, they are:

+LB/HW	Add pounds/knot headwind (amount in thousands)
-LB/TW	Subtract pounds/know tailwind (amount in thousands)
QNH -.01	Correction for each .01 altimeter setting is below standard. If MB/HPA is selected, the title shows QNH -01. The example shows the title for IN HG. QNH +.01. The same as above, for corrections higher than standard. For MB/HPA, the title is QNH +01
ASI	Anti-Skid Inoperative. If this column shows N/A, that means that ASI takeoffs are not authorized. The amount shown is in thousands.
1 PACK	If takeoff is planned with only pack on, add the amount shown.
NO PACKS	If takeoff is planned with NO packs, add the amount shown. The weights in all the columns are based on 3-packs ON.

APT MAX OPER TEMP This is the maximum temperature (in C) for operation at that airport. This only has ramifications at high altitude airports (KDEN, MMMX), and indicates the highest legal temperature for operations at that airport. If weights show in the runway columns above this temperature, they should be ignored.

Notes to use of the takeoff analysis

* If your unit of distance is METERS, LENGTH is replaced by METERS along the far left column.
* Temps below 10C (where the use of NAC A/I is required by the Airplane Flight Manual) have A/I ON data below the line labeled ANTI-ICE BLEEDS ON.
* These weights are NOT based on obstacle clearance.

§ 8. Crew Fuel Record

F LVL/OAT				
Waypoint		Departure		
UTC		ETA/ATA		
1 RES	+			
2 RES	+			
MAIN 1	+			
MAIN 2	+			
CWT	+			
MAIN 3	+			
MAIN 4	+			
3 RES	+			
4 RES	+			
STAB	+			
Total	=			
BURNOFF				
Engine 1	+			
Engine 2	+			
Engine 3	+			
Engine 4	+			
Total	=			
DEP TTL		385.0	385.0	385.0
TL Burn	-			
Calc FREM	=			
FREM	-			
Difference	=			
FPL FOA	+			
ACT FOA	=			

RELEASE FUEL			**RE-RLS**
Alternate	+		
Int'l Resv	+		
30 Min. Hld	+		
CONT	+		
FPL FOA	=		
Taxi	+		
FPL BURN	+		
MIN FU	=		

The Crew Fuel Record is designed to assist the flight crew to verify the accuracy of the flight plan forecast, and to provide a manual backup in case of FMCS failure, to continually provide a means of monitoring the planned fuel on arrival at the destination airport. The flight release will show the estimated fuel on arrival (shown as LND FUEL). The CFR provides a means of verifying these numbers.

To use the CFR, prior to gate departure, enter the fuel quantities in the Departure column for each tank that contains fuel. Fuel declared as ballast or unusable fuel (such as that to comply with MEL requirements) need not be entered. In the FREM row, enter the FREM from the flight plan over each fix. At a minimum, those routes which require the use of Class II navigation (non-ground based navigation) should have a CFR calculated.

As you overfly each fix, enter the tank/fuel remaining values. Enter the fuel burnoff from the PROGRESS -2/2 page for each engine in the spaces provided, and sum those values in the TOTAL burnoff row.

Subtract the TOTAL burnoff from the DEP TTL value, this will give a calculated Fuel Remaining. Calculate this Fuel Remaining, this will give a difference value, and then subtract this value from the flight plan FPL FOA to generate the calculated FOA. See the example on the next page.

F LVL/OAT		KBOS	330/-51	330/-53
Waypoint		Departure	EBONY	DOTTY
UTC		ETA/ATA	1338/38	1451/50
1 RES	+			
2 RES	+	8.8	8.8	1.8
MAIN 1	+	29.1	29.1	29.1
MAIN 2	+	62.6	50.7	43.2
CWT	+	0	0	0
MAIN 3	+	62.6	50.9	43.2
MAIN 4	+	29.1	29.1	29.1
3 RES	+	8.8	8.8	1.8
4 RES	+	0	0	0
STAB	+	0	0	0
Total	=	201.1	177.3	148.2
BURNOFF				
Engine 1	+		6.0	13.2
Engine 2	+		5.9	13.2
Engine 3	+		5.9	13.2
Engine 4	+		5.9	13.2
Total	=		23.7	52.8
DEP TTL		201.1	201.1	201.1
TL Burn	-		23.7	52.8
Calc FREM	=		177.4	148.3
FPL FREM	-		153.0	127.9
Difference	=		+24.4	+20.4
FPL FOA	+		35.5	35.5
ACT FOA	=		59.9	55.9

This is a partial section of a completed Crew Fuel Record. As you can see, the form is prefilled prior to departure with the flight plan estimated fuel over each fix in the FPL FREM section. The planned block-out fuel is copied to each cell in the DEP TTL row. As the flight progressed, the FL, ETA, ATA, and OAT (APU EGT) was copied down to provide a complete flight history. In the column between the row titles and the first quantity column, the necessary math operation (add or subtract) is shown to aid the preparation of the CFR.

For example, over the DOTTY intersection, the CFR shows an estimated FOA of 55.9, 20,4 ahead of flight plan. The flight plan called for an arrival fuel of 35.5.

Fuel Variance Analysis:

The computations on the CFR will show the planned fuel over the destination airport. It must be remembered that any flight plan is only a forecast and the real world will have some variance from the plan. As the flight proceeds and the waypoint by waypoint variance is computed it is important that the flight crew attempt to analyze the reasons for the variance. When the estimated fuel shortfall exceeds the flight plan original estimated by 3000 lbs. (1500 kgs), include the actual fuel remaining in the ATC positions reports, or reports made to company.

The following items should be checked, compared, and analyzed when determining the reasons for a fuel variance.

Area	Approximate Fuel Penalty
Compare ops manual IAS to aircraft IAS.	For .01 mach off chart speed, a 1% fuel penalty. For .02 mach off chart speed, a 6% fuel penalty.
Check aircraft trim.	Up to 1-1/2% for aircraft mistrim.
Compare actual OAT to flight plan OAT. Use the APU EGT when inflight.	1.5% for 5 deg. warmer than forecast. 2.75% for 10 deg. warmer than forecast.
Compare forecast winds to actual winds.	Self-explanatory.
Compare actual fuel burnoff on a segment to fuel which should be burned by using the operations manual tables for the AC weight vs. the Computer Flight Plan fuel burn.	Possibly aircraft is heavier than planned. A 20,000 lb. error in takeoff gross weight will amount to 750-1,000 lbs./hr. of additional fuel burnout with everything else being equal.
Compare aircraft altitude vs. optimum altitude for the A/C weight.	If for ATC of other reasons the A/C is below optimum cruise, the FMCS ECON airspeeds should be used to get the aircraft back on the correct fuel remaining values.

§ 9. Program Notes, Limitations, and Errata.

§ 10-1. Observed Flight Manual Limits - This program observes the following FAA Airplane Flight Manual Limitations:

♦ Maximum Takeoff Weight	875,000 lbs., 396,825 kgs.
♦ Maximum Taxi Weight	878,000 lbs., 398,185 kgs.
♦ Maximum Zero Fuel Weight	535,000 lbs., 242,630 kgs.
♦ Maximum Landing Weight	630,000 lbs., 285,714 kgs.

NOTE:
Actual limits may be limited by performance to values lower than those above.

- Minimum Dispatch Fuel - 50,000 lbs., 22,675 kgs.
- Maximum Runway Slope + / - 2%
- Maximum Takeoff Tailwind Component - 10 kts.
- Maximum Crosswind Component - 30 kts.
- Minimum Outside Air Temperature -65C (inflight limit, for fuel freezing)
- Maximum Operating Temperature, 50C at SL.
- Maximum Takeoff Field Elevation, 10,000' ASL. The program is only programmed with departure V-speeds, and Takeoff N1 values up to 10,000'.
- Minimum Field Length Required for Landing, 5900ft.
- If OAT is below 10C and NAC AI must be ON.
- Maximum Tailwind Limit, 10 kts. While some international carriers use 15kts max tailwind, all US carriers use 10 kts, therefore, 10kts is what the program supports. According to the US FAA Operations Specifications (OpSpecs), they will issue an additional OpSpecs if over 10 kts tailwind authorization is sought, provided special crew training is given. The Boeing Operations Manual charts only include values up to 10K. Upon special authorization, Boeing will provide a Flight Manual Supplement for high-elevation operations.
- Minimum Takeoff Field Length for Runway Clutter
- Anti-Skid Inoperative with Runway Clutter
- Anti-Skid Inoperative Minimum Field Length, 12,000'

Route Designing Notes.

Routes using the LAX LOOP departure were slightly modified to include MERMA intersection (approx. 14 DME west of LAX) to more accurately reflect the distance flown during the LOOP turn, to cross the LAX VOR at/above 10,000ft.

When programming your own stored routes, the best advice is to omit those fixes encountered below 10000ft., except in cruise flight. In most circumstances, this has been done on the routes I have programmed.

Program Limits

The TOP OF CLIMB point must occur within 4 fixes of the departure airport, or an error will occur. The current program will allow up to 70 fixes/flight plan.

Routes that are preprogrammed

The routes that come preprogrammed represent only a portion of the worldwide B747-400 routes. A good portion of, but not all routes that are currently flown by the B747-4 are programmed. Most Intra-Europe routes were intentionally omitted, for rarely are B747-4s used for such routes (i.e., EHAM-EDDF). Citypairs with no current, direct 747-400 flights were also not computed (i.e., EFHK to VHHH), unless I already had the flight plan routing through other various means (ACARS intercepts, airline flight plans that I have, etc.). Since routing in Europe, and Europe to the Far East can be highly confusing, only selected 747-4 routes flown were programmed; the once a week 747-4 operated by No Name Airlines to podunk was omitted. US programmed route coverage attempts to cover all 747 (classic and –400) routes flown by UAL and NWA (the primary US –400 operators), as well as all US preferred routes where one could expect to find a B747-400. ALL current UAL B747-4 routes are programmed, US domestic as well as international. All international NWA routes were programmed as well. This should take care of nearly all Asia-US flying. Airlines which do not currently operate the 747-4 were also for the most part omitted (i.e., SWR). Routes to South Africa (from the US and Europe/Asia) were not programmed in that I do not have sufficient nav chart coverage to/in that part of the World, but I would like to.

Program Cautions, Causes, and Cures

Caution Message	Cause	Cure
CLIMB THRUST LIMIT EXCEEDED	The initial climb-to altitude exceeds the maximum weight that the aircraft can climb to immediately after takeoff. What this means is that there is no Boeing Operations Manual Climb Data for that cruise altitude/takeoff gross weight combination.	Select a lower initial cruise altitude, and rerun the flight plan. This can be avoided by selecting STEP for step climbs, which commands the optimum initial cruise altitude based on direction, and estimated takeoff gross weight based on trip distance and payload weight.
MAXIMUM FUEL LIMIT EXCEEDED	Flight Plan calls for more than maximum fuel capacity for the flight.	Reduce fuel load, if able; or reduce payload, if able; or reduce cruise speed, if able, or plan a fuel stop and carry maximum payload.
OVRWGT	The aircraft TOW exceeds the most restrictive weight limit.	Reduce takeoff weight, and rerun flight plan.

Caution Message	Cause	Cure
MAXIMUM STRUCT WEIGHT EXCEEDED	Takeoff Weight exceeds 875,000 lbs. (or 396,825 kg.)	Reduce takeoff weight, and rerun the flight plan.
BELOW 50.0 AFM MIN DISP FUEL	The planned release fuel is below 50,000 lbs. (or 22675 kgs.), which is minimum fuel for gate departure per the FAA Approved Boeing Airplane Flight Manual.	Increase fuel load, and rerun flight plan.
When operating under US RERLS rules, and **INSUFFICIENT RERLS FUEL** is displayed.	The planned fuel over the redispatch fix is less than the minimum required for continuance onto the final destination. Under the current numbers, a diversion to the initial destination would be required, and the flight would be unable to legally continue to the planned destination.	Add more fuel in the DX OVRD (Dispatcher Override) as a higher minimum fuel amount. You shouldn't plan on crossing over the RDFIX with less than 7-10,000 lbs. (3.5KGs to 4.5 KGS) over the MIN RRLS fuel amount, to account for unforecast winds, etc. It may also be considered to amend the RDFIX, and select a point later in the flight.
When operating under US RERLS rules, and **INSUFFICIENT RAMP FUEL** is displayed.	The flight plan calls for less fuel than that required to fly to the initial, short-release destination.	Add more fuel (in the DX OVRD (Dispatcher Override) as a higher minimum release fuel amount.
EXCESS PAYLD	The preflight planning routine is calling for more fuel for the flight (considering payload) than is available. On the Boeing Operations Manual charts, there is no fuel burnoff entry for this specific payload/distance combination (which means carrying too much payload too far), assuming at a minimum international fuel reserves will still be onboard upon arrival. The charts in the Randazzo manual (which come from the UAL B747-400 Flight Manual) go to dry tanks.	Reduce payload, and rerun the flight plan.

INSUFFICIENT FUEL – FOA LESS THAN 25.0 (KGS - 11,000 KGS)	The flight is forecast to arrive with less than 25,000 lbs. (OR 11,000 kgs)	Add more fuel in the DX OVRD (Dispatcher Override) as a higher minimum fuel amount. Even if the regulatory fuel requirements are met by the flight plan, one should **never** plan to land with less than 25.0/11.0K on board. With less than 11,000 KGs. FOB, the intake ports in the fuel boost pumps could become uncovered during a high attitude go-around.
DX OVRD BELOW MIN RELS	The amount called for as the dispatcher override release fuel is less than the calculated minimum fuel (advisory only).	Advisory only, as long as all other regulatory requirements are met, the flight may be dispatched.
CHK FAA AD 98-25-52	There is an FAA Airworthiness Directive (AD 98-25-52) limiting the takeoff weight to 858,500 lbs., if the all of the fuel tanks are full. This prompt is displayed above 384,000 lbs. (or metric equivalent) fuel on board. The original AD required the HST to remain empty and to prohibit inflight fuel transfer from the HST to the CWT, limiting range/payload. One US airline came up with an alternate method of compliance, where the takeoff weight is limited to a lower amount if the tanks will be FULL at departure.	Enter 858,500 in the XTOG Override cell if the fuel level is above 384,000 lbs. at gate departure. If this weight is more restrictive than the most restrictive performance limit, it becomes the limiting weight for takeoff. If is not the most limiting weight, that weight remains the most limiting weight for takeoff.
#N/A appears in the Route Distance cell, and various other cells after a flight plan solution has been attempted.	You have attempted a flight plan solution, and in the STORED ROUTES list, you list a fix/fixes which is/are not in the NAVDATA database. Use the DataEntry worksheet to verify the route. #N/A in the DIST and TC cells indicates no corresponding entry in the NAVDATA database. Where there is a pair of fixes indicating #N/A, the fix which is first is missing/not matching in the NAVDATA database.	Program the appropriate navaids into the NAVDATA database, resort the database (Data menu, Sort), and rerun the flightplan.

When using US RERLS, and **#N/A** appears in the datacells for RRLS PLND, RRLS REQD, and INITIAL REQD, and in the planned RLS FU, PLND TOG, and PLND LWT cells. NOTE: There is a valid burnoff/enroute time to the final destination.	The fix designated as the RDFIX does not exist as a fix on the flight planned route.	US FAA OpsSpecs ¶ B44 requires that the selected RDFIX be a point listed on the flightplan. Therefore, redesignate a new RDFIX, or revise the stored 99R route and insert the selected fix into the route's Stored Routes entry, and rerun the flight plan. Note also that when using oceanic fixes (i.e., 59N010W), use the FMS IDENT for the fix (e.g., 5910N)
MAX TAILWIND LIMIT is displayed on the Flight Setup worksheet when the runway data is entered.	The FAA Airplane Flight Manual sets the maximum tailwind limit to 10 Kts, without special crew training, and without an authorizing paragraph in the Operations Specifications. This tailwind/runway combination exceeds that limit.	Select another runway.
If **#DIV/0** is displayed in the TIME section of the fuel analysis to the planned destination, as well as the ATC TEXT of the Flight Plan sheet.	The distance to the TOP OF CLIMB exceeds the current four-fix-limit.	Rerun the flight plan solution, and select a lower initial cruise altitude. In some occasions, MAN altitude control may be required to stay within in the 4-fix limit.
ALTN W/ ISLD RSV	You are declaring an alternate airport for the destination with ISLD RSV (Island Reserves) selected as the Operating Rules.	Either change the operating rules or remove the destination alternate. Having a destination alternate declared with Island Reserves selected is incorrect. Review § 1-2 SOM.