



# User's Manual Performance Planning Card (PPC) Program for the UH-60A and UH-60L (Clean Configuration)



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# 1. Introduction

This PPC application automates the performance planning process for the UH-60 aircraft. The Flight Performance Models (FPMs) embedded in the PPC application are based on flight test data and the performance charts in the UH-60 Operator's Manual.

Revisions to the PPC program and this manual are anticipated in order to conform to updates to the Aircrew Training Manual. Comments from the field are encouraged. If you encounter problems with the program, the trouble report in Appendix A may be completed and faxed to (256) 705-9895, or a trouble report may be filled out online at <http://www.aeromech.redstone.army.mil/>.

## 1.1 Warning, Caution, and Note

Warning, Caution, and Note are In Accordance With the ATM.

## 1.2 System Requirements

The PPC application requires Windows 95, Windows 98, Windows ME, Windows NT v4.0, Windows 2000, or Windows XP. All FPMs must comply with Flight Performance Model Advanced (FPMA), Interface Control Document (ICD). February 5, 1998, Version 4.00, and must have an accompanying PPC Module.

## 1.3 Installation Instructions

- 1) From the PPC installation media, double click on setup.exe and wait for the InstallShield Wizard with the AMRDEC logo to appear.
- 2) Click the Next button to continue.
- 3) The distribution and authorization screen is displayed next. You must read and agree to the distribution and usage terms to proceed. Click the Next button to continue.
- 4) The release notes screen is displayed next. Click the Next button to continue.
- 5) The installation program will suggest a default destination folder for the application. If you want to change the directory, click the Change button and select the desired location.
- 6) Click the Next button to continue.
- 7) Click the Install button to proceed with the installation.
- 8) Click Finish to complete the installation.

To run the PPC application, select Start/Programs/PPC-M

**NOTE:** The installer may install certain required system files to your PC. In certain cases, one or more reboots may be necessary. If this is the case, the installer may again ask you for the installation folder. This is normal: simply repeat step 5 above.

## **1.4 Authorized Use**

This software is available for download For Official Use Only (FOUO) through the following web site: <https://register.aeromech.redstone.army.mil/>

Once logged on to the site, the secure web site symbol will be seen. Users should request access to “Performance Planning Web Site” in order to register for permission to download. An Internet browser with 128-bit encryption is required to access this web site.

**NOTE 1:** Current notices regarding the use and availability of the software, as well as the most current Airworthiness Release will be posted at the Performance Planning web site.

**NOTE 2:** In this manual, with the exception of Chapter 3, TM 1-1520-237-10 is referred to as “the -10” or “-10”.

## 2. User Interface

### 2.1 Menu, Toolbar, and Status Bar

This section describes the standard user interface elements.

#### 2.1.1 Menu

The application menu is a standard Windows menu that cannot be undocked or moved. The main PPC menu is composed of four submenus: File, PPC, View, and Help. Many menu items are also represented by toolbar buttons.

##### 2.1.1.1 File Menu

###### 2.1.1.1.1 Open Command

Use the Open command to open an existing PPC file. When you choose the Open command, the Select PPC File dialog box appears. Use this dialog box to select the PPC file you want to load.

###### 2.1.1.1.2 Save Command

Use the Save command to save the current state of the PPC application to a file. All current input values will be preserved in the file. Version information will be written to the file for the FPM and PPC module. If the file already exists, the previous version will be overwritten. For additional information see Section 2.2.3.2, User Defaults.

**NOTE:** An FPM is a software version of an aircraft's Flight Performance Manual and Flight Test Data. FPMs support various flight modes, accept inputs parameters, check inputs against predefined limits, execute calculations, generate error/alert messages, and provide results through outputs.

A PPC Module is a software component that contains logic for both drawing and calculating the Performance Planning Card.

###### 2.1.1.1.3 Save As Command

Use the Save As command to save the current state of the PPC application to a different file.



###### 2.1.1.1.4 Print Command

This command allows the user to print the PPC to the default Windows printer. For more information about the PPC output, see the section on Output and Reports.



#### **2.1.1.1.5 Print Preview Command**

This command allows the user to view the PPC in a window. The view shows what the card will look like when printed. The user can choose to print the PPC from the preview window by pressing the print button. For more information about the PPC Print Preview, see Section 2.2.7, Print Preview.

**NOTE:** The Hover and Cruise Calculator pages cannot currently be printed. However, displaying the Hover or Cruise Calculator pages and pressing Alt-Print Screen buttons on your keyboard will save the displayed page to the Clipboard. Open Microsoft® PowerPoint, Word, or Paint to a blank page and either right-click (mouse) and select the Paste option or select the Paste option from the Edit option of the main menu. Once the desired pages have been pasted, select the Print option under the File menu.

#### **2.1.1.1.6 Exit Command**

Shuts down the PPC application.

#### **2.1.1.2 PPC Menu**



##### **2.1.1.2.1 Connect to Active Route and Disconnect from Active Route**

The Connect to Active Route command connects the PPC program to PFPS if PFPS is active. The command is enabled when PFPS is active and is grayed out when it is not active.

When connected, the Disconnect to Active Route command disconnects the PPC program from PFPS. The command is enabled when PFPS is active and is grayed out when it is not active.



##### **2.1.1.2.2 Refresh Route**

This command is enabled when PPC is connected to PFPS and a change is made in PFPS. Selecting this command transfers the changed data to PPC. When the data is transferred the command becomes grayed out until the next change is made.

##### **2.1.1.2.3 Select Aircraft**

This command displays the aircraft dropdown list. The list is populated with available aircraft.



##### **2.1.1.2.4 Calculate**

This command executes a PPC calculation. When a calculation is completed, the results are displayed in the active view. If the active view is PPC, executing the Calculate command will do a PPC calculation. Likewise, if the active view is the Cruise or Hover Calculator page, executing a Calculate command will initiate a Cruise or Hover calculation. During the calculation, the status bar will display a progress indicator to visually represent the progress of the calculation.

If there have been no changes to any input parameters since the last calculation, the Calculate command will remain grayed out and unavailable. Only when PPC detects that one or more input parameters have been edited will it re-enable the Calculate command. PPC also gives the user the option of putting the application in Automatic Calculation Mode (See Section 2.1.1.2.8, Options), where the user will never need to execute the Calculate command manually.



#### **2.1.1.2.5 Additional Inputs...**

This command displays the FPM Input Dialog. See the FPM Inputs Dialog section for information on this feature.



#### **2.1.1.2.6 Reset Inputs to Defaults**

If the Options command “Automatically load additional input user defaults” box **is not** checked, this command resets all PPC, HOVER and CRUISE CALCULATOR Inputs and FPM Additional Aircraft Inputs to their original default values.

If the Options command “Automatically load additional input user defaults” box **is** checked, the command resets all PPC, HOVER and CRUISE CALCULATOR Inputs and unsaved FPM Additional Aircraft Inputs to their original default values and saved FPM Additional Aircraft Inputs to the user defaults (See 2.2.3.2, User Defaults).

#### **2.1.1.2.7 Get Weight Data**

This command is currently grayed out (currently not available).



#### **2.1.1.2.8 Options...**

This command displays the PPC Options dialog. Two option tabs (General, Colors) are available. The user can select application options under each tab.

##### **2.1.1.2.8.1 General Tab**

###### **Automatic calculation mode**

When the automatic calculation mode option is checked, PPC will ensure that all calculation outputs are up to date.

###### **Save window size and position**

When checked, this option memorizes the position and size of the main PPC window when the application is shut down. When PPC is re-started, it will appear at the previous size and position.

###### **Automatically load additional input user defaults**

When checked, PPC will automatically load the additional input user defaults when an aircraft is activated.

###### **Connect to active route on application startup**

When checked, if PFPS is active, PPC will connect to the active route (if one exists) when PPC starts.

### **Auto-designate departure, cruise, and arrival route points.**

When checked, if PFPS is active, PPC will automatically designate route points when PPC connects to a PFPS route. PPC will designate the first route point as both the departure and cruise point and the last route point as the arrival point.

### **Always calculate after refreshing route**

When checked, if PSPS is active, PPC will automatically calculate the new values when the Refresh Route command is executed.

### **Log application events (for problem diagnosis)**

When checked, this will cause PPC to generate a log file called ppc.log. This can be useful when diagnosing technical support problems.

## **2.1.1.2.8.2 Colors Tab**

### **Current Scheme**

The pull-down menu allows you to choose the color scheme to be used for mission planning.

### **New Button**

Pressing this button provides the capability to develop new color schemes to define the Input, Output, and Warning fields. The default scheme cannot be altered. However, additional color schemes can be added. Pressing the New button activates the Create New Scheme dialog box. Entering a new scheme name (cannot be Default) and pressing the OK button activates the Edit and Delete buttons.

### **Edit Button**

Pressing the Edit button allows you to create a new color scheme. After making color scheme changes, pressing the OK button, followed by pressing the Apply button will activate the new color scheme.

### **Delete Button**

Pressing the Delete button will delete the active color scheme (except the Default).

## **2.1.1.3 View Menu**

The menu items on the view menu allow the user to control the display of the toolbar and status bar, switch to the desired application view, and to view available FPM warnings and/or errors.

### **2.1.1.3.1 Toolbar**

Toggles the toolbar on or off. When the toolbar is displayed, a check is placed next to the menu item text.

### **2.1.1.3.2 Status Bar**

Toggles the status bar on or off. When the status bar is displayed, a check is placed next to the menu item text.



#### **2.1.1.3.3 Route**

When PPC is connected to PFPS, selecting this command switches the viewed page to the Route View. When the Route view is the current view, a dot is placed next to the menu item text.



#### **2.1.1.3.4 PPC**

Switches to the PPC View. When the PPC view is the current view, a dot is placed next to the menu item text.



#### **2.1.1.3.5 Hover Calculator**

Switches to the Hover Calculator View. When the Hover Calculator view is the current view, a dot is placed next to the menu item text.



#### **2.1.1.3.6 Cruise Calculator**

Switches to the Cruise Calculator View. When the Cruise Calculator view is the current view, a dot is placed next to the menu item text.



#### **2.1.1.3.7 Warnings**

Displays all warnings in the Warning dialog box. If there are no warnings available, this command is grayed out.

Some warnings may be associated with one or more cells in one of the application views. See Section 2.2.6, Errors and Alert Messages.



#### **2.1.1.3.8 Errors**

Displays all errors in the Error dialog box. If there are no errors available, this command is grayed out.

### **2.1.1.4 Help Menu**

#### **2.1.1.4.1 Contents**

Displays the PPC help file.



#### **2.1.1.4.2 About Current Aircraft...**

Displays a dialog containing information about the current aircraft FPM. The dialog contains an advanced button that will expand the dialog to show file version information for the current FPM and PPC module.

The View Manual button will display the aircraft PPC User's Manual for the current aircraft.

#### **2.1.1.4.3 About PPC...**

Displays the About PPC dialog box. The box includes the PPC version number, an email address for email support, and a world-wide-web address for web support.

## **2.1.2 Toolbar**

All items on the toolbar have menu counterparts except for the Current Aircraft drop down combo box control. The Current Aircraft drop down combo box control allows the user to choose the current aircraft.

## **2.1.3 Color Bar (Inputs, Output, Warning)**

The Input color-codes (Default, Manual, PFPS Value) define the type of data being displayed. For example, the Default color indicates fields where data is entered by PPC that may be changed by the user. Entering a value into a default color-coded field will change the field color to the Manual color-code, signifying an entry by the user.

The Output color-code identifies fields that will be, or are, populated with data when a calculation is conducted. The Warning color-code defines a field that includes a Warning or Error message.

## **2.1.4 Status Bar**

The status bar is a standard Windows status bar whose location is fixed at the bottom of the main PPC window. During calculation operations, the status bar will host a progress indicator to visually represent progress. The rightmost portion of the status bar displays status indicators for the caps lock, num lock, and scroll lock keys.

## 2.2 Application Views

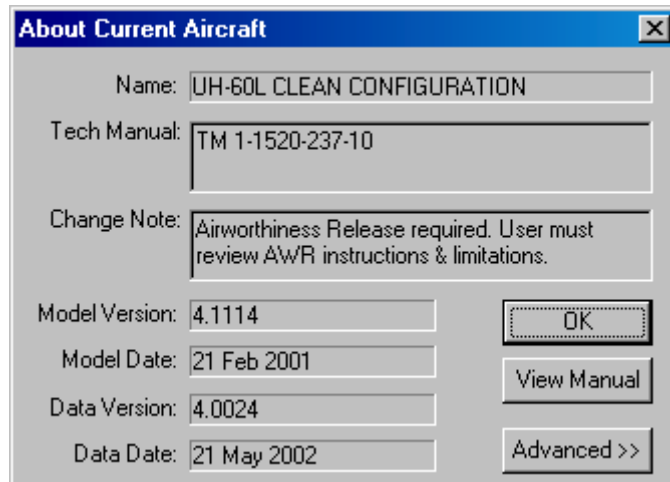
Application views fill the client area of the main PPC window. Each application view automatically adjusts its size to conform to the current PPC window size. If the user resizes the PPC application, the current view will also resize.

### 2.2.1 About Current Aircraft Dialog

The About Current Aircraft dialog displays information about the current aircraft. Aircraft information is acquired from the FPM itself and consists of:

Name	FPM name
Tech Manual	technical order reference
Change Note	Airworthiness Release information
Model Version	version of the FPM model
Model Date	date of the FPM model
Data Version	version of the aircraft data that the model uses
Data Date	date of the aircraft data that the model uses

**Table 2-1**



**Figure 2-1**

### 2.2.1.1 The Advanced Button

The Advanced button enlarges the dialog to show component information. The name and version are reported for the following components:

Current FPM and Current PPC Module

The version is reported for the following components:  
fpm32.dll

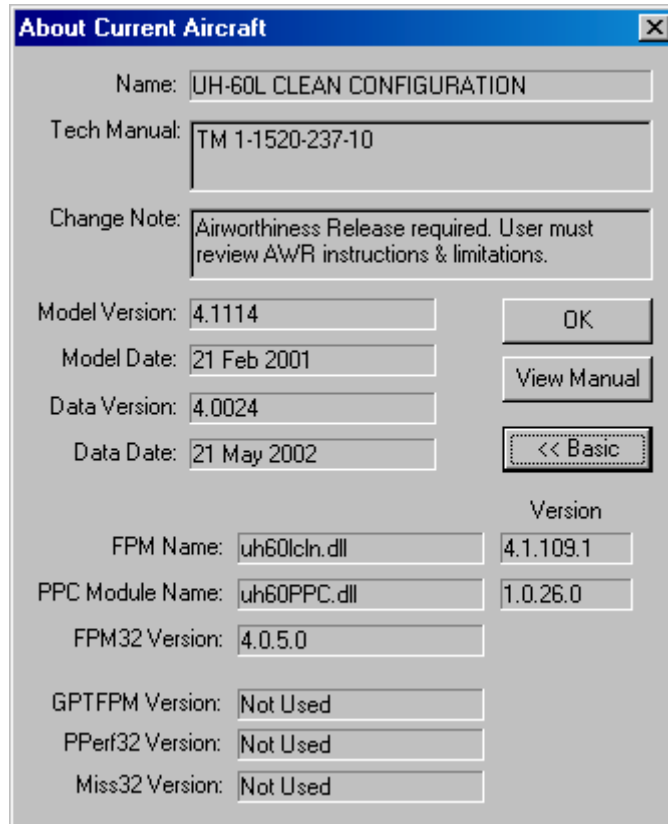


Figure 2-2

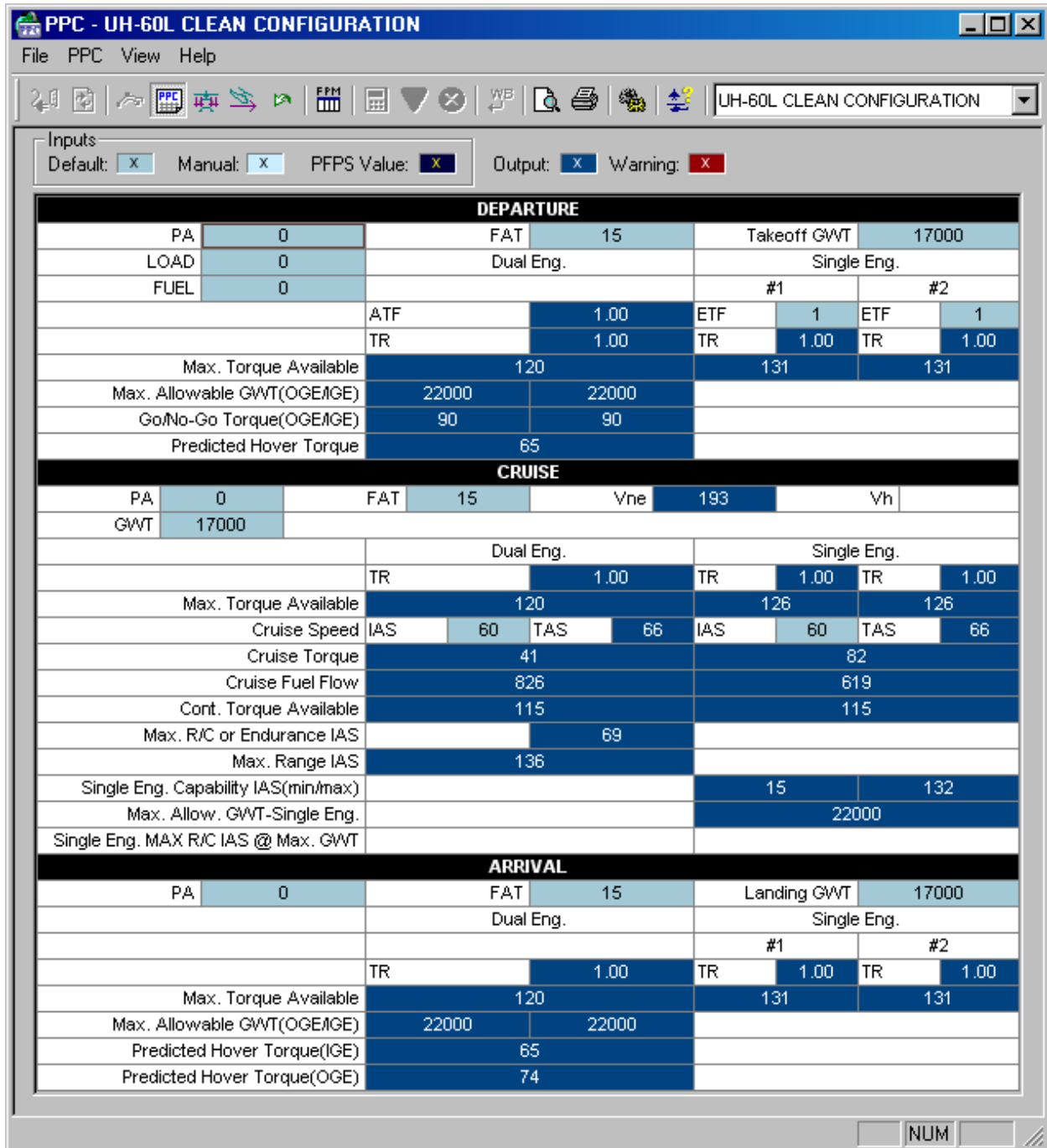
### 2.2.1.2 The View Manual Button

The View Manual button displays the PPC manual for the current aircraft.

## 2.2.2 PPC View



The PPC view displays an editable representation of the PPC for the current aircraft. The user can use this view to enter data used in PPC calculations. The user can edit all input parameters. These parameters are defined in Table 2-2 and 2-3.



**Figure 2-3**

The PPC View attempts to mimic the overall look of the actual PPC. Because of this, not all of the possible FPM input parameters are shown in the PPC View. To gain access to these additional parameters, open the FPM Inputs Dialog.

There are two methods to calculate PPC data:

**Calculate Command**

To enter data into an input cell place the cursor on the input cell and “click”, enter the data, move the cursor off of the input cell and “click” or press the Enter key on the keyboard. After a change in input parameters, all of the output cells will be cleared until a calculation is commanded. Select the Calculate command. After a calculation has been executed, the output cells will display the calculated results.

**Automatic Calculation Mode**

To enter data into an input cell place the cursor on the input cell and “click”, enter the data, move the cursor off of the input cell and “click” or press the Enter key on the keyboard. After a calculation has been executed, the output cells will display the calculated results.

After a calculation, some of the cells in the view might have warnings associated with them. This is indicated by coloring the cell’s background with the warning color (red by default). For more information about warnings, see Section 2.2.6.

**PPC View Input Limits  
UH-60A and UH-60L**

Input Name	Units	Min	Max	Default
Pressure Altitude (PA)	ft	0	20000	0
Free Air Temperature (FAT)	deg C	-50	60	15
Gross Weight (GWT)	lb	12000	UH-60A 22000 UH-60L 23500	16000
Load	lb	0	100000	0
Fuel	lb	0	100000	0
Speed (IAS or TAS)	kts	0	193	60
Engine Torque Factor (ETF)	decimal	.85	1.0	1.0

**Table 2-2**

**NOTE:** In this application an input cell for load is present; however, the ATM does not require this entry and any input to this cell has no effect on the PPC calculation.

**WARNING**

ETF is a very critical component in determining aircraft performance. The default ETF for the UH-60 A and L in the PPC program is 1.0 for both engines. Verify the aircraft ETF numbers. If different from 1.0, make the change(s) in the Departure section of the PPC. If the ETFs are not changed (when different), the aircraft will not perform as indicated by the PPC Program.



### 2.2.3 Additional Input Dialog

The Additional Input dialog allows access to those additional input parameters that are not accessible via the PPC view. To open the additional Aircraft Dialog window, (1) select the FPM Inputs icon from the PPC toolbar or (2) select Additional Inputs... from the PPC menu. The Additional Inputs dialog shows all possible additional aircraft inputs, regardless of what the current active view is. Each row in the dialog's grid represents one input. A maximum of five values are possible for each input, one value for each type of calculation supported by PPC. If a particular input is not found in a particular calculation type, the corresponding cell is blank.

Standard, numeric inputs accept integer and/or floating point numbers. Non-numeric inputs allow the selection of possible values via a drop-down combo box. To change any values using the Additional Inputs dialog, select a user-changeable value (indicated by the manual input background color) and either type in or select the new value. These values are used by the PPC software to determine aircraft performance.

Additional Aircraft Inputs (Departure, Cruise and Arrival only) also appear in the REMARKS section of the reverse side of the printed PPC (see 2.2.7, Print Preview).

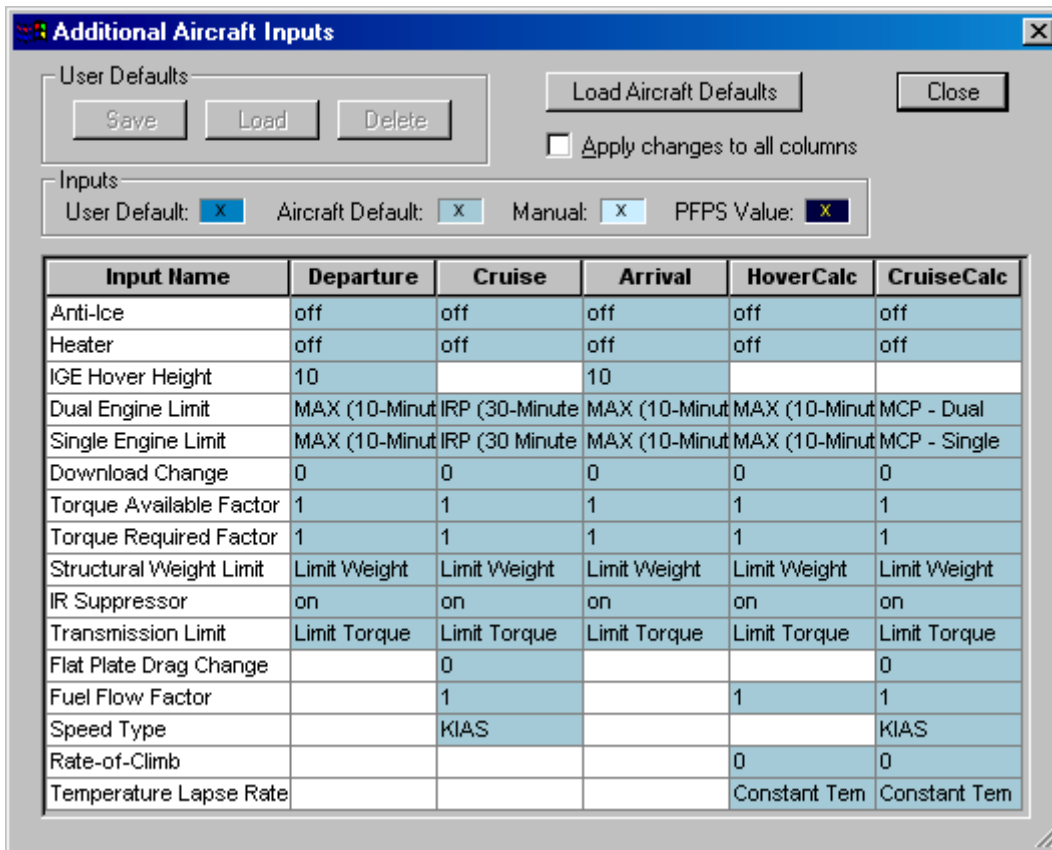


Figure 2-4 (UH-60L)

### 2.2.3.1 Apply Changes to All Checkbox

This checkbox control located at the top of the dialog allows for quicker editing when changing all the values of an Input to the same value. If this checkbox is checked when an input's value is changed, all available values for that input will also be changed to the new value. If this checkbox is not checked, editing a value affects only that value.

### 2.2.3.2 User Defaults

The Additional Inputs dialog gives the user the ability to set default values for all inputs that appear in it. To do this, set the aircraft inputs to the desired values and press the 'Save Defaults' button. This will save the values of all inputs. Pressing the 'Load Defaults' button will then restore these values. Delete will delete the user specified defaults. Using the File Menu "Save" or "Save As" function (See Section 2.1.1.1), each aircraft can have its own set of user specified defaults (e.g. saving user defaults by files named as aircraft "Tail Numbers").

### 2.2.3.3 Load Aircraft Defaults

The 'Load Aircraft Defaults' button allows the user to restore all the inputs in the dialog to their as-built FPM default values.

### 2.2.3.4 Inputs (User Default, Aircraft Default, Manual, PFPS Value)

These Input blocks indicate, by color matching the input cell, where the value in the cell originated.

**Additional Input Dialog (FPM Inputs) Input Limits  
UH-60A and UH-60L**

Input Name	Units	Min	Max	Default
Anti-Ice				off
Heater				
IGE Hover Height	Ft	5	1000	10
De-Ice				off
Dual Engine Limit UH-60A				Departure, Cruise, Arrival and HoverCalc: (IRP) 30-Min Limit. CruiseCalc: MCP (Normal)
Single Engine Limit UH-60A				Departure, Cruise, Arrival and HoverCalc: (IRP) 30-Min Limit. CruiseCalc: MCP (Normal)
Dual Engine Limit UH-60L				Departure, Arrival and HoverCalc: MAX (10-Min Limit). Cruise: IRP (30-Min Limit). CruiseCalc MCP (Normal)
Single Engine Limit UH-60L				Departure, Arrival and HoverCalc: MAX (10-Min Limit). Cruise: IRP (30-Min Limit). CruiseCalc MCP (Normal)
Download Change	T/W	0	0.1	0
Torque Available Factor		.9	1	1
Torque Required Factor		1	1.1	1
Structural Weight Limit UH-60L only				Limit Weight
IR Suppressor				On
Transmission Limit				Limit Torque
Flat Plate Drag Change	sq ft	0	100	0
Fuel Flow Factor		1	1.1	1
Speed Type	kts			KIAS
Rate-of-Climb	ft min	-5000	5000	0
Temperature Lapse Rate				Constant Temperature

**Table 2-3**

**NOTE:** Table 2-3 shows FPM Inputs for Download Change, Torque Available Factor, Torque Required Factor and Fuel Flow Factor. These are program functions designed to allow user-selectable conservatism to be applied to PPC computations. There are no references in the -10 that would allow you to accurately use these program functions. Therefore, you should not change these values from their default setting.

**Additional Input Dialog (FPM Inputs) Terms**

<b>TERM</b>	<b>DEFINITION</b>	<b>REFERENCE/REMARKS</b>
Anti-Ice	Engine Inlet Anti-Ice	Section II, IV and VII of the -10
Heater	Cockpit Heater	Section II, IV and VII of the -10
IGE Hover Height	User selected IGE Hover Height	N/A
Dual Engine Limit	User selected Dual Engine limits	Fig. 5-2/3 and Fig. 7-3/7A-4 of the -10
Single Engine Limit	User selected Single Engine limits	Fig. 5-2/3 and Fig. 7-3/7A-4 of the -10
Download Change	See <b>Table 2-3 NOTE</b>	N/A
Torque Available Factor	See <b>Table 2-3 NOTE</b>	N/A
Torque Required Factor	See <b>Table 2-3 NOTE</b>	N/A
Structural Weight Limit UH-60L only	User option to ignore structural weight limits	Allows for calculation of GWT above 22,000 pounds
IR Suppressor	HIRSS	Section II, IV and VII of the -10
Transmission Limit	User option to ignore torque limits	Allows for calculation of Maximum Torque Available from Fig. 7-3/7A-4 of the -10
Flat Plate Drag Change	Drag change when other than Baseline Configuration	Para. 7.17.f/7A.18.f and Chap. 7/7A Section VI of the -10
Fuel Flow Factor	See <b>Table 2-3 NOTE</b>	N/A
Speed Type	User selected airspeed type	Allows for calculations in KIAS or TAS
Rate-of-Climb	User selected rate of climb or descent	Allows for calculation of change in torque for climb or descent. Chap. 7/7A Section VII of the -10
Temperature Lapse Rate	User selected Lapse Rate	Allows for calculations at a constant temperature or at the standard lapse rate of 2 deg. C per 1000 ft.

**Table 2-4**

## **2.2.3.5 Practical Use Of The Additional Input Dialog**

### **2.2.3.5.1 Adjusting for planned use of Anti-Ice**

The Anti-Ice setting is not displayed on the PPC page view, but does appear on the printed card and the print preview on the bottom right side. The Anti-Ice setting affects aircraft performance (-10, Chapter 7 / 7A, Section II, MAXIMUM TORQUE AVAILABLE, and Section IV, CRUISE). To adjust for use of this system, (1) select the FPM Inputs icon from the PPC toolbar or (2) select Additional Inputs... from the PPC menu. A dialog box appears with a table containing the additional inputs. Among these inputs is Anti-Ice, which may be turned ON or OFF. These settings may be applied individually to Departure, Cruise, Arrival, HoverCalc, and CruiseCalc or they may be applied to the entire mission by first checking the box next to "Apply changes to all". For example, to see the effect of Anti-Ice "ON" during cruise, click on the cell at the intersection of the row labeled Anti-Ice and the column labeled CruiseCalc and change the cell value from OFF to ON. Close the dialog box by clicking on the Close button, and recalculate the PPC. Compare the difference in Dual Engine torque available in the PPC screen view (with Anti-Ice "OFF") and the Cruise Calculator screen view (with Anti-Ice "ON"). To correct calculations for Anti-Ice during the entire mission, check the box next to "Apply changes to all" and click on the cell at the intersection of the row labeled Anti-Ice and any of the columns. Close the dialog box by clicking on the Close button, and recalculate the PPC. The resulting calculations are adjusted for any changes made in the FPM Inputs dialog, including Anti-Ice.

**NOTE:** This procedure also applies to the Heater setting of the FPM Inputs.

### **2.2.3.5.2 Wheel heights other than default**

Wheel height is adjusted using the FPM Inputs dialog box. Select the FPM Inputs icon from the PPC toolbar or (2) select Additional Inputs... from the PPC menu. And find the row labeled IGE Hover Height. In the Departure column, change the hover height from 10 to 20. If the box next to "Apply changes to all" is checked, a 20 appears in the Arrival column also. Close the dialog and recalculate the PPC. IGE Hover calculations reflect the wheel height settings in the FPM Inputs dialog.

**NOTE:** The FPM Inputs dialog box allows an entry of up to 1000'. Any input above 60' will result in the IGE torque equaling OGE torque.

### **2.2.3.5.3 Dual and Single Engine Limits other than default**

The PPC application gives you many options to select from for your engine limits. The ATM specifies engine limits to use when completing DA form 5701-R. You must ensure that the FPM Inputs are the engine limits required by the ATM. To select the desired engine(s) limit(s), select the FPM Inputs icon and find the rows labeled Dual Engine Limit and Single Engine Limit. These limits range from Dual Engine Normal "MCP – Dual") to Single Engine Contingency "Emergency (2.5-Minute) – Single". These settings may be applied individually to Departure, Cruise, Arrival, HoverCalc and CruiseCalc or they may be applied to the entire mission by first checking the box next to "Apply changes to all".

#### **2.2.3.5.4 Structural and Transmission Limits**

The PPC application allows you to ignore structural and torque limits. The ATM specifies the engine limits to use when completing DA form 5701-R. Chapter 5 of the -10 gives torque/time and structural limitations. You must ensure that the FPM Inputs are the structural and torque limits required by the ATM and do not exceed those limits in the -10. **Example:** To select the desired torque limit select FPM Inputs icon and find the row labeled Transmission Limit. You are given two options: Limit Torque or Ignore Limit. The Limit Torque will not allow the program to exceed the ATM specified torques. The Ignore Limit allows the program to calculate torque to the maximum amount the engine(s) can produce.

**NOTE 1:** The Ignore Torque option is very useful to determine your actual aircraft capability in an emergency. For example, to adjust calculations to determine minimum Single Engine airspeed at Maximum Single Engine torque available, click on the cell at the intersection of the row labeled Transmission Limit and the column labeled CruiseCalc; then change this cell from Limit Torque to Ignore Limit. Close the dialog box and recalculate the PPC. Compare the difference in Single Engine airspeed in the PPC screen view (with “Limit Torque”) and the Cruise Calculator screen view.

**NOTE 2:** (UH-60L only) At this time the PPC Program will generate an N/C (No Calculation) in all output cells in the associated PPC section (Departure, Cruise or Arrival) for any GWT input over 22,000 pounds. An “Error” message will state that maximum authorized gross weight is 22,000 pounds (See Section 2.2.6.2, Figure 2-7). With the Structural Weight Limit selection set to “Ignore Limit”, the PPC Program will generate a “Warning” message for any GWT input over 22,000 pounds. This message alerts the user that the input is above the maximum authorized gross weight of 22,000 pounds. With the Structural Weight Limit selection set to “Ignore Limit”, the PPC Program will calculate the data based on the GWT input. (See Section 2.2.6.2, Figure 2-8).

#### **2.2.3.5.5 Corrections for non-baseline configurations**

Non-baseline configurations are calculated by adjusting for drag changes using the FPM Inputs dialog. For non-baseline configurations, refer to -10, Chapter 7 / 7A, Section VI, DRAG. Determine and add together the appropriate equivalent square foot change in flat plate drag area. Enter this number in the row labeled Flat Plat Drag Change in the FPM Inputs dialog box. Close the FPM Inputs dialog and recalculate the PPC. The resulting calculations are adjusted for non-baseline configurations.

**NOTE:** The PPC Program does not calculate negative drag values at this time (e.g. HRSS not installed).

### 2.2.3.5.6 Using TAS rather than IAS to input cruise airspeeds

The FPM Inputs dialog can also be used to allow input of TAS values rather than IAS values for cruise by changing the Speed Type to KTAS in the FPM Inputs dialog box. When the dialog box is closed, the PPC will accept KTAS inputs from the CRUISE SPEED cells marked TAS, rather than IAS. When the PPC is calculated, the software will return the corresponding KIAS results in the cells marked IAS. Note that this setting affects only which cells are used for inputs, the results of all calculations are in IAS unless specifically marked otherwise.



### 2.2.4 Hover Calculator

The Hover Calculator is used to provide supplemental information not shown on the PPC, but of potential value to the user in planning a mission or evaluating aircraft capabilities and limitations in hover.

The screenshot shows the 'HOVER CALCULATOR' dialog box within the 'PPC - UH-60L CLEAN CONFIGURATION' application. The interface includes a menu bar (File, PPC, View, Help), a toolbar with various icons, and a status bar at the bottom showing 'Ready' and a 'NUM' button. The main area contains input fields for 'Default', 'Manual', 'PFPS Value', 'Output', and 'Warning', each with a checkbox. Below these is a table with the following data:

HOVER CALCULATOR							
PA	0	FAT	15	GWT	17000	Hov Ht	10
		Dual Engine		Single Engine			
		#1	#2	#1	#2		
ATF/ETF	1.00	1	1	1	1		
Torque Required (IGE)	65	130	130	130	130		
Fuel Flow (IGE)	1061	915	915	915	915		
Torque Required (OGE)	74	*148*	*148*	*148*	*148*		
Fuel Flow (OGE)	1145	1056	1056	1056	1056		
Fuel Flow @ Flight Idle	596						
Fuel Flow @ Ground Idle	362						
APU Fuel Flow	61						
Torque Available	120	131	131	131	131		
Max Hover Weight OGE	22000	*15348*	*15348*	*15348*	*15348*		
Max Hover Weight IGE	22000	17126	17126	17126	17126		

Figure 2-5



## 2.2.5 Cruise Calculator

The Cruise Calculator is used to provide supplemental information not shown on the PPC, but of potential value to the user in planning a mission or evaluating aircraft capabilities and limitations in cruise.

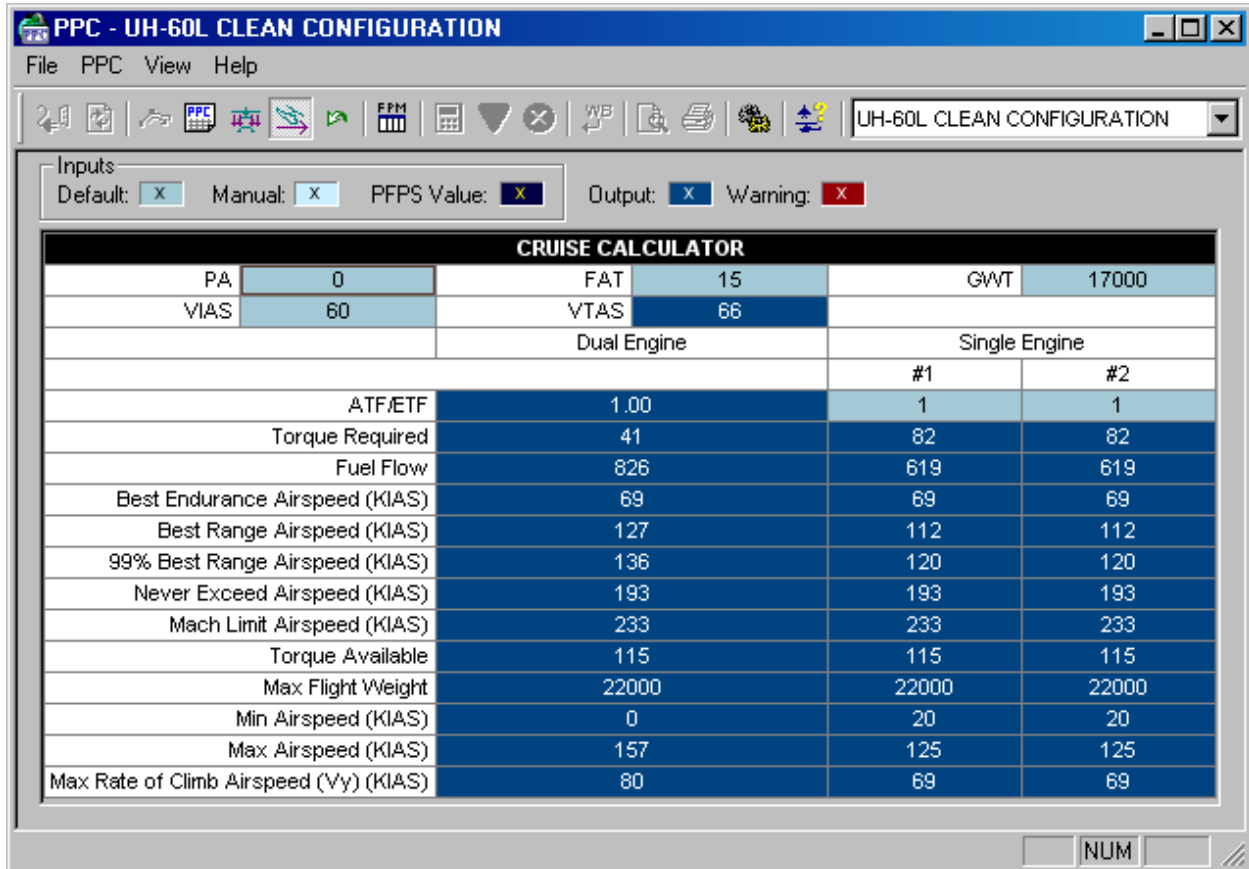


Figure 2-6

### 2.2.5.1 CRUISE CALCULATOR TERMINOLOGY

Best Endurance Airspeed (KIAS). Same as Maximum Endurance Airspeed.

Best Range Airspeed (KIAS) and 99% Best Range Airspeed (KIAS). Best Range Airspeed is the airspeed for the greatest flight range per pound of fuel for a given aircraft gross weight, PA, and FAT. Maximum Range airspeed curves provided in the -10 are actually 99% of the Maximum Range value (99% Best Range Airspeed). This allows the aircraft to cruise at speeds 5-7% faster while sacrificing only 1% in range capability.

Never Exceed Airspeed (KIAS). Airspeed limited by aircraft gross weight as referenced in Figure 5-5/6 of the -10.

Mach Limit Airspeed (KIAS). Airspeed limited by temperature as referenced in Figure 5-5/6 of the -10.



## 2.2.6 Error and Alert Messages



After any calculation, PPC will enable the view warning and/or view error commands if any errors and/or warnings exist for that calculation. These commands are accessible via both the menu and toolbar. Executing either one of these commands will display the Error or Warning dialog boxes, shown above. These Errors and/or Warnings can either result from the user inputting a value that exceeds an aircraft limitation (Chapter 5 of the -10, AWR or ISAQ) or an aircraft performance limitation.

### 2.2.6.1 Warnings

Some warnings may be associated with a cell in one of the application views. If this is the case, the cell's background color will be the warning color. Right clicking on the cell and selecting "View Warning" from the context menu will display only the warning(s) associated with that cell. When viewing the warnings for an individual cell, the index values correspond to those shown by the view all warnings command.

### 2.2.6.2 Error/Warning Dialog Box

The error/warning dialog box displays either errors or warnings; the dialog's title will indicate which. Each error or warning displayed in the dialog will have a unique index associated with it. The user can resize the Error/Warning dialog box.

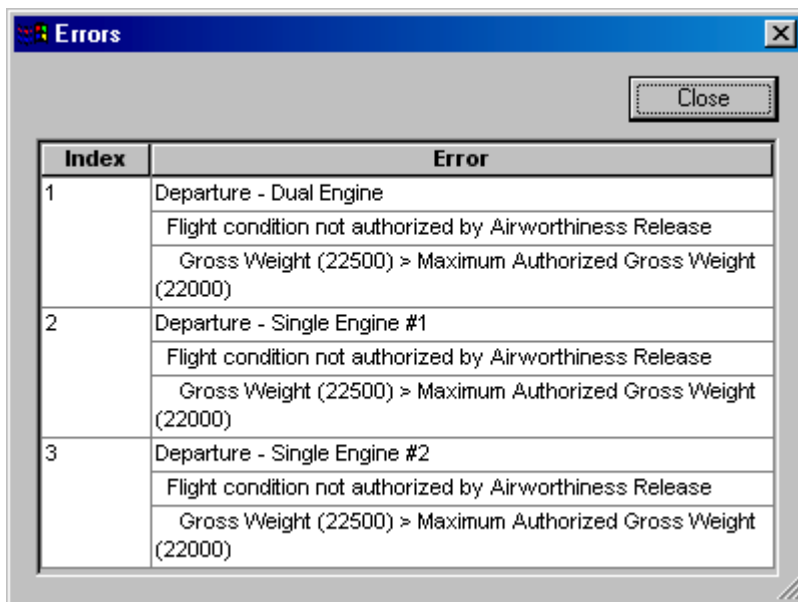


Figure 2-7

Index	Warning
1	Departure - Dual Engine Flight condition not authorized by Airworthiness Release Gross Weight (23500) > Maximum Authorized Gross Weight (22000)
2	Departure - Dual Engine Flight condition not authorized by Airworthiness Release Maximum Gross Weight OGE (24399) > Maximum Authorized Gross Weight (22000)
3	Departure - Dual Engine

**Figure 2-8**



Any calculation that results in an N/C (No Calculation) on the PPC Screen View is present on the Print Preview and printed copy of the 5701-R.

UH-60/AH-64 PERFORMANCE PLANNING CARD					
For use of this form, see TCs 1-212 and 1-214; the proposed category is TRADOC.					
DEPARTURE					
PA	1000	FAT	45	TAKEOFF GWT	22500
LOAD	0	DUAL ENG		SINGLE ENG	
FUEL	0			#1	#2
		ATF	N/C	ETF 1.00	ETF 1.00
		TR	N/C	TR N/C	TR N/C
MAX TORQUE AVAILABLE		N/C		N/C	N/C
MAX ALLOWABLE GWT (0G/1G)		N/C	N/C		
GO/NO-GO TORQUE (0G/1G)		N/C	N/C		
PREDICTED HOVER TORQUE		N/C			

Figure 2-10

### 2.2.8 About PPC Dialog

The About PPC dialog displays the version of the PPC application.

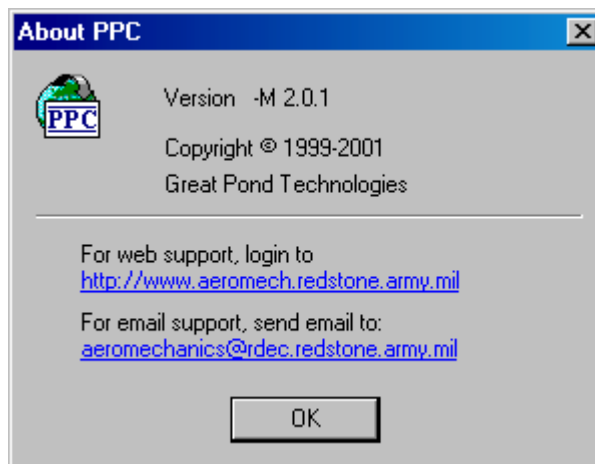


Figure 2-11

### 2.2.8.1 PPC Modules

A PPC module is required for an aircraft to be supported by PPC. PPC Modules are software components that describe how to build the PPC's standard views and how PPC uses the FPM to do calculations.

### 2.2.8.2 PPC Installer

The PPC Installer provides the means to install, update, and remove the PPC software from a computer system.

### 2.2.8.3 Component Locations

The following table shows where essential PPC components are placed by the installer depending on the installation option:

Component	Standalone locations
ppc.exe	...PFPS\PPC folder
PPC Modules	...PFPS\PPC folder
fpm32.dll	...PFPS\PPC folder
FPM's	PFPS\system\fpmdata folder
Objective Grid	...PFPS\PPC folder
MS runtime files	Windows system folder

**Table 2-5**

### 2.2.8.4 Output and Reports

PPC outputs calculated results for preview and printing to the Performance Planning Card associated with each aircraft. All forms are aircraft specific and are installed when PPC support is added for each aircraft.

### 2.2.8.5 Application Information

PPC provides the user with information about the PPC application itself and information about the PPC and installed FPM components.

### **3. TASK 1004**

#### **3.1 Prepare DA Form 5701-R.**

Use the PPC software to complete the procedures required by TC 1-212, Chapter 6, Task 1004, Prepare a performance planning card.

**NOTE:** The wording of these instructions follows that of Task 1004, edited to describe the use of the PPC software to complete DA Form 5701-R. References to performance charts in TM 1-1520-237-10 are removed, as the PPC software automates these calculations without requiring use of printed charts.

The following instructions illustrate the use of the PPC software to complete DA Form 5701-R, given the aircraft takeoff gross weight, engine torque factors, environmental conditions at takeoff, en route and landing.

#### **3.2 Procedures.**

- a. Determine and have available aircraft performance data required to complete the mission. DA Form 5701-R may be used as an aid to organize performance planning data for the mission. Figures 3-1 through 3-4 indicate where the input values are placed or where the calculated values will appear, when values are entered according to the supplemental instructions below (items not indicated by input/output values do not pertain to the UH-60).
- b. When a significant change in the mission's conditions occurs, recompute all affected values. A significant change is defined as an increase of over 10 °C; 2,000 feet PA; and/or 1,000 pounds gross weight..
- c. The data calculated by this program is for the "clean" UH-60A/L. When the external equipment or configuration differs significantly from the "clean" configuration, a drag compensation must be made (Flat Plate Drag Change in FPM Inputs).
- d. Performance planning data is computed the same for the UH-60A and UH-60L aircraft unless specifically noted in the appropriate items.

### 3.2.e. DEPARTURE

#### Item 1: PA

Enter forecast maximum pressure altitude.

#### Item 2: FAT

Enter forecast maximum free air temperature. If the FAT at time of takeoff is more than  $10^0$  C less than maximum, enter it also.

**NOTE:** If the FAT at time of takeoff is more than  $10^0$  C less than maximum, it must be entered on the PPC after it is printed.

#### Item 3: TAKEOFF GWT

Enter planned takeoff gross weight.

#### LOAD

**NOTE:** In this application an input cell for load is present; however, the ATM does not require this entry and any input to this cell has no effect on the PPC calculation.

#### Item 4: FUEL

Enter fuel required for the mission.

**NOTE:** This entry is required by the ATM, it has no effect on the PPC calculations.

#### Item 5a: ATF

Calculated aircraft torque factor. The ATF is the average of the two ETFs (Items 5b and 5c).

**NOTE:** In this application an input cell for load is present; however, the ATM does not require this entry and any input to this cell has no effect on the PPC calculation.

#### Item 5b: ETF (Engine #1)

Enter the engine torque factor for engine #1.

#### Item 5c: ETF (Engine #2)

Enter the engine torque factor for engine #2.

#### Item 6a: TR

Calculated aircraft torque ratio. The calculation is performed at departure conditions using the aircraft torque factor (Item 5a).

**Item 6b: TR (Engine #1)**

Calculated engine #1 torque ratio. The calculation is performed at departure conditions with the engine #1 torque factor (Item 5b).

**Item 6c: TR (Engine #2)**

Calculated engine #2 torque ratio. The calculation is performed at departure conditions using the engine #2 torque factor (Item 5c).

**Item 7a: MAX TORQUE AVAILABLE (Dual Engine)**

Calculated MAXIMUM TORQUE AVAILABLE (Dual Engine). The value is determined at departure conditions and uses the dual engine operating limit specified in the departure column of FPM inputs with the dual engine departure torque ratio (Item 6a) applied.

**NOTE:** Adjust as required for planned use of engine anti-ice and cockpit heater in FPM Additional Inputs.

**Item 7b: MAX TORQUE AVAILABLE (Engine #1)**

Calculated MAXIMUM TORQUE AVAILABLE (Single Engine). The value is determined at departure conditions and uses the single engine operating limit specified in the Departure column of FPM inputs with the single engine departure torque ratio (Item 6b) applied.

**Item 7c: MAX TORQUE AVAILABLE (Engine #2)**

Calculated MAXIMUM TORQUE AVAILABLE (Single Engine) as shown in Item 7b.

**Item 8a: MAXIMUM ALLOWABLE GWT (OGE)**

Calculated dual engine maximum allowable gross weight out-of-ground effect. The calculation is performed at departure conditions using the dual engine MAXIMUM TORQUE AVAILABLE (Item 7a).

**Item 8b: MAXIMUM ALLOWABLE GWT (IGE)**

Calculated dual engine maximum allowable gross weight in-ground effect. The calculation is performed at departure conditions using the dual engine MAXIMUM TORQUE AVAILABLE (Item 7a) and the hover height specified in the Departure column of FPM inputs.

**Item 9a: Go/No-Go Torque (IGE)**

Calculated dual engine in-ground effect go/no-go torque. The value represents the IGE torque required for the aircraft operating at maximum IGE gross weight (Item 8b). The calculation is performed at departure conditions at the hover height specified in the departure column of FPM inputs.

### **Item 9b: GO/NO-GO TORQUE (OGE)**

Calculated dual engine out-of-ground effect go/no-go torque. The value represents the IGE torque required for the aircraft operating at maximum OGE gross weight (Item 8a). The calculation is performed at departure conditions at the hover height specified in the departure column of FPM inputs. This value represents the maximum torque required in-ground effect that ensures there is sufficient capability to hover out-of-ground effect.

### **Item 9c: External load**

Calculated dual engine go/no-go torque. The value represents the torque required for the aircraft operating at maximum allowable OGE gross weight (Item 8a). The calculation is performed at departure conditions at the hover height specified in the departure column of FPM inputs (determine the hover height required to suspend the load at 10 feet AGL).

**NOTE:** GO/NO-GO is calculated using maximum forecast temperature (Item 2). When the actual temperature is less than maximum, the torque required to hover at a given gross weight is less. To ensure that OGE capability exists and/or structural limits are not exceeded, reduce GO/NO-GO by 1% for each 10°C that actual temperature is less than maximum forecast temperature.

### **Item 10: PREDICTED HOVER TORQUE (IGE)**

Calculated torque required to hover IGE. The calculation is performed at departure conditions.

### **3.2.f. CRUISE**

**NOTE:** The PPC program requires an additional entry to provide cruise data on the PPC. This additional entry is identified as A1.

#### **Item 1: PA**

Enter planned cruise altitude.

#### **Item 2: FAT**

Enter the forecast temperature at cruise altitude.

#### **A1: CRUISE GWT**

Enter planned cruise gross weight.

#### **Item 3: Vne**

Calculated Vne. The calculation is performed at cruise conditions.

**Item 4a: TR (Aircraft)**

Calculated aircraft torque ratio. The calculation is performed at cruise conditions using the aircraft torque factor (DEPARTURE Item 5a).

**Item 4b: TR (Engine #1)**

Calculated engine #1 torque ratio. The calculation is performed at cruise conditions using the engine #1 torque factor (DEPARTURE Item 5b).

**Item 4c: TR (Engine #2)**

Calculated engine #2 torque ratio. The calculation is performed at cruise conditions using the engine #2 torque factor (DEPARTURE Item 5c).

**Item 5a: MAX TORQUE AVAILABLE (Dual Engine)**

Calculated MAXIMUM TORQUE AVAILABLE (dual engine). The value is determined at cruise conditions and uses the dual engine operating limit specified in the Cruise column of FPM inputs with the dual engine cruise torque ratio (Item 4a) applied.

**NOTE 1:** The alternate method is not required as the PPC Program calculates data based on input ETFs and cruise conditions.

**NOTE 2:** Adjust as required for planned use of engine anti-ice and cockpit heater in FPM Additional Inputs.

**Item 5b: MAX TORQUE AVAILABLE (Engine #1)**

Calculated MAXIMUM TORQUE AVAILABLE (Single Engine). The value is determined at cruise conditions and uses the single engine operating limit specified in the Cruise column of FPM inputs with the single engine cruise torque ratio (Item 4b) applied.

**Item 5c: MAX TORQUE AVAILABLE (Engine #2)**

Calculated MAXIMUM TORQUE AVAILABLE (Single Engine) as shown in Item 5b.

**Item 6a: CRUISE SPEED (IAS)**

Enter planned cruise IAS.

**NOTE:** To enter true airspeed, select KTAS in the Cruise column of FPM inputs.

**Item 6b: CRUISE SPEED (TAS)**

Calculated true airspeed. The value is determined from the IAS input and cruise conditions.

### **Item 7: CRUISE TORQUE (Dual Engine)**

Calculated dual engine torque required. The value is calculated at cruise conditions and dual engine airspeed (Item 6a/b). The value includes the effect of the additional drag specified in Cruise column of FPM inputs.

### **Item 8: CRUISE FUEL FLOW (Dual Engine)**

Calculated dual engine fuel flow. The value is calculated at cruise conditions and based on the dual engine torque required (Item 7). The value includes the effect of the additional drag specified in Cruise column of FPM inputs.

**NOTE:** Adjust as required for planned use of engine anti-ice and cockpit heater in FPM Additional Inputs.

### **Item 9: CONT TORQUE AVAILABLE (Dual Engine)**

Calculated CONTINUOUS TORQUE AVAILABLE (Dual Engine). The value is determined at cruise conditions and uses the dual engine cruise torque ratio (Item 4a) applied.

**NOTE:** Adjust as required for planned use of engine anti-ice and cockpit heater in FPM Additional Inputs.

### **Item 10: MAXIMUM R/C OR ENDURANCE IAS**

Calculated maximum rate of climb or endurance IAS. The value is determined at cruise conditions. Normally this value may also be used for maximum rate-of-climb IAS with satisfactory results.

**NOTE:** Use of the Max Rate of Climb Airspeed ( $V_y$ ) (KIAS) from the CRUISE CALCULATOR will provide the optimum maximum rate-of-climb.

### **Item 11: MAX RANGE IAS**

Calculated 99% best range indicated airspeed. The value is determined at cruise conditions. The value includes the effect of the additional drag specified in the Cruise column of FPM inputs.

**NOTE:** See 2.2.5.1 for definition of 99% best range airspeed.

### **Item 12a: SINGLE-ENG CAPABILITY IAS (MIN)**

Calculated single engine minimum IAS. The value is determined at cruise conditions and uses the single engine operating limit specified in Cruise column of FPM inputs.

**NOTE 1:** For non-baseline configurations, the value includes the effect of the additional drag specified in the Cruise column of FPM inputs.

**NOTE 2:** If the calculation returns an N/C (No Calculation), there is insufficient power to maintain level flight with a single engine at the current gross weight.

**NOTE 3:** If the ETF is different for each engine, the PPC program calculates the maximum allowable gross weight (single engine) using maximum torque available (single-engine) derived from the lesser of the two ETFs. It does not use the ATF.

**Item 12b: SINGLE-ENG CAPABILITY IAS (MAX)**

Calculated single engine maximum IAS. The value is determined at cruise conditions and uses the single engine operating limit specified in the Cruise column of FPM inputs. See Item 12a **NOTE 1-3**

**Item 12c: MAX ALLOWABLE GWT - SINGLE ENGINE**

Calculated single engine maximum allowable gross weight for flight. The value is determined at cruise conditions and uses the single engine operating limit specified in the Cruise column of FPM inputs. This value represents the maximum weight at which the aircraft can maintain level flight at MAX END AND MAX R/C airspeed. See Item 12a **NOTE 1-3**.

**Item 13a: CRUISE SPEED (Single Engine, IAS)**

To select an IAS that falls within range of the minimum to maximum single engine capability IAS in (Item 12a/b) above, the PPC must first be calculated to establish the range of the minimum to maximum single engine capability IAS. The selected IAS is then entered and the PPC recalculated. The CRUISE Single Eng. data, Items 13b thru 15, will then indicate correct data for the IAS selected. The value is determined from the IAS input and cruise conditions.

**Item 13b: CRUISE SPEED (Single Engine, TAS)**

Convert to TAS as described in Item 6a above.

**Item 14: CRUISE TORQUE (Single Engine)**

Calculated single engine torque required. The value is calculated at cruise conditions and single engine airspeed (Item 13a/b). The value includes the effect of the additional drag specified in Cruise column of FPM inputs.

**Item 15: FUEL FLOW (Single Engine)**

Calculated single engine fuel flow. The value is calculated at cruise conditions and the single engine torque required (Item 14).

**NOTE:** Adjust as required for planned use of engine anti-ice and cockpit heater in FPM Additional Inputs.

### **Item 16: CONT TORQUE AVAILABLE (Single Engine)**

Calculated CONTINUOUS TORQUE AVAILABLE (single engine). The value is determined as described in Item 9 above using single engine cruise speed.

### **3.2.g. ARRIVAL**

#### **Item 1: PA**

Enter forecast pressure altitude.

#### **Item 2: FAT**

Enter forecast temperature.

#### **Item 3: LANDING GWT**

Enter the estimated gross weight for arrival.

#### **Item 4a: TR (Dual Engine)**

Calculated aircraft torque ratio. The calculation is performed at arrival conditions using the aircraft torque factor (DEPARTURE Item 5a).

#### **Item 4b: TR (Engine #1)**

Calculated engine #1 torque ratio. The calculation is performed at arrival conditions with the engine #1 torque factor (DEPARTURE Item 5b).

#### **Item 4c: TR (Engine #2)**

Calculated engine #2 torque ratio. The calculation is performed at arrival conditions using the engine #2 torque factor (DEPARTURE Item 5c).

#### **Item 5a: MAX TORQUE AVAILABLE (Dual Engine)**

Calculated MAXIMUM TORQUE AVAILABLE (dual engine). The value is determined at arrival conditions and uses the dual engine operating limit specified in the Arrival column of FPM inputs with the dual engine arrival torque ratio (Item 4a) applied.

**NOTE:** Adjust as required for planned use of engine anti-ice and cockpit heater in FPM Additional Inputs.

#### **Item 5b: MAX TORQUE AVAILABLE (Engine #1)**

Calculated MAXIMUM TORQUE AVAILABLE (Single Engine). The value is determined at arrival conditions and uses the single engine operating limit specified in the Arrival column of FPM inputs with the single engine arrival torque ratio (Item 4b) applied.

**Item 5c: MAX TORQUE AVAILABLE (Engine #2)**

Calculated MAXIMUM TORQUE AVAILABLE (Single Engine) as shown in Item 5b.

**Item 6a: MAXIMUM ALLOWABLE GWT (OGE)**

Calculated dual engine maximum allowable gross weight out-of-ground effect. The calculation is performed at arrival conditions using the dual engine MAXIMUM TORQUE AVAILABLE (Item 5a).

**Item 6b: MAXIMUM ALLOWABLE GWT (IGE)**

Calculated dual engine maximum allowable gross weight in-ground effect. The calculation is performed at arrival conditions using the dual engine MAXIMUM TORQUE AVAILABLE (Item 5a) and the hover height specified in the Arrival column of FPM inputs.

**Item 7a: PREDICTED HOVER TORQUE (IGE)**

Calculated torque required to hover IGE. The calculation is performed at arrival environmental conditions and landing gross weight at the hover height specified in the Arrival column of FPM inputs.

**Item 7b: PREDICTED HOVER TORQUE (OGE)**

Calculated torque required to hover OGE. The calculation is performed at arrival environmental conditions and landing gross weight.

### Performance Planning Screen View

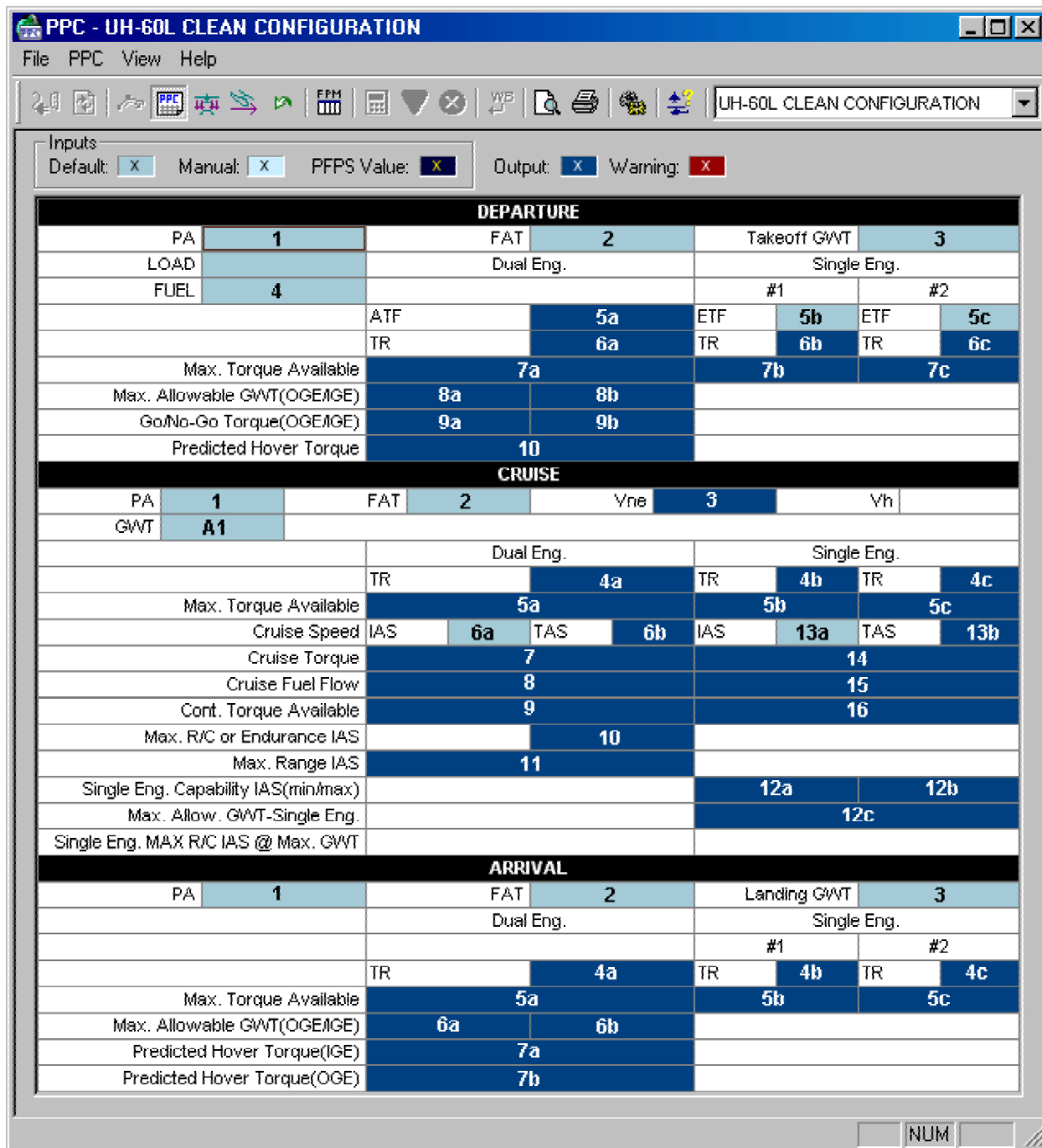


Figure 3-1

# Performance Planning Card (PPC)

UH-60IAH-64 PERFORMANCE PLANNING CARD									
For use with the UH-60A1, H-60A1, H-60A2, H-60A3, H-60A4, H-60A5, H-60A6, H-60A7, H-60A8, H-60A9, H-60A10, H-60A11, H-60A12, H-60A13, H-60A14, H-60A15, H-60A16, H-60A17, H-60A18, H-60A19, H-60A20, H-60A21, H-60A22, H-60A23, H-60A24, H-60A25, H-60A26, H-60A27, H-60A28, H-60A29, H-60A30, H-60A31, H-60A32, H-60A33, H-60A34, H-60A35, H-60A36, H-60A37, H-60A38, H-60A39, H-60A40, H-60A41, H-60A42, H-60A43, H-60A44, H-60A45, H-60A46, H-60A47, H-60A48, H-60A49, H-60A50, H-60A51, H-60A52, H-60A53, H-60A54, H-60A55, H-60A56, H-60A57, H-60A58, H-60A59, H-60A60, H-60A61, H-60A62, H-60A63, H-60A64, H-60A65, H-60A66, H-60A67, H-60A68, H-60A69, H-60A70, H-60A71, H-60A72, H-60A73, H-60A74, H-60A75, H-60A76, H-60A77, H-60A78, H-60A79, H-60A80, H-60A81, H-60A82, H-60A83, H-60A84, H-60A85, H-60A86, H-60A87, H-60A88, H-60A89, H-60A90, H-60A91, H-60A92, H-60A93, H-60A94, H-60A95, H-60A96, H-60A97, H-60A98, H-60A99, H-60A100.									
<b>DEPARTURE</b>									
RA	1	FRT	2	THROTTLE		3			
USAB			DUAL ENG		SINGLE ENG				
FUEL	4								
MAX TORQUE AVAILABLE	HTF	5a		HTF	5b		HTF	5c	
	TR	6a		TR	6b		TR	6c	
	7a		7b		7c				
	8a		8b						
GO-MODE TORQUE (SINGLE ENG)	9a		9b						
RESTRICTED HOVER TO RWIE	10								
REMARKS:									
<b>CRUISE DATA</b>									
RA	1	FRT	2	THR	3	RA			
MAX TORQUE AVAILABLE			DUAL ENG		SINGLE ENG				
	TR	4a		TR	4b		TR	4c	
	5a		5b		5c				
	PG	6a	TAS	6b	PG	13a	TAS	13b	
CRUISE SPEED	7		14						
CRUISE TORQUE	8		15						
CRUISE FUEL FLOW	9		16						
GO-MODE TORQUE AVAILABLE	10								
MAX RANGE PG	11								
SINGLE-ENG CAPABILITY PG (MIN/MAJ)			12a		12b				
MAX ALLOWABLE GWT - SINGLE-ENG			13c						
SINGLE-ENG MAX RWIE PG (MAX GWT)									
DA FORM 5704-R, SEP-92									

FUEL MANAGEMENT									
FUEL/TIME					BURNING/T				
START	1				BURNING				2
STOP	1				CONSUMPTION RATE				3 PER HR
<b>ARRIVAL</b>									
RA	1	FRT	2	LANDING GWT		3			
MAX TORQUE AVAILABLE			DUAL ENG		SINGLE ENG				
	TR	4a		TR	4b		TR	4c	
	5a		5b		5c				
	6a		6b						
RESTRICTED HOVER TO RWIE (S-E)	7a								
RESTRICTED HOVER TO RWIE (O/S)	7b								
REMARKS: INITIAL DUS/WO MRE OPERATION									
Release ID: 081036									
Input Name									
Departure									
Cruise									
Arrival									
Target Request Factor									
Target Available Factor									
Autofuel									
Status									
Fuel Support									
Downwind Range									
Dual Engine Limit									
IEE Max Height									
Transonic Limit									
Single Engine Limit									
Fuel Flow Factor									
Fuel Flow Range									
Altitude Type									
Crew/Pass Weight									
Alt									
DA FORM 5704-R, SEP-92									

Figure 3-2

### **3.3 Hover Calculator**

#### **Item 1: PA**

Enter the PA.

#### **Item 2: FAT**

Enter the FAT.

#### **Item 3: GWT**

Enter Gross Weight.

#### **Item 4: Hover Ht**

Enter Hover Height for in-ground effect calculations.

**NOTE:** The Hover Ht input cell allows an entry of up to 1000'. Any input above 60' will result in the IGE torque/fuel flow equaling OGE torque/fuel flow.

#### **Item 5: ATF**

Calculated aircraft torque factor.

#### **Items 6a and b: ETF**

Enter the engine torque factor for engine #1 and #2.

#### **Items 7a, b and c: Torque Required (IGE)**

Calculated torque to hover IGE at the specified conditions. Other parameters affecting the calculation are set in the HoverCalc column of FPM inputs.

#### **Items 8a, b and c: Fuel Flow (IGE)**

Calculated fuel flow at IGE hover torque required (Item 7a, b and c) and specified conditions. Other parameters affecting the calculation are set in the HoverCalc column of FPM inputs.

#### **Items 9a, b and c: Torque Required (OGE)**

Calculated torque to hover OGE at the specified conditions. Other parameters affecting the calculation are set in the HoverCalc column of FPM inputs.

#### **Items 10a, b and c: Fuel Flow (OGE)**

Calculated fuel flow at OGE hover torque required (Items 9a, b and c) and specified conditions. Other parameters affecting the calculation are set in the HoverCalc column of FPM inputs.

#### **Item 11: Fuel Flow @ Flight Idle**

Calculated flight idle fuel flow at the specified conditions.

### Item 12: Fuel Flow @ Ground Idle

Calculated ground idle fuel flow at the specified conditions.

### Item 13: APU Fuel Flow

Calculated APU fuel flow at the specified conditions.

### Items 14a, b and c: Torque Available

Calculated torque available at the specified conditions. Other parameters affecting the calculation are set in the HoverCalc column of FPM inputs.

### Items 15a, b and c: Max. Hover Weight (OGE)

Calculated maximum weight out-of-ground effect at the specified conditions. Other parameters affecting the calculation are set in the HoverCalc column of FPM inputs.

### Items 16a, b and c: Max. Hover Weight (IGE)

Calculated maximum weight in-ground effect at the specified conditions. Other parameters affecting the calculation are set in the HoverCalc column of FPM inputs.

## HOVER CALCULATOR Screen View

PA	1	FAT	2	GWT	3	Hover Ht	4
					Dual Engine		Single Engine
						#1	#2
				ATFIETF	5	6a	6b
				Torque Required (IGE)	7a	7b	7c
				Fuel Flow (IGE)	8a	8b	8c
				Torque Required (OGE)	9a	9b	9c
				Fuel Flow (OGE)	10a	10b	10c
				Fuel Flow @ Flight Idle	11		
				Fuel Flow @ Ground Idle	12		
				APU Fuel Flow	13		
				Torque Available	14a	14b	14c
				Max Hover Weight OGE	15a	15b	15c
				Max Hover Weight IGE	16a	16b	16c

Figure 3-3

### **3.4 Cruise Calculator**

#### **Item 1: PA**

Enter the PA.

#### **Item 2: FAT**

Enter the FAT.

#### **Item 3: GWT**

Enter Gross Weight.

#### **Item # 4: VIAS**

Enter the selected IAS.

#### **Item # 5: VTAS**

Calculated true airspeed at the specified conditions.

#### **Items 6a and b: ETF**

Enter the engine torque factor for engine #1 and #2.

#### **Item 7: ATF**

Calculated aircraft torque factor at the specified conditions.

#### **Items 8a, b and c: Torque Required**

Calculated engine torque required at the specified conditions. Other parameters affecting the calculation are set in the CruiseCalc column of FPM inputs.

#### **Items 9a, b and c: Fuel Flow**

Calculated fuel flow at the specified conditions. Other parameters affecting the calculation are set in the CruiseCalc column of FPM inputs.

#### **Items 10a, b and c: Best Endurance Airspeed (KIAS)**

Calculated dual engine maximum endurance airspeed (KIAS) at the specified conditions. Other parameters affecting the calculation are set in the CruiseCalc column of FPM inputs.

#### **Items 11a, b and c: Best Range Airspeed (KIAS)**

Calculated maximum range airspeed (KIAS) at the specified conditions. Other parameters affecting the calculation are set in the CruiseCalc column of FPM inputs.

### **Items 12a, b and c: 99% Best Range Airspeed (KIAS)**

Calculated 99% best range airspeed (KIAS) at the specified conditions. Other parameters affecting the calculation are set in the CruiseCalc column of FPM inputs.

### **Items 13a, b and c: Never Exceed Airspeed (KIAS)**

Calculated Vne (KIAS) at the specified conditions. Other parameters affecting the calculation are set in the CruiseCalc column of FPM inputs.

### **Items 14a, b and c: Mach Limit Airspeed (KIAS)**

Calculated mach limit airspeed (KIAS) at the specified conditions. Other parameters affecting the calculation are set in the CruiseCalc column of FPM inputs.

### **Items 15a, b and c: Torque Available**

Calculated engine torque available at the specified conditions. Other parameters affecting the calculation are set in the CruiseCalc column of FPM inputs.

### **Items 16a, b and c: Max Flight Weight**

Calculated maximum flight weight at the specified conditions. Other parameters affecting the calculation are set in the CruiseCalc column of FPM inputs.

### **Items 17a, b and c: Min Airspeed (KIAS)**

Calculated minimum airspeed at the specified conditions. Other parameters affecting the calculation are set in the CruiseCalc column of FPM inputs.

### **Items 18a, b and c: Max Airspeed (KIAS)**

Calculated maximum airspeed at the specified conditions. Other parameters affecting the calculation are set in the CruiseCalc column of FPM inputs.

### **Items 19a, b and c: Max Rate of Climb Airspeed (KIAS)**

Calculated maximum rate-of-climb airspeed (Vy) (KIAS) at the specified conditions. Other parameters affecting the calculation are set in the CruiseCalc column of FPM inputs.

## CRUISE CALCULATOR Screen View

PPC - UH-60L CLEAN CONFIGURATION

File PPC View Help

UH-60L CLEAN CONFIGURATION

Inputs  
 Default:  Manual:  FFPS Value:  Output:  Warning:

CRUISE CALCULATOR					
PA	1	FAT	2	GWT	3
VIAS	4	VTAS	5		
Dual Engine			Single Engine		
			#1	#2	
ATFIETF	7		6a	6b	
Torque Required	8a		8b	8c	
Fuel Flow	9a		9b	9c	
Best Endurance Airspeed (KIAS)	10a		10b	10c	
Best Range Airspeed (KIAS)	11a		11b	11c	
99% Best Range Airspeed (KIAS)	12a		12b	12c	
Never Exceed Airspeed (KIAS)	13a		13b	13c	
Mach Limit Airspeed (KIAS)	14a		14b	14c	
Torque Available	15a		15b	15c	
Max Flight Weight	16a		16b	16c	
Min Airspeed (KIAS)	17a		17b	17c	
Max Airspeed (KIAS)	18a		18b	18c	
Max Rate of Climb Airspeed (Vy) (KIAS)	19a		19b	19c	

Ready NUM

Figure 3-4

## APPENDIX

### Appendix A - PPC Trouble Report

The trouble report can be used for requesting assistance with installation or use of the PPC application, reporting bugs in the software, or requesting improvements in the software. If you have access to the Internet, you can submit a trouble report online at <http://www.aeromech.redstone.army.mil/>. Otherwise, you can print, fill in, and fax the following page.



U.S. Army Aviation and Missile Command  
Aeromechanics Division  
Aviation Engineering Directorate  
Attn: AMSAM-RD-AE-A  
Redstone Arsenal, AL 35898  
<http://www.aeromech.redstone.army.mil/>  
[aeromechanics@rdec.redstone.army.mil](mailto:aeromechanics@rdec.redstone.army.mil)



# PPC Trouble Report

To: Aeromechanics PPC Support

Fax: 256-705-9895

Submitter's Name: \_\_\_\_\_

Submitter's Email: \_\_\_\_\_

PPC Version: \_\_\_\_\_

Description of Problem: \_\_\_\_\_

\_\_\_\_\_  
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## Appendix B – PPC integrated with PFPS

### B.1 Introduction

Integrating the PPC application with PFPS allows extraction of PFPS data for use in PPC with the goal of generating a PPC from a PFPS route quickly and easily. The data extraction process saves the steps of manually transferring 41 values from PFPS while ensuring their accuracy.

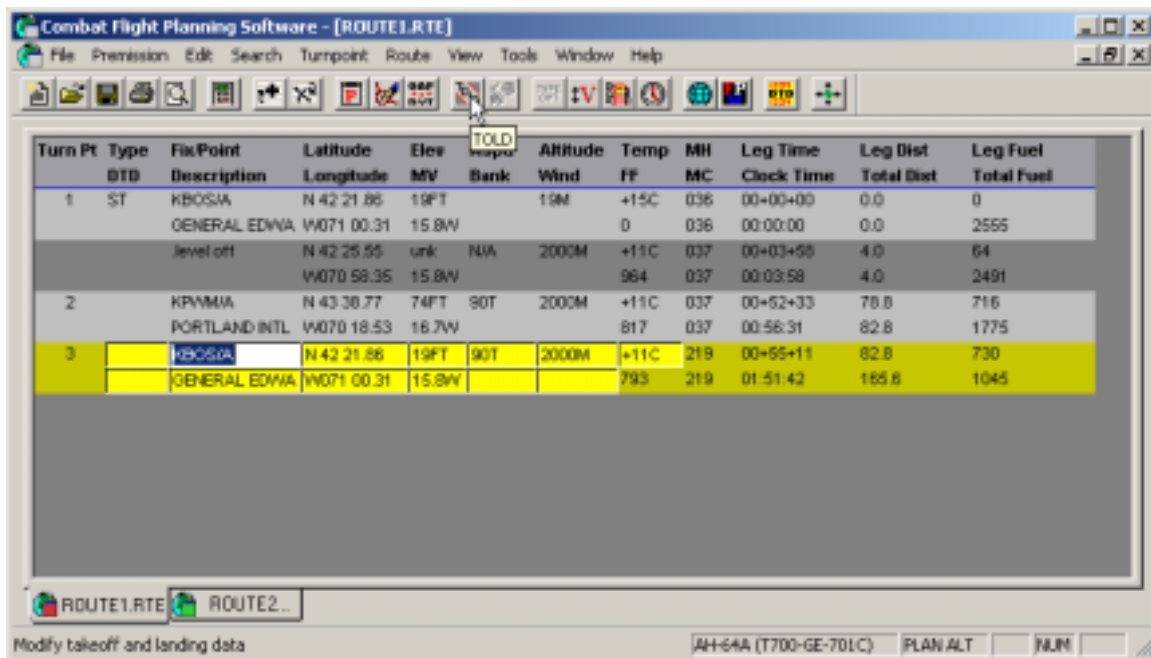
The procedure for this process has four steps:

- Generate a PFPS route
- Connect PPC to that route
- Tell the PPC (designate) which routepoints to transfer the data from
- Verify correctness, make last minute changes, and print the PPC card

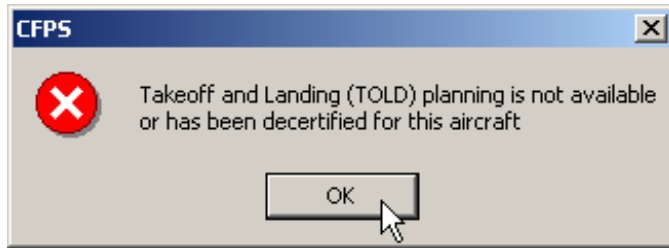
### B.2 Connect to Active Route

There are two methods of connecting the PPC to the active route. The first is CFPS TOLD and the second is PPC Connect.

#### B.2.1 CFPS TOLD button

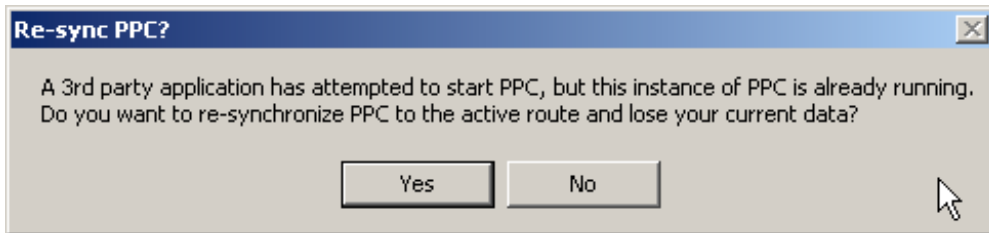


The CFPS TOLD button will only launch the PPC if the active route uses an FPM supported by PPC. Otherwise, an error message will appear.



Only one instance of PPC can be running. If PPC is not running when the CPFS TOLD button is pressed (and the FPM is supported by PPC), then the CFPS TOLD button will launch the PPC. The PPC will then connect and display the active route.

If an instance of PPC is already running, you will see the following message:



Selecting No will cancel the operation. Selecting Yes will connect and display the active route. Note: selecting Yes will overwrite the current data in the PPC.

## B.2.2 PPC Connect button

The screenshot shows the PPC software interface for an AH-64A (T700-GE-701C) helicopter. The 'Connect' button is highlighted in blue, indicating it is enabled. Below the button are three status indicators: 'Default: x', 'Manual: x', and 'PFPS Value: x'. To the right, 'Output: x' and 'Warning: x' are also shown. The main display area is divided into three sections: DEPARTURE, CRUISE, and ARRIVAL, each with a table of flight parameters.

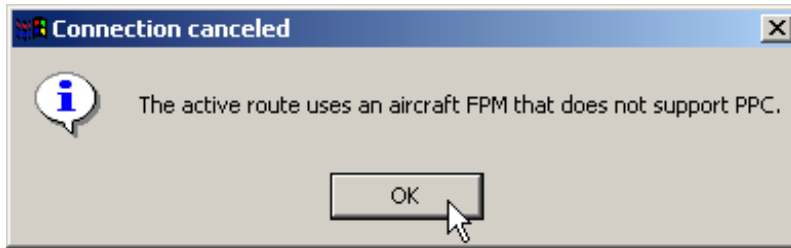
DEPARTURE							
PA	0	FAT	15	T/O GWT	16000		
LOAD	0	Dual Eng.		Single Eng.			
FUEL(T/O&Mission)	0	0		#1	#2		
	ATF			ETF	1	ETF	1
	TR			TR		TR	
Max. Torque Available							
Max. Allowable GWT(OGEAGE)							
Go/No-Go Torque(OGEAGE)							
Predicted Hover Torque (OGEAGE)							
CRUISE							
PA	0	FAT	15	Vne	Vh		
GWT	16000			Dual Eng.		Single Eng.	
				TR		TR	
Max. Torque Available							
Cruise Speed		IAS	60	TAS		IAS	
Cruise Torque							
Cruise Fuel Flow							
Continuous Torque Available							
Max. R/C or Endurance IAS							
Max. Range IAS							
Sngl-Eng Capability(TAS)							
Max. Allow. GWT-Sngl Eng							
Sngl Eng MAX R/C IAS (Max. GWT)							
ARRIVAL							
PA	0	FAT	15	Landing GWT	16000		
		Dual Eng.		Single Eng.			
				#1	#2		
				TR		TR	
Max. Torque Available							
Max. Allowable GWT(OGEAGE)							
Predicted Hover Torque(IGE)							
Predicted Hover Torque(OGE)							

At the bottom of the window, there is a status bar with the text 'Connect to the active RouteServer route' and a 'NUM' button.

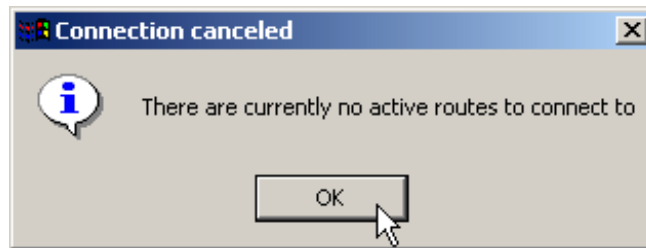
When PPC is launched and CFPS is detected, the PPC Connect button will be enabled. The figure above shows an enabled connect button. If CFPS is not detected, the PPC Connect button will be disabled. When the Connect button is enabled and clicked, three conditions are possible.

If CFPS has an active route using an FPM supported by PPC, the PPC will synchronize with CFPS and display the active route.

1. If CFPS has an active route not using an FPM supported by PPC, The Connect button will display a PPC Error message:



2. If CFPS has no route, the Connect button will display a PPC Error message



### ***B.3 Disconnect from Active Route***

There are two different levels of disconnecting from the active route. You can completely disconnect the PPC from the route by clicking on the Disconnect button in PPC, or you can disconnect one section of the PPC from the route by undesignating it's use in the route view. Exiting CPFS will not disconnect the PPC from the active route, as the route server will keep running until all programs that are using the route have ended.

### ***B.4 PPC Interaction with PFPS***

Once connected to PFPS, the PPC will retrieve the ambient and operating conditions from the user designated PFPS route points for use in the PPC calculations. The PPC locks the values it retrieves from PFPS. The PPC has a route view, which allows the user to view the connected route and designate which points of the route to use in the PPC Departure, PPC Arrival, PPC Cruise, Hover and Cruise Calculators. The PPC view, Hover Calculator view and Cruise Calculator view allow the user to manually change some of the inputs to those calculations that aren't locked by PFPS. Disconnecting from the route will cause the PPC to run in standalone mode. However, PPC will leave (but unlock) all the values retrieved from PFPS.

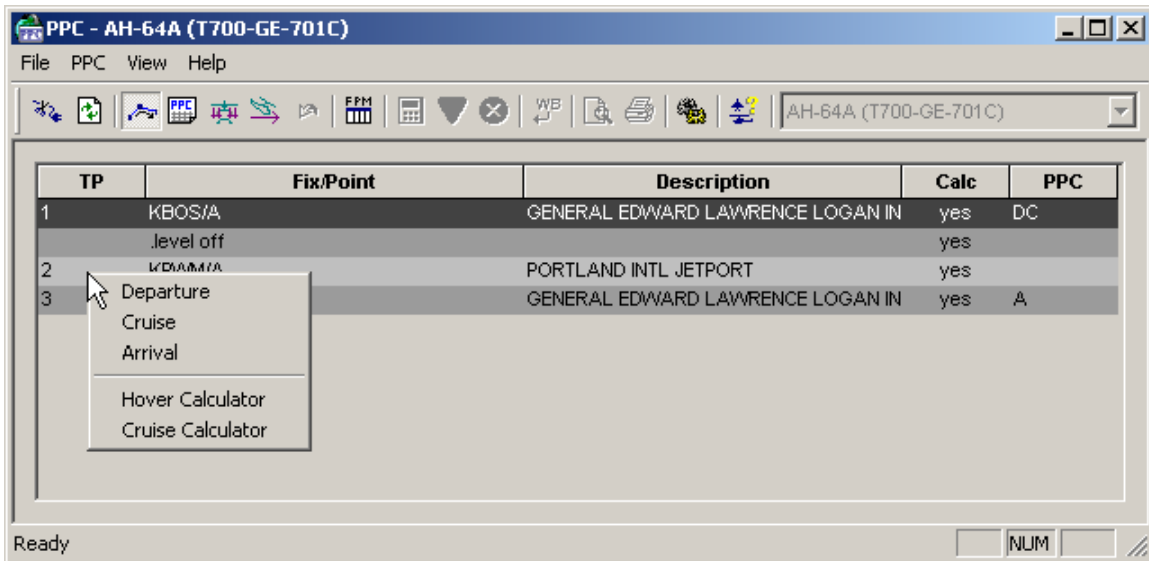
## B.4.1 Route View

When the PPC is initially connected the Route View is displayed. The route view of the PPC below is connected to the PFPS route below.

TP	Fix/Point	Description	Calc	PPC
1	KBOS/A level off	GENERAL EDWARD LAWRENCE LOGAN IN	yes yes	DC
2	KPVM/A	PORTLAND INTL JETPORT	yes	
3	KBOS/A	GENERAL EDWARD LAWRENCE LOGAN IN	yes	A

Turn Pt	Type	Fix/Point	Description	Latitude	Longitude	Elev	MV	Aspd	Bank	Altitude	Wind	Temp	FF	MHI	MC	Leg Time	Clock Time	Leg Dist	Total Dist	Leg Fuel	Total Fuel
1	ST	KBOS/A	GENERAL EDWA	N 42 21.86	W071 00.31	19FT	15.8W			19M		+15C	036	036	036	00+00+00		0.0	0.0	0	2555
		level off		N 42 25.55	W070 58.35	unk	15.8W	N/A		2000M		+11C	037	037	037	00+03+58		4.0	4.0	64	2491
2		KPVM/A	PORTLAND INTL	N 43 38.77	W070 18.53	74FT	16.7W	90T		2000M		+11C	037	037	037	00+52+33		78.8	82.8	716	1775
3		BOS/A	BOSTON	N 42 21.45	W070 59.37	20FT	15.8W	90T		2000M		+11C	218	218	218	00+55+16		82.9	165.7	731	1044

Right clicking on any of the route points in the PPC route view allows the user to designate whether that point is used in any of the calculators.



### B.4.2 PPC View

When PPC is connected to a route, the PPC view will be populated with route data. The PPC view is unique for each aircraft – the intent being to mimic the actual paper PPC card. PFPS has several special designated FPM input IDs (variables), and during a calculation, it computes and manages these values point by point along the route's integrated path. These values are retrieved by PPC when connected to the route. Several of these variables require a calculated route. If the route is not calculated, the value will NOT be changed in the PPC view. The following table indicated these variables and the computed route requirement.

ID	Variable	Requires Calculated Route?
417	Altitude (PA)	No
1138	Free Air Temperature (FAT)	No
730	Gross Weight	Yes
1099	True Airspeed	Yes
581	Drag	No
8000	Load (store weight)	Yes
661	Fuel Weight	Yes

These values are independent of the aircraft and the FPM mode called by PFPS to determine the aircraft performance. PPC retrieves these values from the route point designated (in the Route View) for each section of the PPC or calculators.

The following figure displays the PPC view while connected to a route. Note the color-coding of the values from PFPS.

PPC - AH-64A (T700-GE-701C)

File PPC View Help

Inputs: Default:  Manual:  PFPS Value:  Output:  Warning:

**DEPARTURE - GENERAL EDWARD LAWRENCE LOGAN INTL (KBOS/A)**

PA	19	FAT	15	T/O GWT	14517
LOAD	0	Dual Eng.		Single Eng.	
FUEL(T/O&Mission)	2517			#1	#2
	ATF		ETF	1	ETF
	TR		TR		TR
Max. Torque Available					
Max. Allowable GWT(OGE/IGE)					
Go/No-Go Torque(OGE/IGE)					
Predicted Hover Torque (OGE/IGE)					

**CRUISE - GENERAL EDWARD LAWRENCE LOGAN INTL (KBOS/A)**

PA	19	FAT	15	Vne	Vh
GWT	14517				
	Dual Eng.		Single Eng.		
	TR		TR		TR
Max. Torque Available					
Cruise Speed	IAS		TAS	110	IAS
Cruise Torque					
Cruise Fuel Flow					
Continuous Torque Available					
Max. R/C or Endurance IAS					
Max. Range IAS					
Sngl-Eng Capability(TAS)					
Max. Allow. GWT-Sngl Eng					
Sngl Eng MAX R/C IAS (Max. GWT)					

**ARRIVAL - BOSTON (BOS/R)**

PA	2000	FAT	11	Landing GWT	13227
	Dual Eng.		Single Eng.		
			#1		#2
	TR		TR		TR
Max. Torque Available					
Max. Allowable GWT(OGE/IGE)					
Predicted Hover Torque(IGE)					
Predicted Hover Torque(OGE)					

Ready NUM

### B.4.3 PPC Additional Inputs

The PPC retrieves additional data from PFPS if there is a non-manual FPM mode used to determine the aircraft performance at the designated point. The data is retrieved by the PPC by matching IDs and is independent of the calculated state of the aircraft. For example, if the point designated as the cruise point uses a cruise standard mode in CFPS and defines the Anti-Ice system as ON then the PPC will retrieve the state of the Anti-Ice (ON), use it in the PPC cruise calculations and display it in the Additional Aircraft Inputs dialog box in the cruise column. The picture below shows that the departure, cruise, and arrival calculations have been assigned a route point and additional information was retrieved from PFPS.

Input Name	Departure	Cruise	Arrival	HoverCalc	CruiseCalc
Anti-Ice	off	off	off	off	off
IGE Hover Height	5		5		
De-Ice	off	off	off	off	off
Dual Engine Limit	Dual Engine Conti	Dual Engine Conti	Dual Engine Conti	Dual Engine 30 Mi	Dual Engine 30 Mi
Single Engine Limit	Single Engine Con	Single Engine Con	Single Engine Con	Single Engine Con	Single Engine Con
Download Change	0	0	0	0	0
Accessory Torque	0	0	0	0	0
Torque Available Factor	1	1	1	1	1
Torque Required Factor	1	1	1	1	1
Transmission Limit	Limit Torque	Limit Torque	Limit Torque	Limit Torque	Limit Torque
Flat Plate Drag Change		0			0
Fuel Flow Factor		1		1	1
Speed Type		KTAS			KIAS
Rate-of-Climb				0	0
Temperature Lapse Rate				Constant Temper	Constant Temper

### B.4.4 Making a change within CFPS

The PPC monitors route server and receive notification events. When a change in PFPS is detected the Refresh Route button is enabled. This allows users to manually refresh the route in PPC. Changes to the route, such as calculating in PFPS, adding a route point, or changing any of the parameters, or changing the active route in PFPS will have this affect.

The screenshot shows the PPC - AH-64A (T700-GE-701C) software interface. The main window displays flight performance data for three phases: DEPARTURE, CRUISE, and ARRIVAL, all for GENERAL EDWARD LAWRENCE LOGAN INTL (KBOS/A). The interface includes a menu bar (File, PPC, View, Help), a toolbar with various icons, and a status bar at the bottom with a 'Refresh route' button and a 'NUM' field.

**DEPARTURE - GENERAL EDWARD LAWRENCE LOGAN INTL (KBOS/A)**

PA	19	FAT	15	T/O GWT	14517	
LOAD	0	Dual Eng.		Single Eng.		
FUEL(T/O&Mission)	2517	0		#1	#2	
	ATF	1.00	ETF	1	ETF	1
	TR	1.00	TR	1.00	TR	1.00
Max. Torque Available	100		122		122	
Max. Allowable GWT(OGE/IGE)	18836	21000				
Go/No-Go Torque(OGE/IGE)	83	97				
Predicted Hover Torque (OGE/IGE)	69	58				

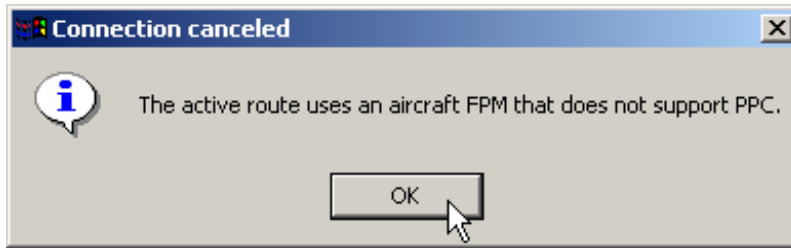
**CRUISE - GENERAL EDWARD LAWRENCE LOGAN INTL (KBOS/A)**

PA	19	FAT	15	Vne	187	Vh
GWT	14517					
	Dual Eng.		Single Eng.			
	TR	1.00	TR	1.00	TR	1.00
Max. Torque Available	100		122		122	
Cruise Speed	IAS	105	TAS	110	IAS	TAS
Cruise Torque	48					
Cruise Fuel Flow	891					
Continuous Torque Available						
Max. R/C or Endurance IAS	67					
Max. Range IAS	124					
Sngl-Eng Capability(TAS)			18	127		
Max. Allow. GWT-Sngl Eng			21000			
Sngl Eng MAX R/C IAS (Max. GWT)						

**ARRIVAL - BOSTON (BOS/R)**

PA	2000	FAT	11	Landing GWT	13227	
	Dual Eng.		Single Eng.			
			#1	#2		
	TR	1.00	TR	1.00	TR	1.00
Max. Torque Available	100		122		122	
Max. Allowable GWT(OGE/IGE)	18496	21000				
Predicted Hover Torque(IGE)	52					
Predicted Hover Torque(OGE)	62					

**Note:** changing the active route to an FPM that is not an FPM supported by PPC will enable the refresh button. Hitting the refresh button then will cause the following error message to appear and will leave the PPC in it's current state.



## **B.4.5 PPC Options**

The PPC has user options (on/off) that affect how it interacts with PFPS. They don't provide additional functionality, they potentially make the PPC easier to use as a matter of personal preference.

### **B.4.5.1 Automatic Calculation Mode**

PPC has an option that when enabled recalculates every time the user changes a value.

### **B.4.5.2 Connect to Active Route on Application Startup**

With PFPS running, and this option enabled, the PPC will automatically connect to the route when it starts without any user intervention.

### **B.4.5.3 Auto-designate Departure, Cruise, and Arrival Route Points**

This option, when enabled, causes PPC to automatically designate the departure, cruise, and arrival points when PPC connects to a PFPS route. The departure and cruise points are set to the first point in the route and the arrival point is set to the last point in the route. The user has the ability to change these automated designations in the Route View.

## ***B.5 What-If Calculations***

Connecting PPC to a route and then disconnecting the PPC will populate the PPC card with values from PFPS and then allow the user to "tweak" them to perform last minute calculations.

## Appendix C – Training Exercise

The objective of this exercise is to plan a mission using the performance and mission planning capabilities provided by the PFPS and PPC software programs. Use the AH-64A (T700-GE-701) as the PPC FPM model for this exercise. Do not be concerned with threat data for the purposes of this exercise.

### WARNINGS, CAUTIONS, AND NOTES

Warnings, Cautions, and Notes are used to emphasize important and critical instruction and are used for the following conditions:

#### WARNING

An operating procedure, practice, condition or statement, which if not correctly followed, could result in personal injury or loss of life.

#### CAUTION

An operating procedure, practice, condition or statement, which if not strictly observed, could result in damage to or destruction of equipment, loss of mission effectiveness or long term health hazards to personnel.

#### NOTE

An operating procedure, condition, or statement, which is essential to highlight.

## PREMISSION INFORMATION

Refueling is available on request. OGE hover power is required at departure and destination points. The following information is provided for planning purposes.

a. Crew and equipment (add to basic aircraft weight of 10960.7 lbs.):

<b>Weight (lbs.)</b>	<b>Description</b>
440	Crew of two (220 x 2)
90	Survival kit bay (equipment)
50	Left storage bay (equipment)
278.2	Hellfire Launchers (pair)
173.6	M-261 Rocket launchers (pair)
9	Chaff dispenser
1040.8	Total crew and equipment weight

b. Munitions/Expendables

<b>Weight (lbs.)</b>	<b>Description</b>
799.2	Hellfire missiles (8)
1029.8	MPSM warhead w/MK66 (38)
885.5	M-789 30mm rds. (1150)
10	Chaff cartridges (30)
2724.5	Total munitions/expendables weight

c. Fuel

<b>Weight (lbs.)</b>	<b>Description</b>
2517	Main fuel cells

d. Planning Weather Forecast:

	<b>Salt Lake City (KSLC) RW32 (at takeoff time) N 40° 46.43' W 111.57.79'</b>	<b>Fairchild AFB (KSKA) (at approx. arrival time) N 47° 36.90' W 117.39.35°</b>
Pressure Altitude	4000	2200
Free Air Temperature	+30° C.	+30° C.
Winds	270/10	290/15
Ceiling	Unrestricted	5000 ft.
Visibility	Unrestricted	Unrestricted

## PERFORMANCE AND MISSION PLANNING

Step 1. Determine operating weight.



Add the following weights to determine the operating weight.

Weight (lbs.)	Description
10960.7	Basic weight
1040.8	Crew and equipment
12001.5	Operating weight

Step 2. Determine takeoff weight

Weight (lbs.)	Description
12001.5	Operating weight
2517	Takeoff fuel
2724.5	Munitions/Expendables
17243	Takeoff gross weight

Step 3. Calculate Departure performance values using the PPC program.


	Description	Icon
1	Launch the PPC program.	
2	Verify the current FPM (AH-64A T700-GE-701)	
3	Press the Additional Inputs icon on the toolbar	
4	Press the "Load Aircraft Defaults" button	
5	Verify that the Departure Dual Engine limit is set to the "30 Minute Limit."	
6	Close the Additional Aircraft Inputs dialog box.	
7	In the PPC page, enter the following values into the Departure section PA = 4000 (Wx forecast)      FAT = +30° C      T/O GWT = 17243	
8	Select and press the Calculator icon.	

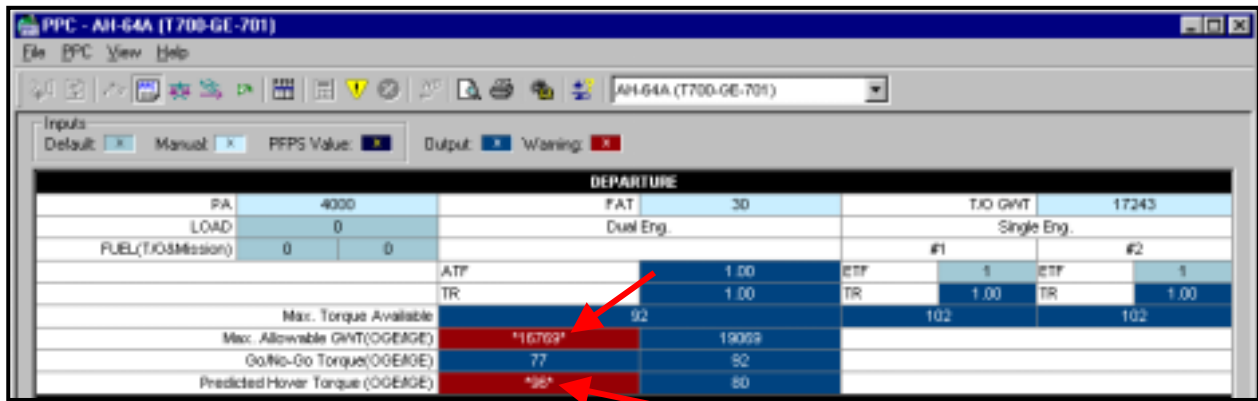
### WARNING

ETF is a very critical component in determining the maximum allowable gross weight, especially at higher free air temperatures. The default ETF for the AH-64A T700-GE-701 and T700-GE-701C in the PPC program is 1.00 for both engines. Any lower numbers will make the aircraft less capable.

Remember to verify your aircraft ETF numbers. If different from 1.00, make the change(s) in the Departure section of the PPC. If you fail to change the ETFs (when different), the helicopter will not be as capable as you think it is.

Step 3. Determine if sufficient power is available to support the mission.

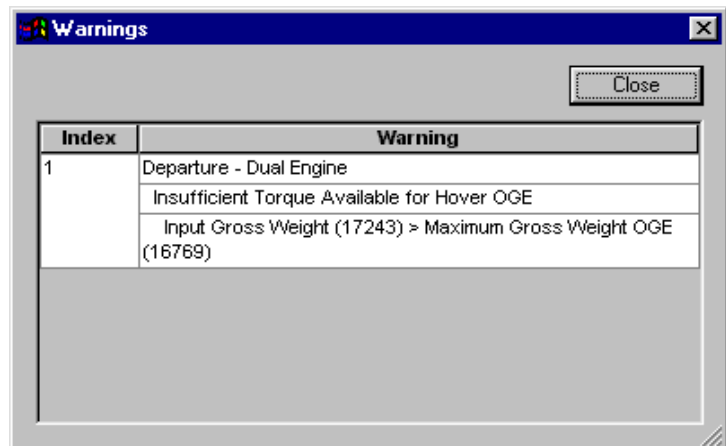
Analyze the performance values in the Departure section. As depicted below, the Max. Allowable GWT (OGE) and the Predicted Hover Torque (OGE) have warning messages associated with them. Right-click in each of the Warning fields. When you right-click, a small "View Warnings" box will appear. Left-click on the  box to view the warning message.



DEPARTURE			
PA	4000	FAT	30
LOAD	0	Dual Eng.	
FUEL(T/O Mission)	0	T/O GWT	17243
		Single Eng.	
		#1	#2
		ATP	1.00
		CTF	1
		TR	1.00
		TR	1.00
Max. Torque Available			92
Max. Allowable GWT(OGE)	16769		19059
Go/No-Go Torque(OGE)	77		52
Predicted Hover Torque (OGE)	96		80

Warning #1: based on the T/O gross weight, there is insufficient torque available for HOVER OGE. The input gross weight (17243) is greater than the Maximum Gross Weight OGE (16769).

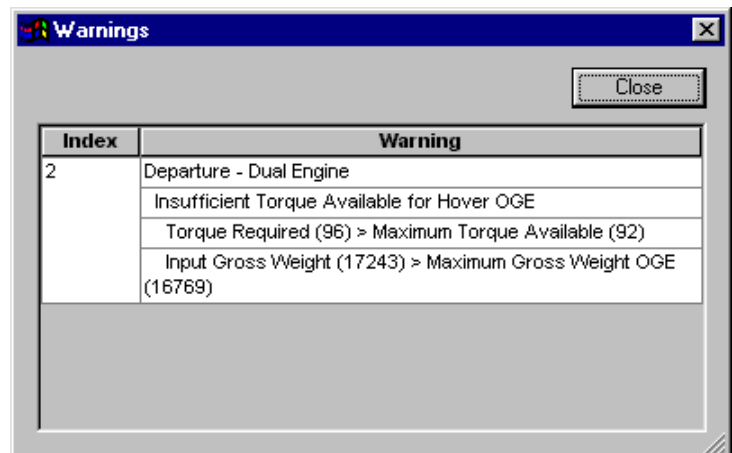
Comment: based on the mission requirements (OGE power required at takeoff) the crew must reduce the T/O gross weight to a weight equal to or less than 16769.



Index	Warning
1	Departure - Dual Engine Insufficient Torque Available for Hover OGE Input Gross Weight (17243) > Maximum Gross Weight OGE (16769)

Warning #2: the first (insufficient Torque...) and third lines (Input Gross Weight...) are the same ones displayed in Warning message #1.

The percent Torque Required (96) is greater than the Maximum percent Torque Available (92).



Index	Warning
2	Departure - Dual Engine Insufficient Torque Available for Hover OGE Torque Required (96) > Maximum Torque Available (92) Input Gross Weight (17243) > Maximum Gross Weight OGE (16769)

Step 4. Make Decision on T/O gross weight.

Since Hover OGE power is not available at the takeoff point the takeoff gross weight must be reduced to 16769 or less (reduction of 474 lbs.).

At this point you should evaluate the mission and equipment to determine what should be removed.

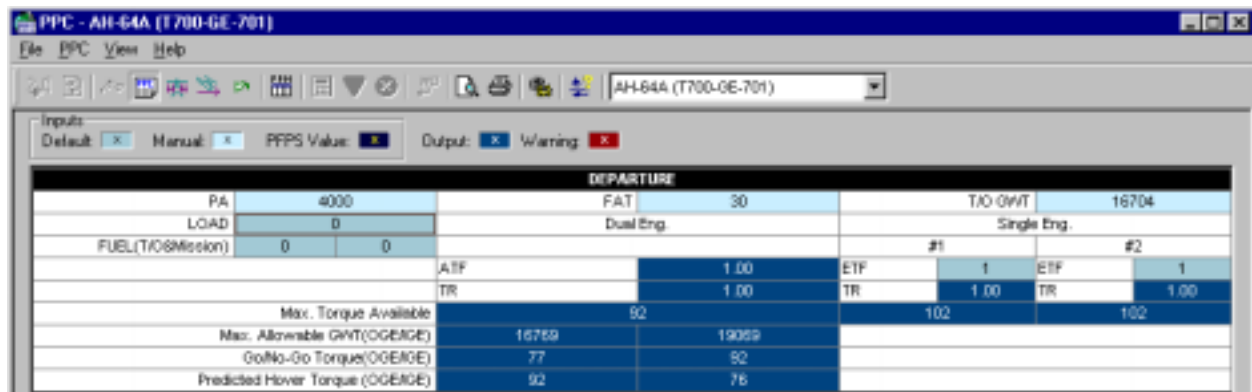
After careful review, the decision is made to remove 700 30mm rounds. This decision is made because ammo will be available at the destination.

The reduction of 700 30mm rounds reduces the T/O gross weight by 539 lbs.

The new T/O gross weight is now 16704 (17243 – 539).

Step 5. Recalculate Departure PPC with new T/O Gross weight value.

Change the T/O GWT value from 17243 to 16704, press the Calculator icon, then review the performance values.



DEPARTURE					
PA	4000	FAT	30	T/O GWT	16704
LOAD	0	Dual Eng.		Single Eng.	
FUEL(T/O Mission)	0			#1	#2
		ATF	1.00	ETF	1
		TR	1.00	TR	1.00
Max. Torque Available			92	102	102
Max. Allowable GWT(OGE)	16769		19029		
Go/No-Go Torque(OGE)	77		92		
Predicted Hover Torque (OGE)			92		76

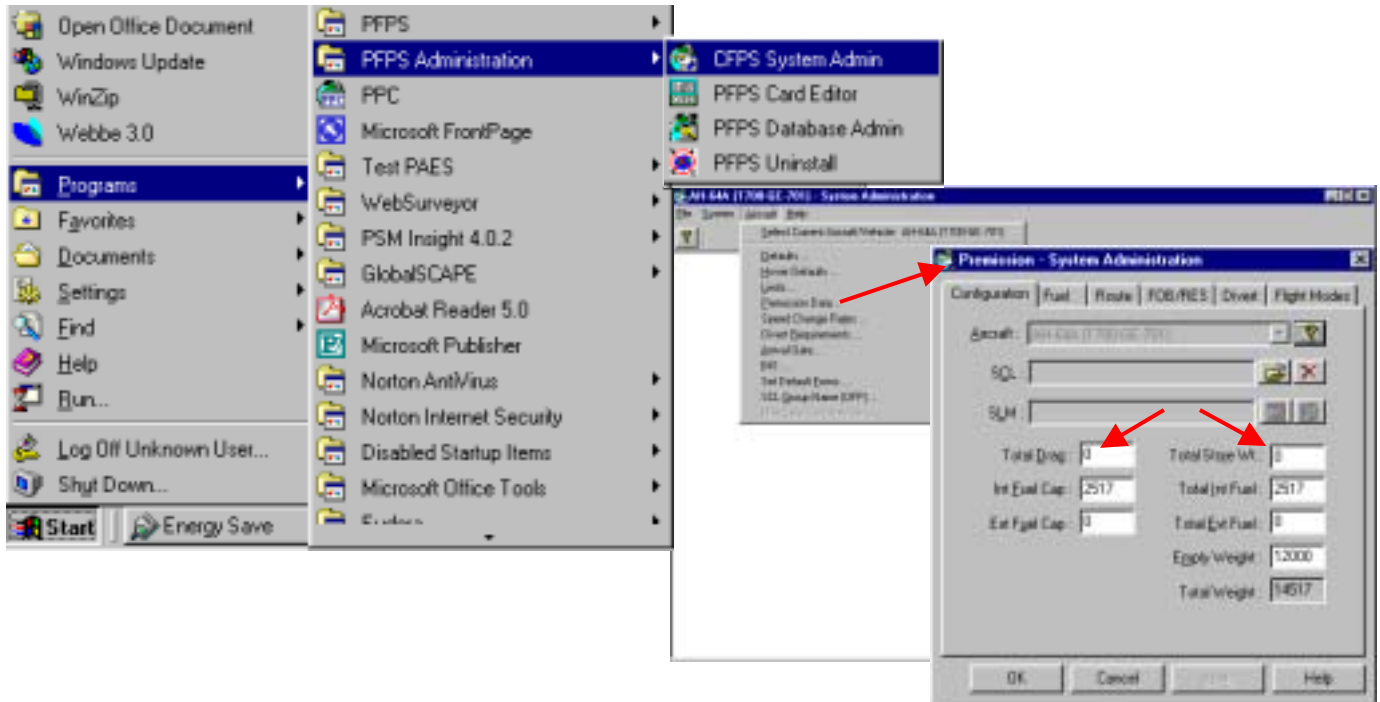
Sufficient power is now available for hover OGE. The predicted hover torque (OGE) is equal to or less than the maximum torque available.

**NOTE**

The value (92) depicted for Predicted Hover Torque OGE and Max Torque Available appears to be the same. However, the values are rounded off. In essence, the actual Max Torque Available value is slightly greater than the Predicted Hover Torque value for OGE.

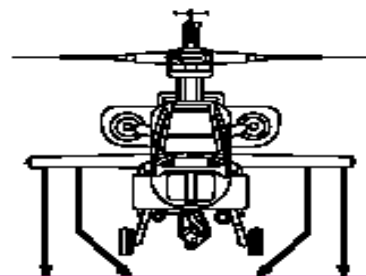
Step 6. Update the CFPS Permission Configuration values

Default values for each FPM are stored in the PFPS Route-Server database. These default values can be viewed in the CFPS System Admin dialog boxes, as displayed below. Note that the start internal fuel value is 2517 lbs. and the Total Stores Wt. Value is zero (0).



The baseline drag configuration for the AH-64A includes the left and right side stores pylons plus a Hellfire missile launcher (with four Hellfire missiles) on each side.

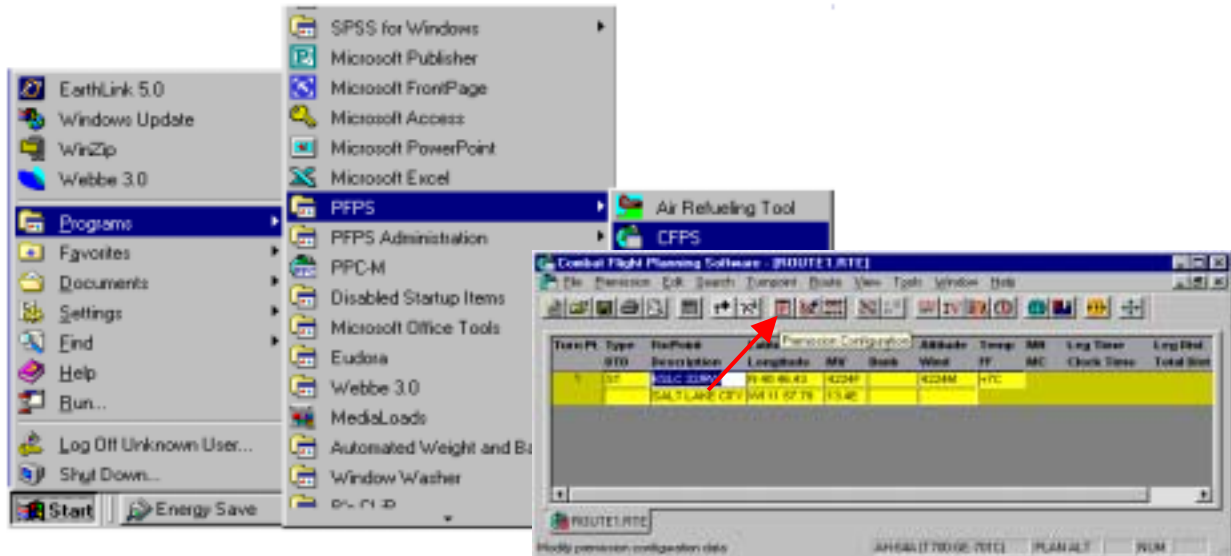
The baseline configuration must be changed to conform to the current mission configuration. Changes to the baseline configuration must be input into the CFPS *Permission* dialog box via the *Permission* dialog button on the CFPS toolbar.



RIGHT WING STORES		LEFT WING STORES		▲ F (SQ. FT.)	MULTIPLYING FACTOR
OUTBOARD	INBOARD	INBOARD	OUTBOARD		
○	○	○	○	+5.2	+0.52
☼			☼	0 (BASELINE)	0 (BASELINE)
	☼	☼		0 (BASELINE)	0 (BASELINE)
☼	☼	☼	☼	+1.2	+0.12
☼	☼	☼	☼	+1.2	+0.12
●	☼	☼	●	+1.9	+0.19
☼	●	●	☼	+1.9	+0.19
☼	☼	☼	☼	+9.6	+0.96

**NOTE**  
 The baseline configuration for the AH-64A 701 does not include the Wire Strike Protection System (WSPS). To account for the drag (if installed), increase the square foot value by +1.9. A multiplying factor is not required in the PPC program.

The path to the *CFPS* Permission – *System Administration* Configuration page is displayed on the preceding page. Inputs to any field in *CFPS* System Administration are permanent, until you change them again. The path to the *PFPS* Permission Configuration page is displayed below.



Before going any further, let's define the fields displayed in the *PFPS* Permission Configuration page. SCL only applies to Air Force F-16's. SLM is not usable by Army helicopters.

Aircraft: FPM used for performance planning

Total Drag: drag change if different from AH-64A Operator's Manual baseline drag configuration derived from Chapter 7.

Int Fuel Cap: max capacity of internal fuel cells (and internal aux tank if installed).

Ext Fuel Cap: max capacity of external fuel cells (if external tanks are installed).

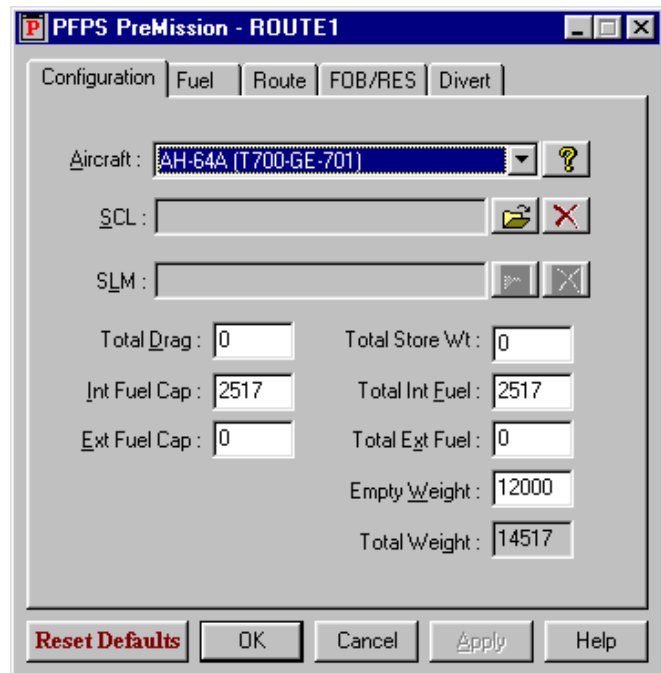
Total Store Wt: munitions & expendables

Total Int Fuel: start/takeoff internal fuel

Total Ext Fuel: start/takeoff external fuel

Empty Weight (same as Operating Weight): basic aircraft weight plus crew and mission equipment weight.

Total Weight: takeoff gross weight (calculated automatically)



Now that you have an understanding of the PFPS Permission fields, compare the mission requirements with the baseline configuration to determine what changes, if any, should be made to the aircraft configuration. In this case, changes are warranted in Total Drag, Total Store Wt., and the Empty Weight fields.

Field	Rationale	New value
Total Drag	A drag value of +1.9 must be added for the addition of two stores pylons plus 19 tube rocket launchers IAW Figure 7-18 (Drag Chart & Authorized Armament Configurations). For this exercise, the WSPS is not installed (701 engine).	+ 1.9
Total Store Wt.	Munitions & expendable have been added. However, the munitions were reduced by 700 rds (539 lbs.: 1150 to 450 rds.)	2185.5 lbs.
Empty Weight	The basic aircraft weight plus the training mission equipment do not add to 12000	12001.5 lbs.
Total Weight	Empty wt. + Total Store Wt. + Int. Fuel Wt. (automatic calculation)	16704

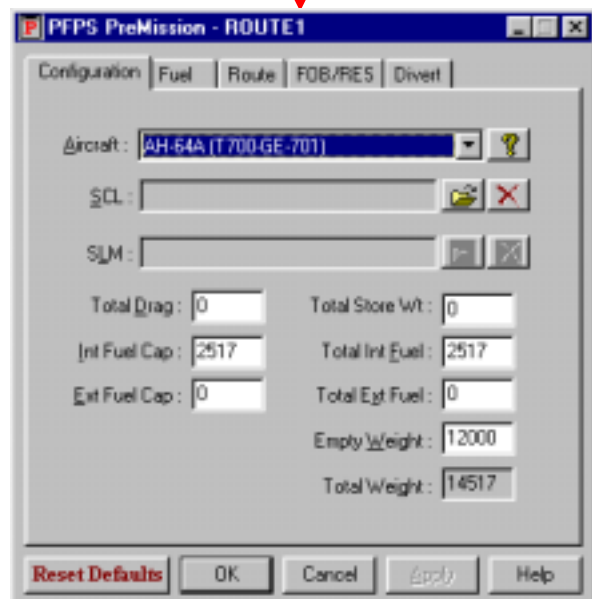
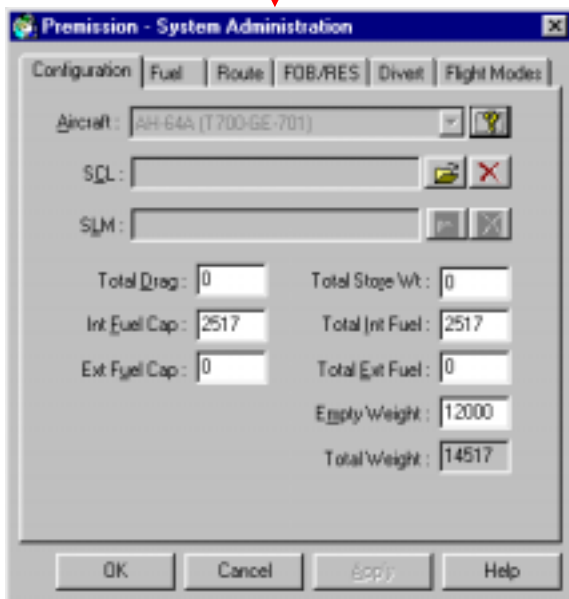
Once the changes are verified, the next step is to input the values into the PFPS Permission Configuration page.

**CAUTION**

Inputting changes in the CFPS System Admin dialog boxes will change the default configuration for all future calculations, while changing the current mission.

Changes made to the CFPS System Administration defaults impact all future calculations, as the new values become the

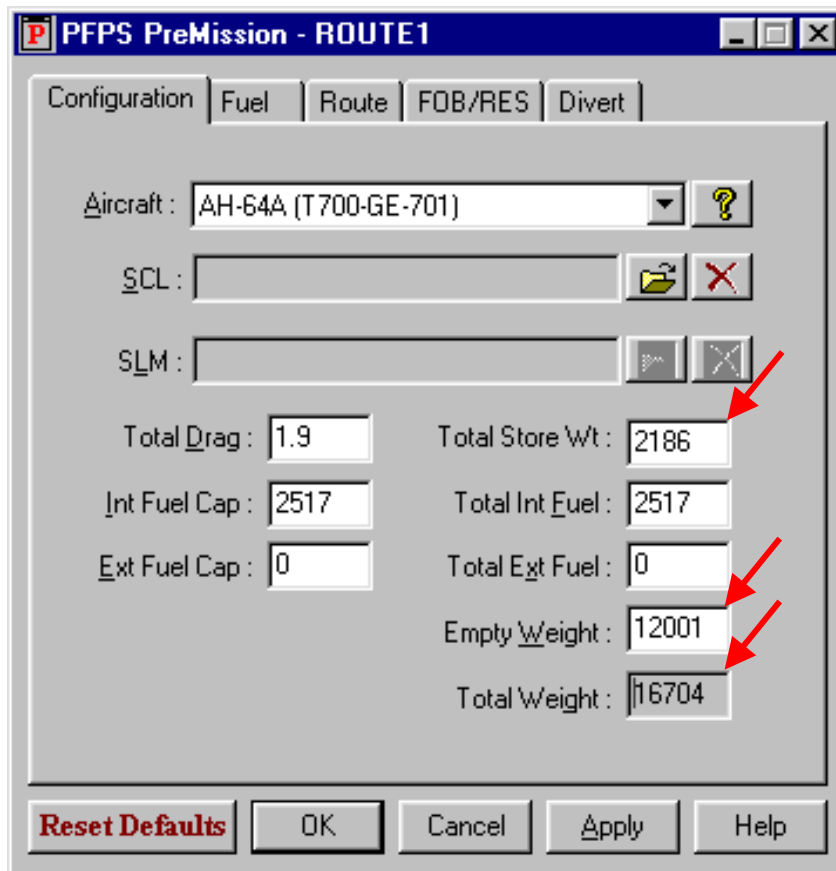
These defaults may be changed in CFPS for each mission planning session. Access to this page is via the Permission icon.



**NOTE**

With the exception of the Total Drag field, only integer values can be entered in the fields (no decimal values).

A decision is made to round up the total store weight to 2186 and to round down the Empty Weight to 12001. The input values are displayed below. As depicted, the Total Store Wt., Empty Weight, and the Total Weight reflect the mission weights.



**NOTE**

The internal fuel capacity (Int Fuel Cap) value of 2517 is based on the main internal fuel cells. If the internal Aux. tank is installed the 2517 value would be changed to 3438.

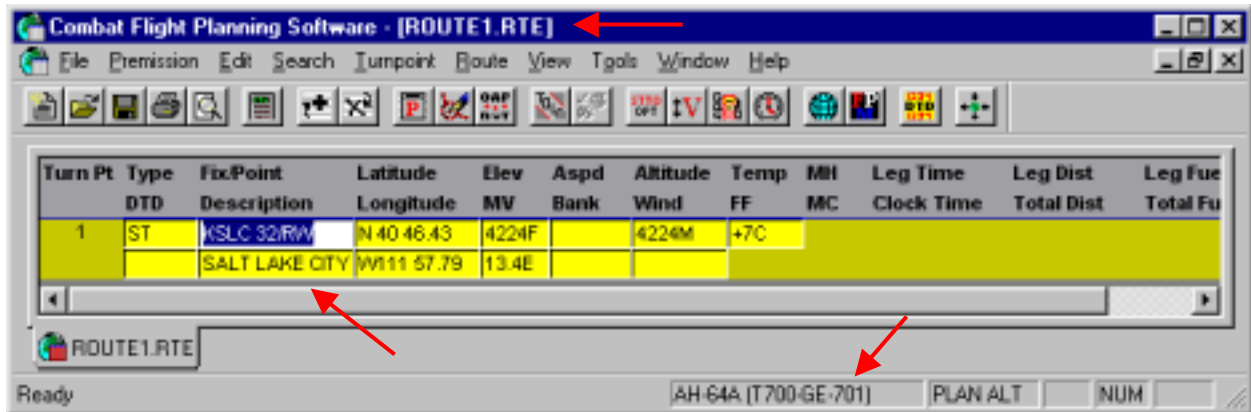
Step 7. Conduct a map recon, and plan the route from takeoff point to destination.

**NOTE**  
This step may be conducted concurrently with steps 1-6

Prior to conducting a map recon, verify that the default aircraft configuration in CFPS is the AH-64A T700-GE-701. Verify that default departure location is Salt Lake City.

Insert the North West USA Map Data CD. This CD provides total map coverage from Salt Lake City to Fairchild AFB.

Launch FalconView; note that the STTO is located at Salt Lake City, Utah. The CFPS title bar displays the name "ROUTE1.RTE," which indicates that this is a new route.



For a preliminary estimate of the distance and direction to be flown, select the destination as the next route point from the STTO. Select the "Range Bearing" icon (right-most icon) on the FalconView toolbar, then select the start and arrival points for distance. This action provides a quick-glance at the length of the route.

However, be cautious of straight-line distances; there may be quite a difference in distance between the straight line route and the planned mission route.



The approximate straight line distance between the two points is 476.5 NM with a true course of 331°. Based on the distance and the aircraft configuration, the aircrew should plan to refuel at some point along the route.

After a thorough map analysis using a 1:250,000 JOG-A the mission route is planned. A TIROS (4 Km) map is used here (see map on right) to display the route.

The route includes a total of 8 turnpoints. The departure location is defined as turnpoint #1 and the destination (Fairchild AFB) is defined as the final turnpoint #8.

FalconView automatically transfers route data to CFPS. The figure below (CFPS) displays the turnpoints in tabular view. Each turnpoint in CFPS defines a turnpoint on the map.



Combat Flight Planning Software - [spokane.ste]

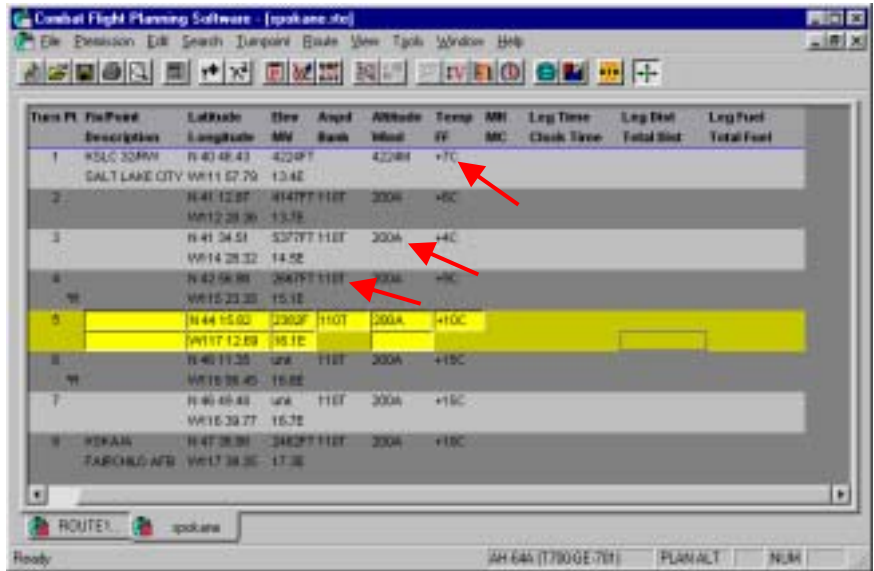
File Permission Edit Search Turnpoint Route View Tools Window Help

Turn Pt	Fix Point	Latitude	Elev	Asp'd	Altitude	Temp	MH	Leg Time	Leg Dist	Leg Fuel
	Description	Longitude	MV	Bank	Wind	FF	MC	Clock Time	Total Dist	Total Fuel
1	KSLC 32RWY SALT LAKE CITY	N 40 46.43 W111 57.79	4224FT 13.4E		4224M	+7C				
2		N 41 12.87 W112 28.36	4147FT 13.7E		200A	+6C				
3		N 41 34.51 W114 28.32	5377FT 14.5E		200A	+4C				
4		N 42 58.98 W115 23.35	2667FT 15.1E		200A	+9C				
5		N 44 15.82 W117 12.89	2392F 16.1E	110T	200A	+10C				
6		N 46 11.35 W116 56.45	unk 16.6E	110T	200A	+15C				
7		N 46 49.48 W116 39.77	unk 16.7E	110T	200A	+15C				
8	KSKAA FAIRCHILD AFB	N 47 36.90 W117 39.35	2462FT 17.3E		200A	+10C				

ROUTE1... spokane

Ready AH-64A (T700-GE-701) PLAN ALT NUM

Airspeed (110T) and altitude (200A) are based on the preset values defined in the CFPS System Admin Permission Data dialog box. Elevation values are based on DTED data at the specified turnpoints and are automatically transferred to the appropriate elevation value fields. Temperature values are calculated based on the DTED elevation and temperature lapse rate. However, wind values must be provided by the user.



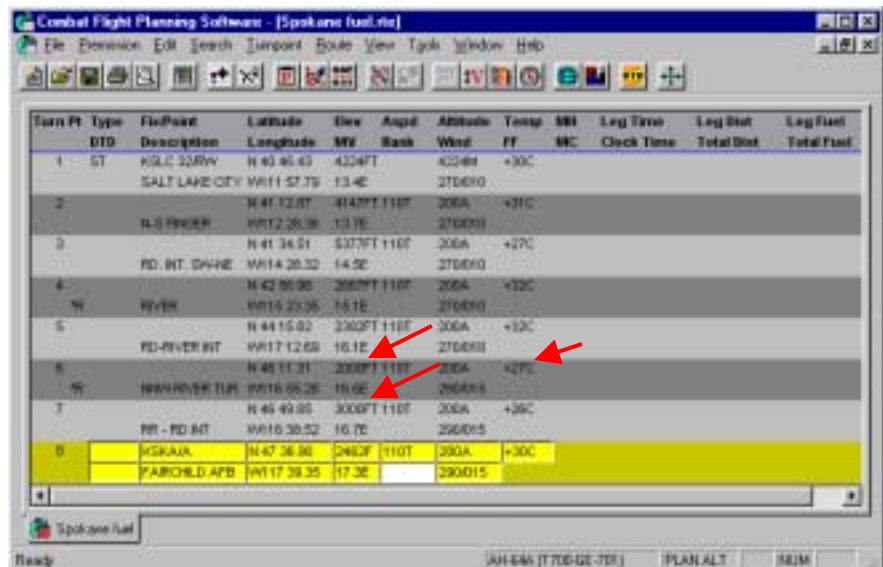
Note the temperature for each turnpoint. CFPS uses a value of +15° C at sea level on a standard day as the baseline temperature. Turnpoint temperature values are calculated using a standard lapse rate of 2° C per thousand feet. For example, the elevation at Salt Lake City is displayed as 4224 ft. Using a temperature lapse rate of 2° C per thousand ft. an increase of approximately 4000 ft. from mean sea level decreases the temperature by 8° C., which reduces the temperature from +15° C to +7° C. However, the weather forecast reflects a Temp of +30C, which should replace the +7° value.

**NOTE**  
DTED elevation data is not available for all areas.

Elevation data is not available for turnpoint #6 and #7. When DTED elevation data is not available CFPS automatically enters the baseline temperature value (+15° C). A map analysis must be conducted to determine the elevation values for turnpoints #6 and #7. The resulting values should then be inserted.

Temperature values must be based on forecast weather. Review the weather data and update the temperature fields. In addition, enter wind information in the wind fields.

Description information can be added to each turnpoint. Descriptive information helps to identify the turnpoints as you fly over them.



Single letter asterisk codes may appear in the Turnpoint column, depending on the event(s) happening at each point. Multiple events (up to 5) can be performed at any turnpoint. The following list defines the letter asterisk codes.

- D- Drag Change
- d - Ground/Maritime Delay
- f - Percent fuel flow increase
- H - Rotary Wing Delay
- M - Manual FPM mode setting
- m - User defined manual leg
- R - Serpentine leg
- S - Store/Cargo change

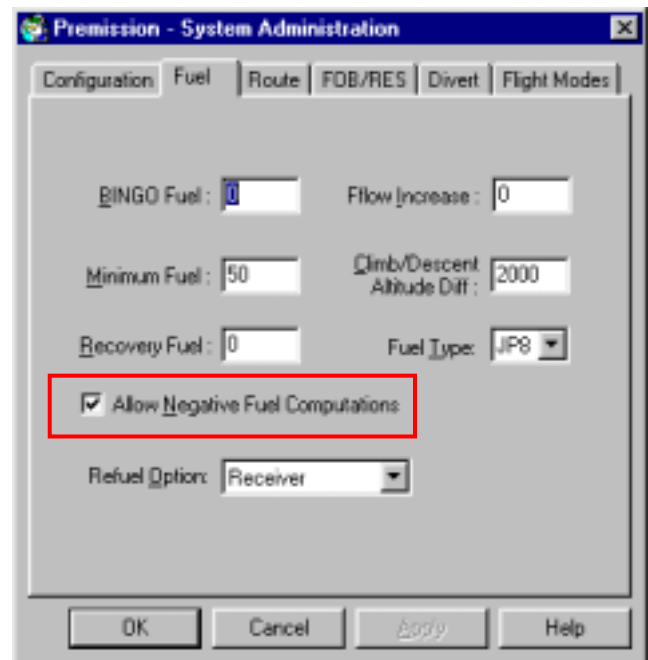
Turn Pt	Type	Description	Latitude	Elev	Azhd	Altitude	Temp	HR	MC	Leg Time	Leg Dist	Leg Fuel
1	ST	KSLC 32RW	N42 46.43	4224FT		4224ft	+30C					
		SALT LAKE CITY	N41 57.78	13.4E		275010						
2		N-SPRNGS	N43 52.87	4147FT 1101		206A	+31C					
			N42 26.38	13.7E		275010						
3		RD INT DVA HE	N43 34.91	5577FT 1101		206A	+27C					
			N43 20.32	14.5E		275010						
4			N43 56.30	2687FT 1101		206A	+32C					
		RD INT	N44 15.82	2582FT 1101		206A	+32C					
5			N44 15.82	2582FT 1101		206A	+32C					
		RD-REVER INT	N44 15.82	2582FT 1101		206A	+32C					
6			N44 11.21	2088FT 1101		206A	+27C					
		RD-REVER INT	N44 11.21	2088FT 1101		206A	+27C					
7			N44 49.95	3000FT 1101		206A	+34C					
		RD-REVER INT	N44 49.95	3000FT 1101		206A	+34C					
8		HOKAIA	N47 26.30	2462FT 1101		200A	+30C					
		FARCHILD AFB	N47 39.39	17.3E		290015						

Step 8. Evaluate the Fuel Requirements.

Prior to determining which points to designate for performance calculations you can conduct a preliminary CFPS route calculation to get an idea of the time required to fly the mission, the distance, and the fuel required.

CFPS provides two fuel calculation methods. One method (no checkmark) terminates the calculation at the point prior to fuel starvation while the other (w/checkmark) calculates the entire route by allowing negative fuel computations.

You, as the mission planner, want to know how much fuel will be required for the mission and the point where the aircraft will reach fuel starvation (good information for planning the location of a tactical refueling point). You place a checkmark in the box.




**NOTE**


The status of the checkbox for the “Allow Negative Fuel Computations” option is based on the last way the option was selected for ANY aircraft in EITHER System Administration or CFPS Permission. There is NO default in System Administration for this value. The option must be set to the desired state in CFPS Permission.

**NOTE**

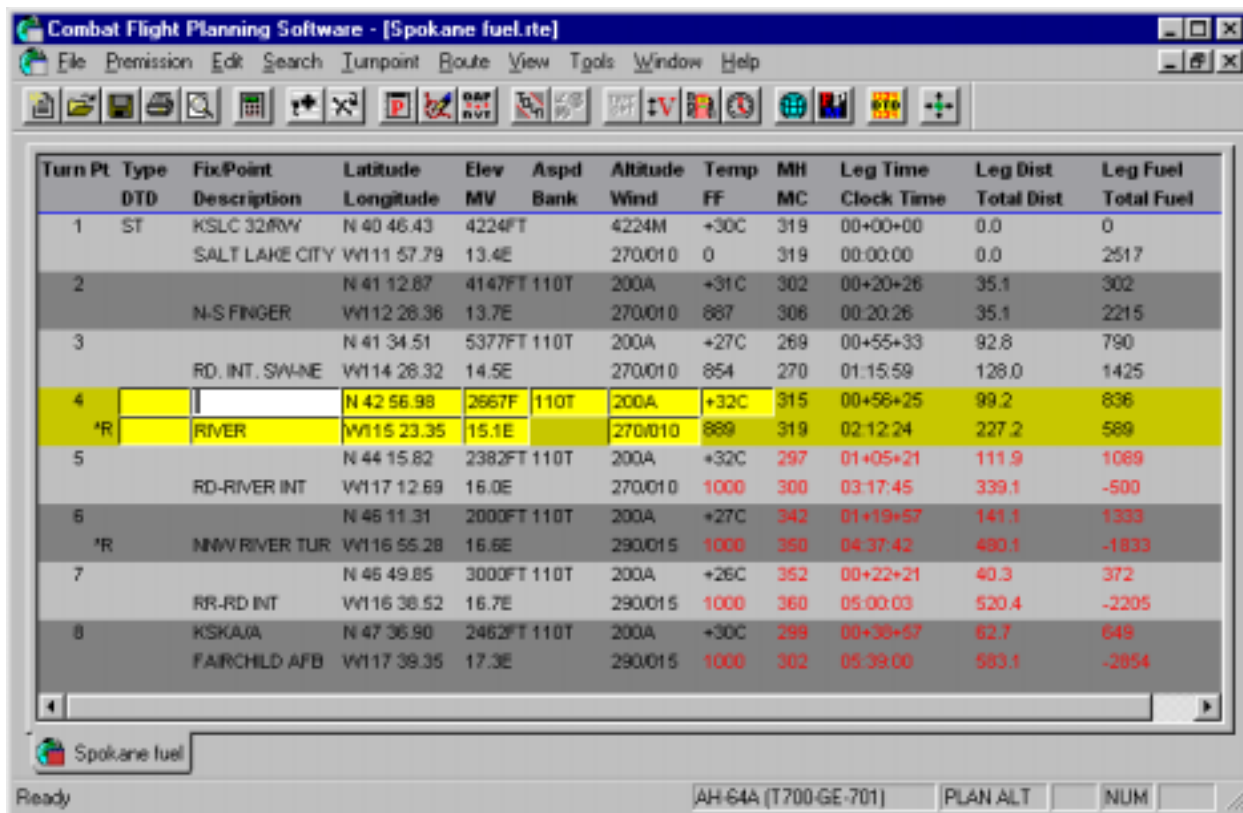
Negative fuel burn rates are calculated using the “manual” mode in PFPS. The resulting fuel burn rates are approximations of the fuel burn rate.

Before you calculate the route, you should verify that the Permission dialog box has been updated to reflect the mission T/O weight and the Total Drag.

Press the Permission icon on the CFPS toolbar to display the PFPS Permission  dialog box. A review of the values in the Total Drag, Total Store Wt, and Total Weight confirms that the changes have been made. You are now ready to calculate the route.

Press the Calculator icon the CFPS toolbar. 

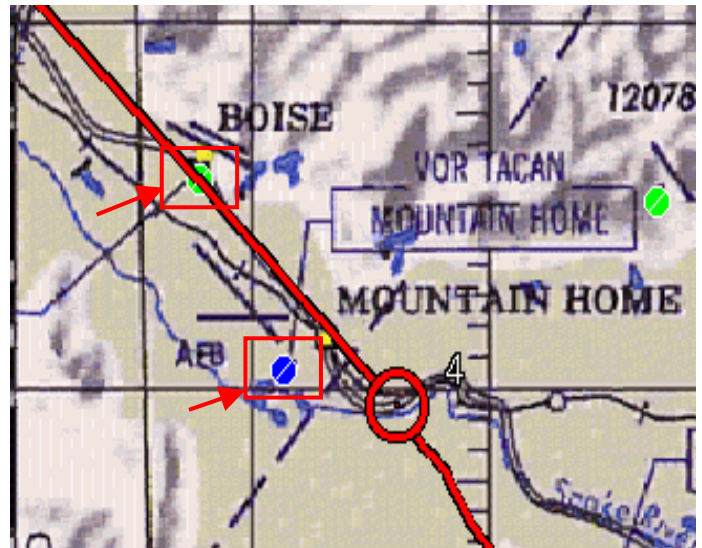
A review of the calculations indicates that the aircraft will run out of fuel between turnpoints #4 and #5.



Turn Pt	Type	FixPoint	Latitude	Longitude	Elev	Aspd	Altitude	Temp	MH	Leg Time	Leg Dist	Leg Fuel
DTD		Description			MV	Bank	Wind	FF	MC	Clock Time	Total Dist	Total Fuel
1	ST	KSLC 32RWY	N 40 46.43		4224FT		4224M	+30C	319	00+00+00	0.0	0
		SALT LAKE CITY	W111 57.79	13.4E			270/010	0	319	00:00:00	0.0	2517
2		N-S FINGER	N 41 12.87		4147FT 110T		200A	+31C	302	00+20+26	35.1	302
			W112 28.36	13.7E			270/010	887	306	00:20:26	35.1	2215
3		RD. INT. SWANE	N 41 34.51		5377FT 110T		200A	+27C	269	00+55+33	92.8	790
			W114 28.32	14.5E			270/010	854	270	01:15:59	128.0	1425
4			N 42 56.98		2667F	110T	200A	+32C	315	00+56+25	99.2	836
*R		RIVER	W115 23.35	15.1E			270/010	889	319	02:12:24	227.2	589
5		RD-RIVER INT	N 44 15.82		2382FT 110T		200A	+32C	297	01+05+21	111.9	1089
			W117 12.69	16.0E			270/010	1000	300	03:17:45	339.1	-500
6		NNW RIVER TUR	N 46 11.31		2000FT 110T		200A	+27C	342	01+19+57	141.1	1333
*R			W116 55.28	16.6E			290/015	1000	350	04:37:42	480.1	-1833
7		RR-RD INT	N 46 49.85		3000FT 110T		200A	+26C	352	00+22+21	40.3	372
			W116 38.52	16.7E			290/015	1000	360	05:00:03	520.4	-2205
8		KSKAJA	N 47 36.90		2462FT 110T		200A	+30C	299	00+35+57	62.7	649
		FAIRCHILD AFB	W117 39.35	17.3E			290/015	1000	302	05:39:00	583.1	-2854

The route calculation resulted in a final fuel status of –2854 lbs. Therefore, the amount of fuel required to fly the route is 5371 lbs. (2517 + 2854). Adding an additional 20 minutes of flight time at an approximate fuel burn rate of 1000 lbs./hr increases the amount of fuel required by 333 lbs. The approximate amount of fuel required to support the mission is 5704 lbs.

Because of the ease of use and flexibility of PFPS the ability to conduct “what if” options can be accomplished quickly and accurately. Before deciding where to refuel you conduct a map recon to determine the options that are available in the vicinity of turnpoint #4.



The map recon shows that Mountain Home AFB and the Boise Air Terminal are possible options for refueling. You relocate turnpoint #4 from its original position to each of the alternate locations and calculate each option. The Temp values are not changed at this point.

As each of the optional turnpoints are defined you change their Temp value to +30C before initiating the calculations. The Mountain Home AFB option increases the total distance by 2.6 NMs. The aircraft will have 407 lbs. of fuel upon arrival at turnpoint #4 and will require an additional 2851 lbs. after the 407 lbs. are burned.

4		KMUO/A	N 43 02.62	2996F	110T	200A	+30C	306	01+08+59	120.1	1018
*R		MOUNTAIN HOM	W115 52.35	15.3E		270/010	896	311	02:24:58	248.1	407
5			N 44 15.82	2382FT	110T	200A	+32C	303	00+54+14	93.6	904
		RD-RIVER INT	W117 12.69	16.0E		270/010	1000	307	03:19:12	341.7	-487
6			N 46 11.31	2000FT	110T	200A	+27C	342	01+19+57	141.1	1333
*R		NNW RIVER TUR	W116 55.28	16.6E		290/015	1000	350	04:39:09	482.7	-1830
7			N 46 49.85	3000FT	110T	200A	+26C	352	00+22+21	40.3	372
		RR-RD INT	W116 38.52	16.7E		290/015	1000	360	05:01:30	523.0	-2202
8		KSKAJA	N 47 36.90	2462FT	110T	200A	+30C	299	00+38+57	62.7	649
		FAIRCHILD AFB	W117 39.35	17.3E		290/015	1000	302	05:40:27	585.7	-2851

4		KBO/A	N 43 33.86	2871F	110T	200A	+30C	309	01+26+23	150.5	1270
*R		BOISE AIR TERM	W116 13.37	15.6E		270/010	882	313	02:42:22	278.5	155
5			N 44 15.82	2382FT	110T	200A	+32C	295	00+35+03	60.0	584
		RD-RIVER INT	W117 12.69	16.0E		270/010	1000	299	03:17:25	338.4	-429
6			N 46 11.31	2000FT	110T	200A	+27C	342	01+19+57	141.1	1333
*R		NNW RIVER TUR	W116 55.28	16.6E		290/015	1000	350	04:37:22	479.5	-1762
7			N 46 49.85	3000FT	110T	200A	+26C	352	00+22+21	40.3	372
		RR-RD INT	W116 38.52	16.7E		290/015	1000	360	04:59:43	519.8	-2134
8		KSKAJA	N 47 36.90	2462FT	110T	200A	+30C	299	00+38+57	62.7	649
		FAIRCHILD AFB	W117 39.35	17.3E		290/015	1000	302	05:38:40	582.5	-2783

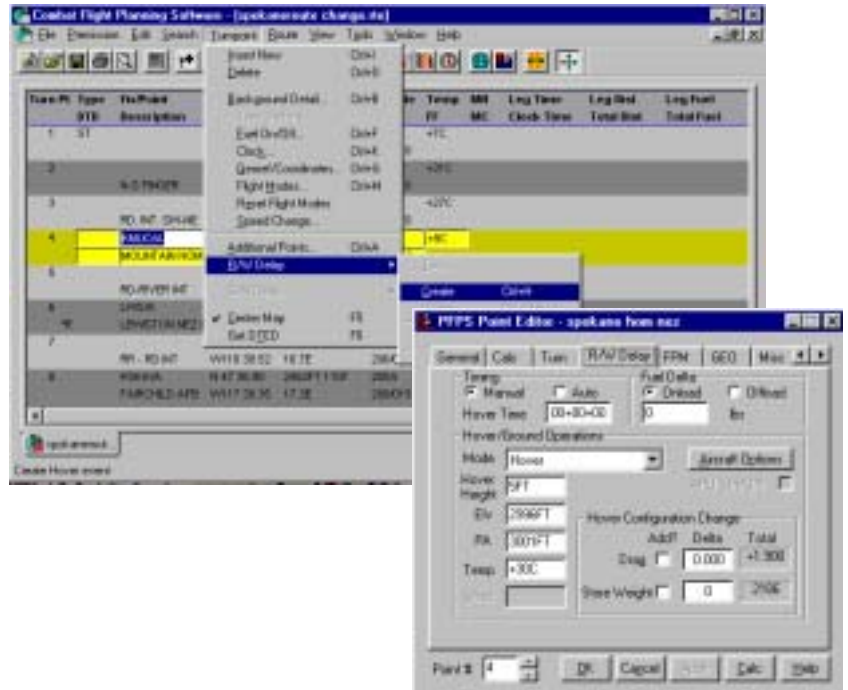
The Boise Air Terminal option does not increase the total distance but it does decrease the total amount of fuel burned by 71 lbs. (5371 – 5300). The aircraft will have 155 lbs. of fuel upon arrival at turnpoint #4, not quite enough for a 20-minute reserve.

After an analysis of both options, a decision is made to refuel at Mountain Home AFB. Upon further review, it appears that two refueling points will be necessary.

The following changes are made to the route: 1) turnpoint #4 is moved from its current position to Mountain Home AFB. 2) turnpoint #6 is moved slightly to the northeast to the Lewiston Nez Pierce County airport.

Refueling at Mountain Home AFB. The calculated route (previous page), using Mountain Home AFB as turnpoint #4, indicates that the aircraft will land with 407 lbs. of fuel. Thus, the aircraft can only take an additional 2110 lbs. (2517 – 407).

Fuel can be added using different methods in CFPS. For this exercise we will use a R/W Delay point. Place the cursor at any location within turnpoint #4 and left-click (row should be highlighted). From the main menu bar, select and press the Turnpoint option. From the available options, select the R/W Delay, followed by the Create option. The R/W Delay tab in the PFPS Point Editor dialog box should be displayed.



For planning purposes, figure 45 minutes for refueling (shutdown). Enter the value 00+45+00 in the Hover Time field. Change the Mode field to “Shutdown,” add the value 2110 to the lbs. field.

Note that the Drag and Store Weight information is carried forward from turnpoint #1. Press the Apply button followed by the OK button. An \*H should now appear in turnpoint #4.

**NOTE**

If the value in the lbs. field, added to the fuel on board, exceeds the capacity of the main internal fuel cells the value entered in CFPS will automatically adjust itself to the max main internal fuel capacity (without aux. tank).




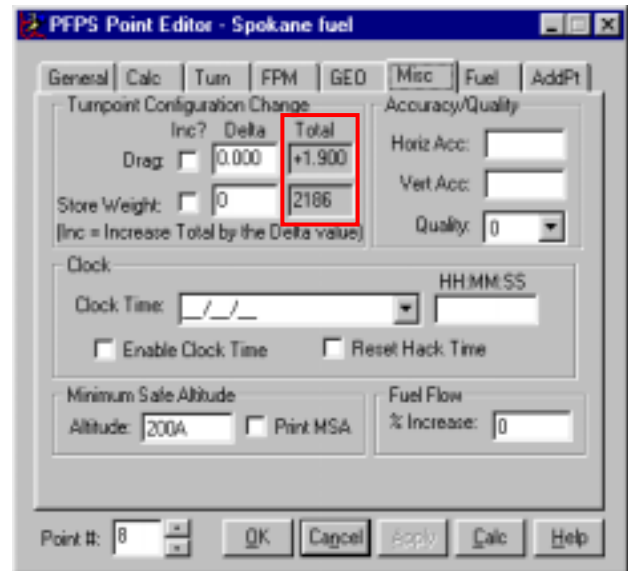
Plan on adding 2000 lbs. of fuel at Lewiston Nez Pierce. Use the same R/W Delay method for adding fuel. The aircraft will be shutdown for refueling for 45 minutes. Change the Temp to +34C. Press the Apply button, followed by the OK button. An \*H should now appear in turnpoint #6.

Step 9. Final Verification of Data Inputs.

Prior to conducting the performance calculations you should conduct a final review of: 1) all changes to the baseline configuration (fuel, total stores weight, drag, etc.), 2) CFPS turnpoint values (Temp, wind, elevation, etc.), and 3) the desired FPM values (e.g., Dual Engine 30 Min., Anti-Ice, etc.) for the turnpoints.

a. Changes to Baseline Configuration.

Conduct a final check to see if the required changes to the aircraft configuration were entered correctly. Remember, the baseline configuration includes the left and right side stores pylons plus a Hellfire missile launcher on each side (loaded with 4 missiles each). The addition of two stores pylons plus 19 tube rocket launchers increases the drag by +1.9. You can reverify the drag value you entered under the Misc. Tab in the Point Editor for TP #8. Place the cursor in value field in turnpoint #8 and left-click. Press the  Background Detail (Point Editor) toolbar icon and verify that the Total Drag (1.9) and Stores Weight (2186) values remain as entered.



Conduct a final check to ensure the correct refueling information for turnpoints #4 and #6 was entered.

b. CFPS Turnpoint Values. Turnpoint information was automatically inserted into CFPS as you planned the route in FalconView. Verify the turnpoint elevations, wind, and temperature values that you previously entered for correctness. Check to ensure that the descriptions for each turnpoint are adequate.

c. Desired FPM Inputs. You are just about ready to calculate the CFPS route. Have you thought about how you want the FPM mode values set for the calculations? Before you calculate the performance values you should check to see if the operating limits are correctly set in CFPS.

Other important items to check are the Rate of Climb and Rate of Descent for the Climb and Descent modes. Also, since the default value for most "power losses" (e.g., Anti-Ice, De-Ice, etc.) is the OFF position, you should be careful to check that they are turned on and accounted for (power-wise) if they are needed for the mission.

## WARNING

Flight into areas that require the Anti-Ice or De-Ice should be considered during the mission planning session. Failure to turn these on in PFPS will cause pilots to think the aircraft is more capable than it actually is.

For this exercise, you decide to use the “Dual Engine 30 Min” limit for the departure, turnpoints #4 and #6 (after refueling), and the arrival point (TP #8). The “Dual Engine Continuous” limit is used for all cruise turnpoints.

## NOTE

The FPM Operating Limit default setting for all turnpoints is the Dual Engine Continuous limit.

Using the Background Detail (PFPS Editor) button on the CFPS toolbar, select the FPM tab on the PFPS Point Editor page, then select the Inputs button for the Cruise row. This will take you to the FPM Mode Inputs page. Check the Operating Limit value in the Change Value box.

The screenshot displays the Combat Flight Planning Software (CFPS) interface. The main window is titled "Combat Flight Planning Software - [Mountain Nez change.rte]". The "PFPS Point Editor - Mission" window is open, showing the "FPM" tab selected. The "Inputs" button for the "Cruise" row is highlighted. The "FPM Mode Inputs" dialog box is open, showing the "Operating Limit" dropdown menu set to "Dual Engine Continuous".

Altitude	Temp	MH	Leg Time	Leg Dist	Leg Fuel
Wind	FF	MC	Clock Time	Total Dist	Total Fuel
4224M	+30C				
270/010					
200A	+31C				
270/010					
200A	+27C				
270/010					
200A	+30C				
270/010					

**FPM Mode Inputs**

Download Change	0.000
Operating Engines	2
Engine #1 Torque Factor	1.000
Engine #2 Torque Factor	1.000
Anti-Ice	off
De-Ice	off
Accessory Torque	0.000
Torque Required Factor	1.000
Torque Available Factor	1.000
Fuel Flow Factor	1.000
Operating Limit	Dual Engine
Transmission Limit	Limit Torque

Change Value

Operating Limit

Dual Engine Continuous

Dual Engine 30 Min

Single Engine Continuous

Single Engine 30 Min

Remember, the CFPS FPM default value is Dual Engine Continuous. Press the pull-down menu and select the Dual Engine 30 Min limit, then press the OK button. In the PFPS Point Editor display page, press the Apply button, then the OK button. The Dual Engine 30 Min value is now set.

Using the Point # pulldown buttons on the PFPS Point Editor page, select each of the designated turnpoints to be used for performance planning and verify that the desired FPM mode values have been set.

Step 10. Calculating the CFPS route. You are now ready to calculate the CFPS route.

a. Route Calculation. Select and press the Calculate icon on the CFPS toolbar. Turnpoints #4 and #6 now show two additional rows. The first row displays the R/W delay point with a 45-minute delay while the second point displays the amount of fuel that was added.

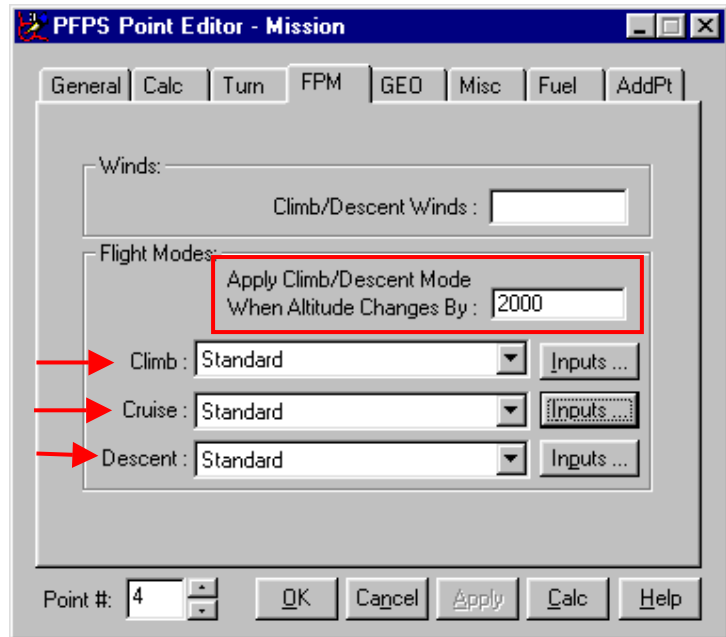
Turn Pt	Type	FixPoint	Latitude	Elev	Aspd	Altitude	Temp	MH	Leg Time	Leg Dist	Leg Fuel
DTD	Description	Longitude	MV	Bank	Wind	FF	MC	Clock Time	Total Dist	Total Fuel	
1	ST	KSLC 32/RV	N 40 46.43	4224FT		4224M	+30C	319	00+00+00	0.0	0
		SALT LAKE CITY	W111 57.79	13.4E		270.010	0	319	00:00:00	0.0	2517
2		N-S FINGER	N 41 12.87	4147FT 110T		200A	+31C	302	00+20+26	35.1	302
			W112 28.36	13.7E		270.010	887	305	00:20:26	35.1	2215
3		RD. INT. SW-NE	N 41 34.51	5377FT 110T		200A	+27C	269	00+55+33	92.8	790
			W114 28.32	14.5E		270.010	854	270	01:15:59	128.0	1425
4		KMUOIA	N 43 02.62	2996FT 110T		200A	+30C	306	01+06+59	120.1	1016
	%HR	MOUNTAIN HOME	W115 52.35	15.3E		270.010	886	311	02:24:58	248.1	407
		hover	N 43 02.62	2996FT 0T	5A	+30C	255	00+45+00	0.0	0.0	0
			W115 52.35	15.3E		0	255	03:09:58	248.1	407	
		.onload	N 43 02.62	2996FT 0T	5A	+30C	255	00+00+00	0.0	0.0	0
		2110 lbs	W115 52.35	15.3E		270.010	0	255	03:09:58	248.1	2517
5		RD-RIVER INT	N 44 15.82	2382FT 110T		200A	+32C	303	00+54+14	93.6	808
			W117 12.69	16.0E		270.010	884	307	04:04:12	341.7	1709
6		LWSIA	N 46 22.47	1438FT 110T		200A	+34C	340	01+26+46	152.4	1288
	%HR	LEWISTON NEZ P	W117 00.92	16.7E		290.015	891	348	05:30:58	494.0	421
		hover	N 46 22.47	1438FT 0T	5A	+27C	273	00+45+00	0.0	0.0	0
			W117 00.92	16.7E		0	273	06:15:58	494.0	421	
		.onload	N 46 22.47	1438FT 0T	5A	+27C	273	00+00+00	0.0	0.0	0
		2000 lbs	W117 00.92	16.7E		290.015	0	273	06:15:58	494.0	2421
7		RR-RD INT	N 46 49.05	3000FT 110T		200A	+26C	005	00+16+56	31.4	252
			W116 38.52	16.7E		290.015	891	013	06:32:54	525.5	2169
8		KSKA/A	N 47 36.90	2462F 110T		200A	+30C	299	00+38+57	62.7	574
		FAIRCHILD AFB	W117 39.35	17.3E		290.015	884	302	07:11:51	588.2	1595

**NOTE**  
The Calculator icon can be pressed either from the PFPS Point Editor R/W Delay tab dialog box or from the CFPS toolbar.

The total route distance is 588.2 NMs. Based on the current plan, the mission will take a total of 7 hrs. 11 minutes and 51 seconds. A total of 5332 lbs. of fuel will be required (2517 – 407 + 2517 – 421 + 2421 – 1595 + 333).

b. Information on CFPS FPM Mode values. By default, the first turnpoint in the route uses the FPM Cruise inputs. The inputs used for the CFPS FPM mode calculations are from the point you are flying toward. By default, cruise legs are generated from point to point along the route. If there is a “significant” altitude change (in this case, 2000 ft. or more), then a calculated climb or descent leg is inserted.

If the final altitude of the next turnpoint is greater than the initial altitude of the previous turnpoint, you will see a *level off* point and the two legs will consist of a *climb* calculation followed by a *cruise* calculation.



If the final altitude of the next turnpoint is less than the initial altitude of the preceding turnpoint, you will see a *cruise* calculation followed by a *descent* calculation.

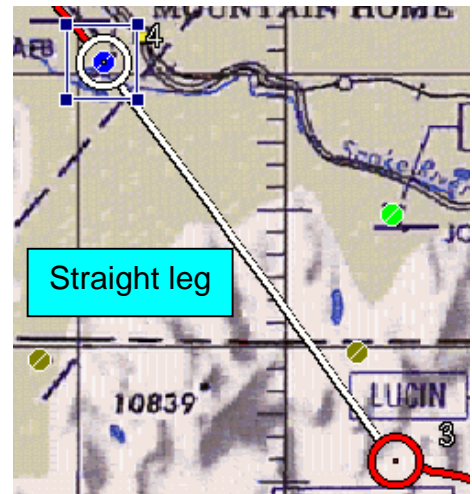
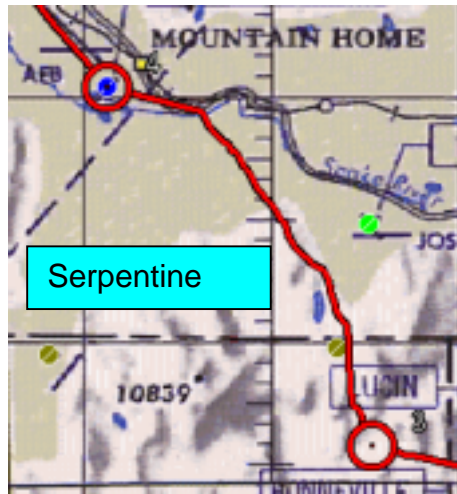
Using 2000 ft. as the “Apply Climb/Descent Mode Altitude Changes” difference threshold will tend to reduce the number of leveloff and descent points. Subsequently, reducing the altitude threshold difference (e.g., 500 ft) will tend to increase the number of level off and descent points.

Using the figure below as an example you will note the following:

The elevation between turnpoints 1-2 decreases by 77 ft. (4224 to 4147).  
 The elevation between turnpoints 2-3 increases by 1230 ft. (4147 to 5377).  
 The elevation between turnpoints 3-4 decreases by 2381 ft. (5377 to 2996).

Turn Pt	Type	Fix/Point Description	Latitude Longitude	Elev MV	Aspd Bank	Altitude Wind	Temp FF	MH MC	Leg Time Clock Time	Leg Dist Total Dist	Leg Fuel Total Fuel
1	ST	KSLC 32/RW SALT LAKE CITY	N 40 46.43 W111 57.79	4224FT 13.4E		4224M 270/010	+30C 0	319 319	00+00+00 00:00:00	0.0 0.0	0 2517
2		N-S FINGER	N 41 12.87 W112 28.36	4147FT 110T 13.7E		200A 270/010	+31C 887	302 306	00+20+26 00:20:26	35.1 35.1	302 2215
3		RD. INT. SW-NE	N 41 34.51 W114 28.32	5377FT 110T 14.5E		200A 270/010	+27C 854	269 270	00+55+33 01:15:59	92.8 128.0	790 1425
4		KMUO/A	N 43 02.62	2996FT 110T		200A	+30C	306	01+08+59	120.1	1018
*HR		MOUNTAIN HOME	W115 52.35	15.3E		270/010	886	311	02:24:58	248.1	407

The altitude change between turnpoints 3-4 is in excess of 2000 ft. Normally, this difference would result in a cruise calculation followed by a descent calculation. However, because the route to turnpoint #4 is based on a serpentine leg it does not initiate a climb, level off, or descent calculation.



Turn Pt	Type	Fix/Point	Latitude	Elev	Aspd	Altitude	Temp	MH	Leg Time	Leg Dist	Leg Fuel
	DTD	Description	Longitude	MV	Bank	Wind	FF	MC	Clock Time	Total Dist	Total Fuel
1	ST	KSLC 32/RW	N 40 46.43	4224FT		4224M	+30C	319	00+00+00	0.0	0
		SALT LAKE CITY	W111 57.79	13.4E		270/010	0	319	00:00:00	0.0	2517
2		N-S FINGER	N 41 12.87	4147FT 110T		200A	+31C	302	00+20+26	35.1	302
			W112 28.36	13.7E		270/010	887	306	00:20:26	35.1	2215
3			N 41 34.51	5377FT 110T		200A	+27C	269	00+55+33	92.8	790
		RD. INT. SW-NE	W114 28.32	14.5E		270/010	854	270	01:15:59	128.0	1425
		.descent pt	N 42 58.75	unk	110T	5577M	+27C	306	00+59+31	103.1	816
			W115 48.55	15.3E		270/010	823	311	02:15:30	231.1	609
4		KMLU/A	N 43 02.62	2996F	N/A	200A	+9C	309	00+04+46	4.8	50
		MOUNTAIN HOM	W115 52.35	15.3E				632	02:20:16	235.9	559

The figure above depicts a calculated route between turnpoints #1 and #4 where the serpentine leg between turnpoints #3 and #4 has been replaced with a straight leg. Note that a descent point now follows the cruise calculation. Whether PPC retrieves the additional inputs from the Climb, Cruise, or Descent Inputs in CFPS depends on the leg type as you approach the *next* route point.

**NOTE**

Typical mission profiles require the AH-64A to fly at low altitudes for entire missions and the altitude changes from turnpoint to turnpoint are usually minimal. Therefore, altitude changes may be considered as instantaneous for planning purposes.

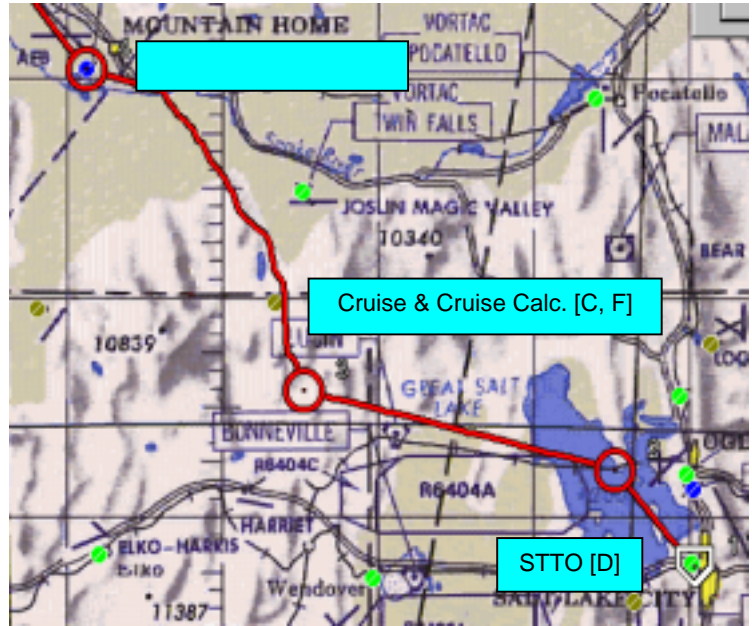
**Step 11. Designating Turnpoints for PPC Performance Calculations.**

The next step is to conduct a route assessment to identify the turnpoints to be used for performance calculations. Based on the assessment of the planned route you designate the following turnpoints (TP):

STTO: Departure (D)  
TP #3: Cruise & Cruise Calculator (C, F)  
TP #4: Hover Calculator (H)  
TP #8: Arrival (A)

The letters to the right of the designated TPs above (D, C, F, H, A) are used in the PPC route page to identify the type of calculations to be performed by the AH-64A T700-GE-701 FPM.

The figure to the right depicts three of the TPs to be used for performance planning.



Departure performance information (STTO) is required to determine if you have sufficient takeoff and OGE hover power for the flight (OGE hover power required at this location). When the PPC program is connected to CFPS this information will be inserted into the Departure section of the PPC card.

TP #3 was selected because of the higher elevation that must be traversed enroute to Mountain Home AFB (5377 ft.). You want to ensure you have sufficient power to maintain 110 knots true airspeed through the higher terrain.

The Cruise information will be inserted into the Cruise section of the PPC card. Cruise Calculator information is desired to obtain additional performance information.

Mountain Home AFB was selected for Hover Calculator performance information to show the additional information provided by this page and, since the aircraft will be refueled there, it provides good information on the power available after refueling.

TP #8 is the final destination. As such, the performance calculations will be inserted into the Arrival section of the PPC card.

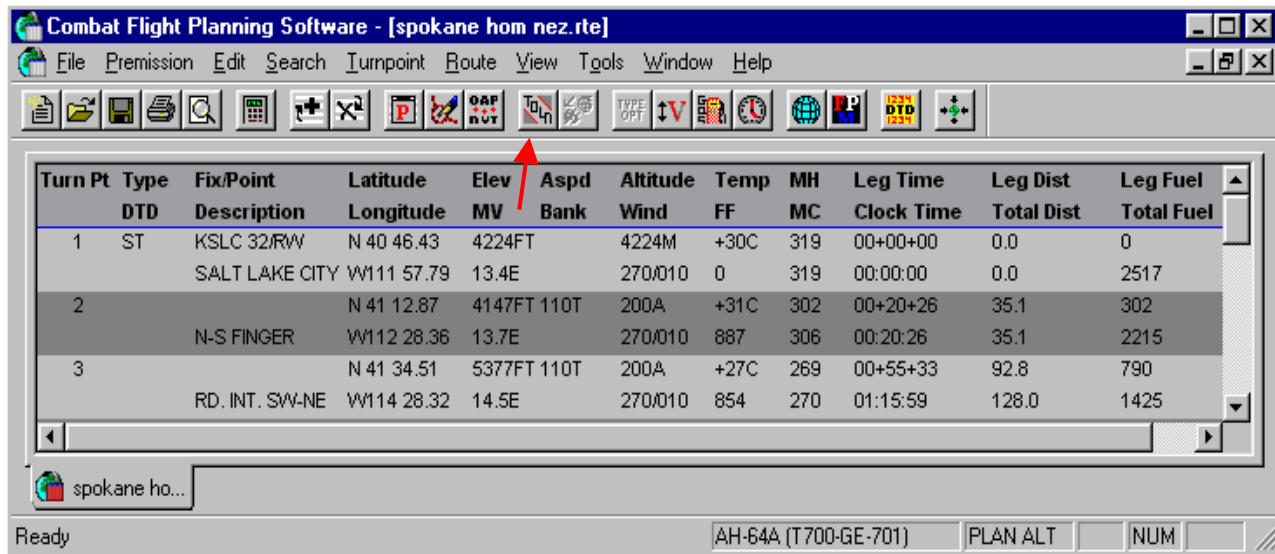
Remember, Hover OGE power is required upon arrival at the destination. Hover OGE information is available in the Arrival section.

**NOTE**

The ability to conduct 'what if' performance planning can be accomplished quickly and easily. A good map recon, coupled with careful performance planning, can aid the overall mission planning process. You can quickly determine what you can and can't do based on the performance calculations.

Step 12. Connecting to the PPC program.


The next step in the process is to connect the CFPS route to the PPC program. This task is accomplished by pressing the TOLD button on the CFPS toolbar. Pressing the TOLD icon launches the PPC Program.




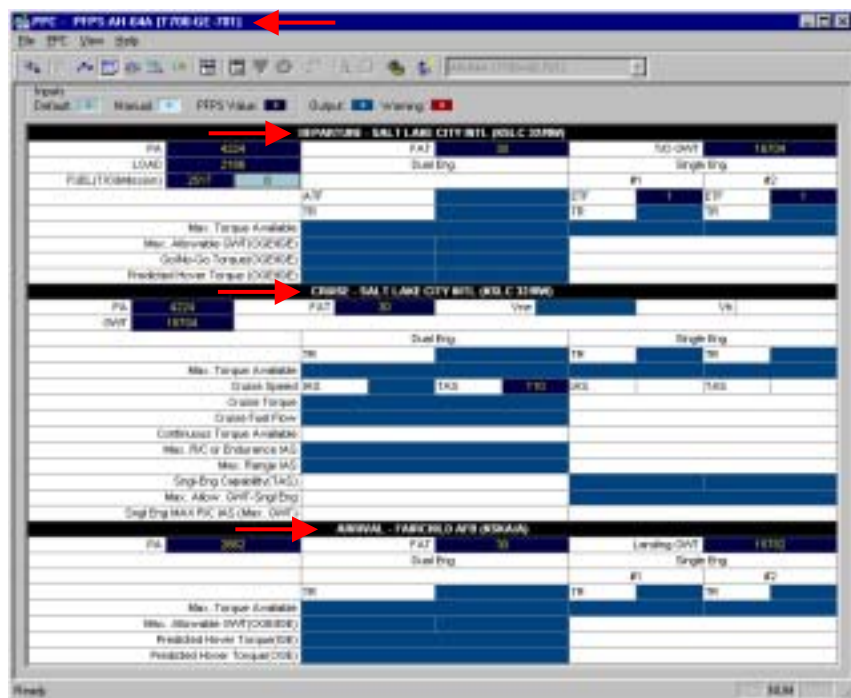
As depicted on the right, the active FPM is the AH-64A (T700-GE-701).

Tip: the PPC program automatically connects to CFPS when the PPC option “connect to active route on application startup” is active (as in this case).

Tip: there are two indications that the CFPS route has connected to the PPC program.

1. “Disconnect” icon on toolbar is active. 

2. Input fields are color-coded the same as the PFPS input color. 



**NOTE**

In the Options dialog box (under PPC – Main Menu) if the “Auto-designate departure, cruise, and arrival route points” option is active the program will automatically designate the STTO (#1) for Departure and Cruise calculations and the final turnpoint (#8) for Arrival calculations.

In this example, the Auto-designate option was turned on. Turnpoint #1 was designated for Departure and Cruise calculations and turnpoint #8 for Arrival calculations.

Upon connection to CFPS the PPC program retrieves data for calculations. Specifically, PA, FAT, GWT, and TAS data are extracted from CFPS. The PPC interface locks all available data from CFPS (cannot be altered) on connection.

**NOTE**

The transfer of data between CFPS and the PPC program is a one-way process only. The PPC program extracts data from CFPS. Data is never passed from the PPC program to CFPS.

**CAUTION**

The PA values that PFPS uses do not correct for daily anomalies in barometric pressure. PFPS provides the altitude of a particular routepoint, which is only equal to a “corrected PA” at standard atmospheric conditions.

To calculate using the corrected PA, disconnect the PPC program from CFPS once the calculated route values have been extracted. The PPC program was specifically designed to maintain the extracted values after disconnecting to aid performance planning. Simply change the PA to the correct value, press the Tab key, and then press the calculator icon.

**WARNING**

Attempts to manipulate the elevation and/or altitude values in CFPS to obtain a corrected PA value should be avoided. Changing elevation or altitude values may impact other mission planning attributes provided by PFPS. For example, the Route Analysis Tool uses time and altitude to conduct analyses for route deconfliction.

### Step 13. Designating Turnpoints in PPC.

The next step is to designate the turnpoints to be used for performance calculations (defined during the route assessment). If not displayed select and press the “View Route” button on the PPC toolbar. This action displays the Route page.



TP	FixPoint	Description	Calc	PPC
1	KSLC 32RW	SALT LAKE CITY INTL	yes	DC
2		N-S FINGER	yes	
3		RD INT SW NE	yes	
4	KMUGA	MOUNTAIN HOME AFB	yes	
	hover		yes	
	onload	2110 lbs	yes	
5		RD-RIVER INT	yes	
6	LNSGA	LEWISTON NEZ PERCE CO	yes	
	hover		yes	
	onload	2000 lbs	yes	
7		RR-RD INT	yes	
8	KSKGA	FARCHILD AFB	yes	A

TP, Fix/Point, Description, and Calculation status information is passed to the PPC program from CFPS. Designation status (PPC) information is strictly handled within the PPC program.

The Route Page below depicts the Route page with the Departure [D], Cruise [C], and Arrival [A] points automatically designated.

Five designating PPC values are available: 1) Departure [D], 2) Cruise [C], 3) Arrival [A], 4) Hover Calculator [H], and 5) Cruise Calculator [F]. To designate a turnpoint simply right-click (mouse) within the desired row and the designator box will be displayed. Checkmarks to the left of designator values imply that these values are currently set for that row. To delete the current designator value simply select the value and click, or select a different row and select the desired value. Note that the turnpoints have been calculated in CFPS.

TP	FixPoint	Description	Calc	PPC
1	KSLC 32RW	SALT LAKE CITY INTL	yes	DC
2		N-S FINGER	yes	
3		RD INT SW NE	yes	
4	KMUGA	MOUNTAIN HOME AFB	yes	
	hover		yes	
	onload	2110 lbs	yes	
5		RD-RIVER INT	yes	
6	LNSGA	LEWISTON NEZ PERCE CO	yes	
	hover		yes	
	onload	2000 lbs	yes	
7		RR-RD INT	yes	
8	KSKGA	FARCHILD AFB	yes	A

- Departure
- Cruise
- Arrival
- Hover Calculator
- Cruise Calculator

Only five designator values may be set at one time. For example, if you want to use the Cruise Calculator at two different turnpoints you must select the first turnpoint, conduct the calculation, then select the second turnpoint and do the same.

Calculate the CFPS route before conducting performance planning. This action will ensure the correct values (gross weight, etc.) are transferred to the designated turnpoints.

**WARNING**

Connecting a non-calculated CFPS route to the PPC does not transfer the gross weight data to the PPC. Although the PPC gross weights will be color-coded dark blue (signifying the value has been passed from CFPS), the displayed PPC gross weight values will be the values that were already there.

The Route page displayed below reflects the designated turnpoints identified for calculations during the map assessment. Note that the turnpoints have been calculated in CFPS.

TP	FixPoint	Description	Calc	PPC
1	KSLC 32RW	SALT LAKE CITY INTL	yes	D
2		N-S FINGER	yes	
3		RD. INT. SW-NE	yes	CF
4	KMUOIA	MOUNTAIN HOME AFB	yes	
	hover		yes	
	onload	2110 lbs	yes	H
5		RD-RIVER INT	yes	
6	LINSIA	LEWISTON NEZ PERCE CO	yes	
	hover		yes	
	onload	2000 lbs	yes	
7		RR-RD INT	yes	
8	KSKAJA	FAIRCHILD AFB	yes	A

Step 14. Calculating the PPC page.

You are now ready to initiate the calculations at the designated turnpoints. Press the PPC button on the toolbar to display the PPC page. Verify that the correct turnpoints have been inserted for the Departure, Cruise, and Arrival sections (Departure – Salt Lake City, Cruise – Rd.Int.Sw-NE, Arrival – Fairchild AFB). Press the Calculator button on the PPC toolbar (results presented on the following page). The Warnings button on the toolbar is now visible. You now conduct an analysis and determine the following:



The Departure, Cruise, and Arrival sections were not calculated with the correct PA. However, you conducted a calculation with the correct Departure values at the beginning of this exercise and based on a review of the results, you determined you have sufficient Hover OGE power for departure.

The Cruise PA value (5577) at TP #3 is based on the turnpoint elevation (5377) added to the aircraft altitude (200 ft. AGL) over that point. Based on the weather forecast and the barometric pressure in the local area the PA at turnpoint #3 is approximately 5150, a difference of 427 ft.

The screenshot displays the PPC software interface for flight performance calculations. It is divided into three main sections: DEPARTURE, CRUISE, and ARRIVAL.

**DEPARTURE - SALT LAKE CITY INTL (KSLC 3210W)**

PA	4224	FAT	30	T/O GWT	16704
LOAD	2186	Dual Eng.		Single Eng.	
FUEL(T/O Mission)	2617	0		#1	#2
ATF	1.00	ETF	1	ETF	1
TR	1.00	TR	1.00	TR	1.00
Max. Torque Available	76		101		101
Max. Allowable GWT(OGE)	14626*		14623*		
Go/No-Go Torque(OGE)	63		75		
Predicted Hover Torque(OGE)	192*		177*		

**CRUISE - RD. INT. SW-NE ( )**

PA	5577	FAT	27	V <sub>ne</sub>	160	V <sub>h</sub>	
GWT	15612						
		Dual Eng.		Single Eng.			
TR		1.00		TR	1.00	TR	1.00
Max. Torque Available		77		99		99	
Cruise Speed	IAS	91	TAS	110	IAS	TAS	
Cruise Torque		51					
Cruise Fuel Flow		630					
Continuous Torque Available							
Max. ROC or Endurance IAS		60					
Max. Range IAS		107					
Sngl-Eng Capability(TAS)				49		108	
Max. Allow. GWT-Sngl Eng						17130	
Sngl Eng MAX ROC IAS (Max. GWT)							

**ARRIVAL - FAIRCHILD AFB (KSKAA)**

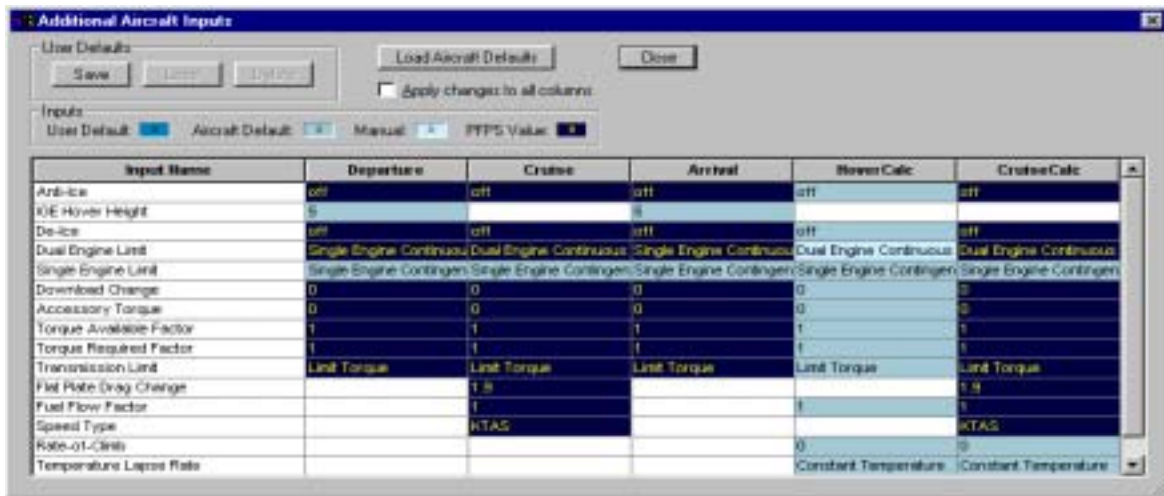
PA	2662	FAT	30	Landing GWT	15782
		Dual Eng.		Single Eng.	
				#1	#2
TR		1.00		TR	1.00
Max. Torque Available		81		107	107
Max. Allowable GWT(OGE)		14567*		17694	
Predicted Hover Torque(OGE)		69			
Predicted Hover Torque(OGE)		83*			

A review of the cruise calculations indicates that the aircraft has single engine capability at the higher PA based on the use of the 'Single Engine Contingency' limit for cruise flight. A new calculation at the lower PA is not required. However, a new calculation will be conducted for discussion purposes.

The Arrival section needs to be recomputed using the correct PA (2200 vs. 2662) before any changes are considered. A review of the current calculations indicates that the aircraft will not have sufficient power to hover OGE upon Arrival at the destination at the higher PA. The predicted hover torque for OGE is 83% while the Max. torque available is 81.

Because the Arrival section requires recalculating, a decision is made to recalculate all three sections with their correct PA values. The PPC program will be disconnected from CFPS, the correct PA values will be inserted, and new calculations will be initiated. However, before disconnecting, check the Additional Aircraft Inputs page to verify that the correct FPM Dual Engine Limits were used in the calculations.

A check of the Additional Aircraft Inputs page indicates that the values were not applied in CFPS. The Departure and Arrival leg FPM values were not changed. It is apparent that the Apply button was not pressed each time an FPM limit was changed. This error enforces the rule of rechecking the values before initiating calculations.



Disconnect the PPC program from CFPS by pressing the Disconnect icon on the toolbar.

Two ways to verify that the PPC program has been disconnected from CFPS are:

- 1) the color of the input fields change color (no longer dark blue), and
- 2) the three section title bars no longer display the descriptions of the turnpoints.

The route has been disconnected and the Additional Aircraft Input values have been changed to their correct settings. The Enter key, up/down/ arrows, left/right arrows, and clicking the mouse to another cell are all valid ways of finishing input in all calculation pages and the Additional Aircraft Inputs dialog box. One other method of finishing input is by clicking the calculate button on the toolbar. However, this method is not doable in the Additional Aircraft Inputs page.

Input Name	Departure	Cruise	Arrival	Hover Calc	Cruise Calc
Anti-Ice	off	off	off	off	off
IGE Hover Height	5		5		
De-Ice	off	off	off	off	off
Dual Engine Limit	Dual Engine 30 Min	Dual Engine Continuous	Dual Engine 30 Min	Dual Engine Continuous	Dual Engine Continuous
Single Engine Limit	Single Engine Contingen	Single Engine Contingen	Single Engine Continen	Single Engine Contingen	Single Engine Contingen

## WARNING

A failure to verify the correct FPM values in the Additional Aircraft Inputs dialog box prior to conducting performance calculations can have a dramatic impact on mission related decisions.

The PPC Page calculations are displayed below.

The screenshot shows the PPC software interface for an AH-64A helicopter. It displays performance metrics for three phases: DEPARTURE, CRUISE, and ARRIVAL. The DEPARTURE phase shows a PA of 4000, LOAD of 2186, and FUEL of 2517. The CRUISE phase shows a PA of 5150, GWT of 15612, and a cruise speed of 110 TAS. The ARRIVAL phase shows a PA of 2200 and a landing GWT of 15782. The interface includes input/output selection buttons and a warning icon.

DEPARTURE							
PA	4000	FAT	30	T/O GWT	16704		
LOAD	2186	Dual Eng.		Single Eng.			
FUEL(T/O&Mission)	2517	0		#1	#2		
ATF		1.00	ETF	1	ETF	1	
TR		1.00	TR	1.00	TR	1.00	
Max. Torque Available		92		102	102		
Max. Allowable GWT(OGEAGE)		16769		19069			
Go/No-Go Torque(OGEAGE)		77		92			
Predicted Hover Torque(OGEAGE)		92		76			
CRUISE							
PA	5150	FAT	27	Vme	163		
GWT	15612			Vh			
		Dual Eng.		Single Eng.			
		TR	1.00	TR	1.00	TR	1.00
Max. Torque Available		78		101	101		
Cruise Speed	IAS	92	TAS	110	IAS	TAS	
Cruise Torque		51					
Cruise Fuel Flow		842					
Continuous Torque Available							
Max. R/C or Endurance IAS		61					
Max. Range IAS		108					
Sngl-Eng Capability(TAS)				46	110		
Max. Allow. GWT-Sngl Eng				17429			
Sngl Eng MAX R/C IAS (Max. GWT)							
ARRIVAL							
PA	2200	FAT	30	Landing GWT	15782		
		Dual Eng.		Single Eng.			
		TR	1.00	TR	1.00	TR	1.00
Max. Torque Available		99		109	109		
Max. Allowable GWT(OGEAGE)		17970		20436			
Predicted Hover Torque(OGE)		68					
Predicted Hover Torque(OGE)		82					

### NOTE

If the same values are displayed for power available and power required, yet a warning message is provided, it indicates that the power required is slightly greater than the power available.

A review of the Departure values confirms the initial performance analysis. Sufficient power is available for Hover OGE.

Based on the lower PA, the Cruise performance capabilities have improved. Specifically, the TAS for single engine #1 has improved from 46 to 49 while the TAS for single engine #2 has improved from 108 to 110.

The Max Allowable GWT – single engine has improved from 17130 to 17429, an increase of 299 lbs. The increase of 299 lbs. might be sufficient to justify jettisoning the expendables if an engine failure occurs.

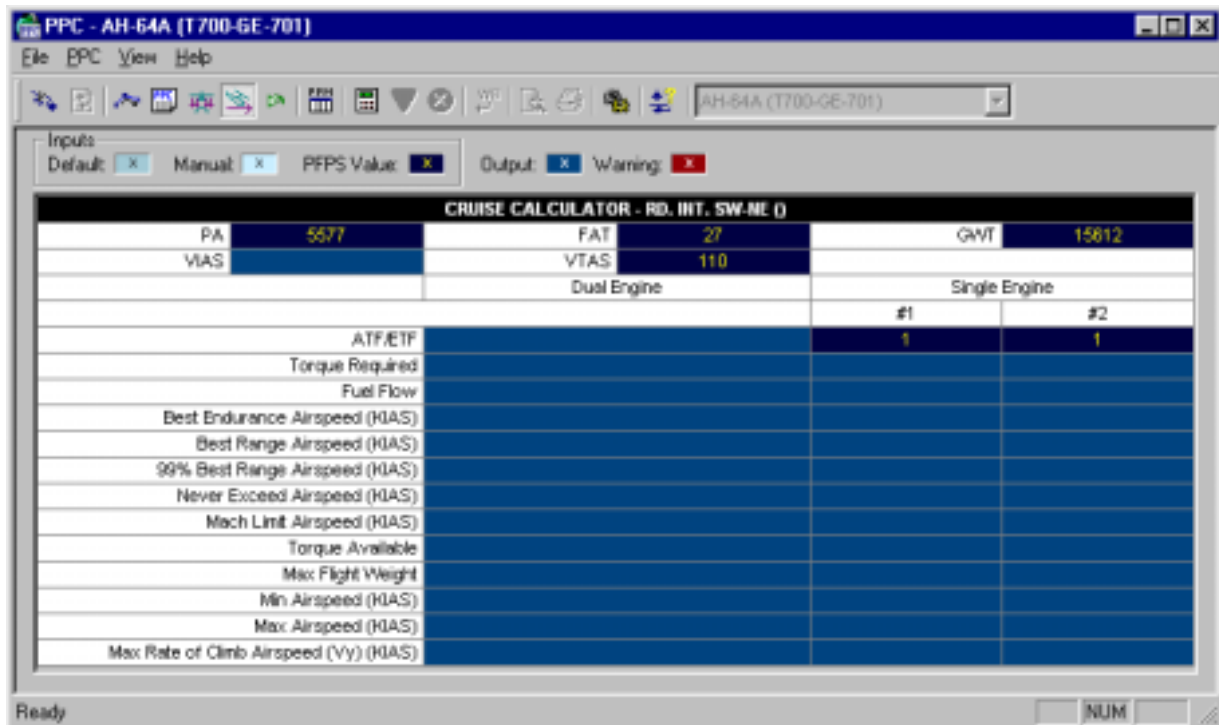
A review of the Arrival calculations indicates that sufficient power (to include Hover OGE) will be available upon landing at TP #8.

The next calculations to be conducted will be in the Cruise Calculator page. This page provides additional information about cruise performance that is not available in the Cruise section of the PPC page.

Press the Connect button on the toolbar to reconnect the PPC program to CFPS. Verify that the PPC application is reconnected to CFPS. Press the Route view button on the toolbar.



In Route view, left-click in row three (TP#3), when highlighted, right-click and select the Cruise Calculator option. Press the “View Cruise Calculator” button on the toolbar to view the Cruise Calculator page. Verify that TP #3 information (RD.INT.SW-NE) is located in the title bar. You now have the information you need to conduct the calculation.



At this point, disconnect the PPC program from CFPS. Replace the value in the PA field with the value 5150, press the Tab key, then press the calculator button on the toolbar.

A review of the calculations indicates that sufficient power is available for dual engine flight, but the VTAS and the Torque Required for single engine capability are somewhat limited.

CRUISE CALCULATOR					
PA	5150	FAT	27	GWT	15612
VIAS	92	VTAS	*110*		
		Dual Engine		Single Engine	
				#1	#2
ATF/ETF	1.00			1	1
Torque Required	51			*101*	*101*
Fuel Flow	842			721	721
Best Endurance Airspeed (KIAS)	61			61	61
Best Range Airspeed (KIAS)	100			91	91
99% Best Range Airspeed (KIAS)	108			92	92
Never Exceed Airspeed (KIAS)	163			163	163
Mach Limit Airspeed (KIAS)	167			167	167
Torque Available	92			101	101
Max Flight Weight	20970			15584	15584
Min Airspeed (KIAS)	0			33	33
Max Airspeed (KIAS)	128			92	92
Max Rate of Climb Airspeed (Vy) (KIAS)	63			62	62

The warning messages for the Cruise Calculator page are displayed on the right. The messages displayed for Single #1 (1-2) and #2 (3-4) are the same.

Warning message #1 & #3 both indicate that the torque required (101) is slightly less than the maximum torque available (101).

Although the values appear to be the same (101), the torque required is actually higher, but appears to be the same value due to rounding.

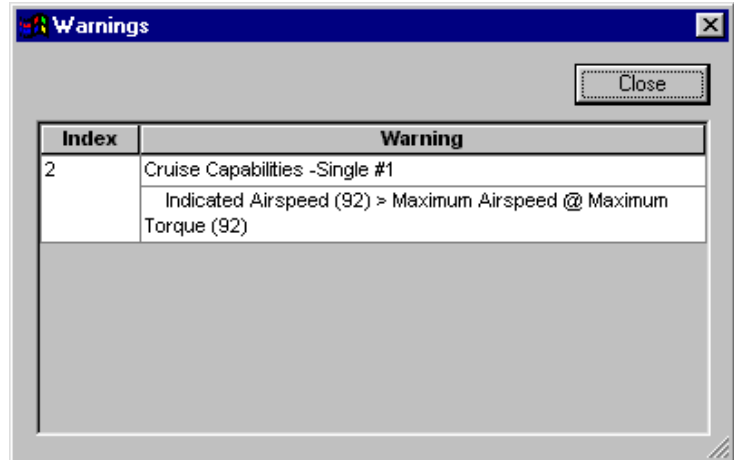
**NOTE**

Messages that display the same information for both single engines indicate that they have equal ETF values. Engines having different ETF values will not necessarily display the same messages (different power capabilities).

Index	Warning
1	Cruise Capabilities -Single #1 Insufficient Torque Available for Cruise at maximum torque Torque Required (101) > Maximum Torque Available (101) Input Gross Weight (15612) > Weight at maximum torque (15584)
2	Cruise Capabilities -Single #1 Indicated Airspeed (92) > Maximum Airspeed @ Maximum Torque (92)
3	Cruise Capabilities -Single #2 Insufficient Torque Available for Cruise at maximum torque Torque Required (101) > Maximum Torque Available (101) Input Gross Weight (15612) > Weight at maximum torque (15584)
4	Cruise Capabilities -Single #2 Indicated Airspeed (92) > Maximum Airspeed @ Maximum Torque (92)

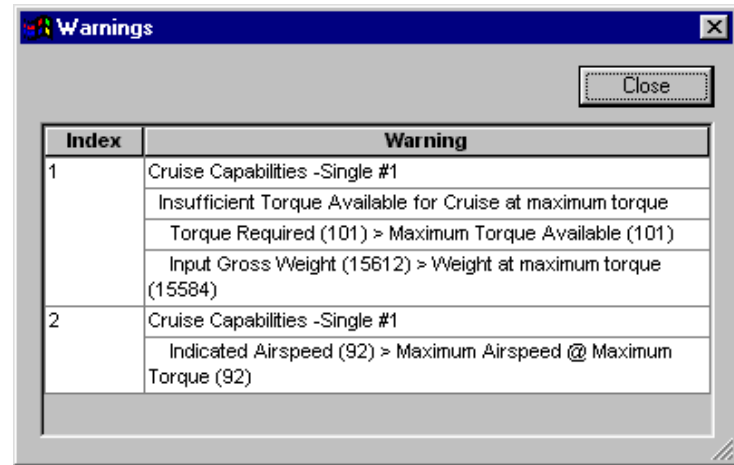
The warning associated with the VTAS field is displayed to the right.

The message states that the indicated airspeed (92) is slightly greater than the maximum airspeed allowed at maximum torque.

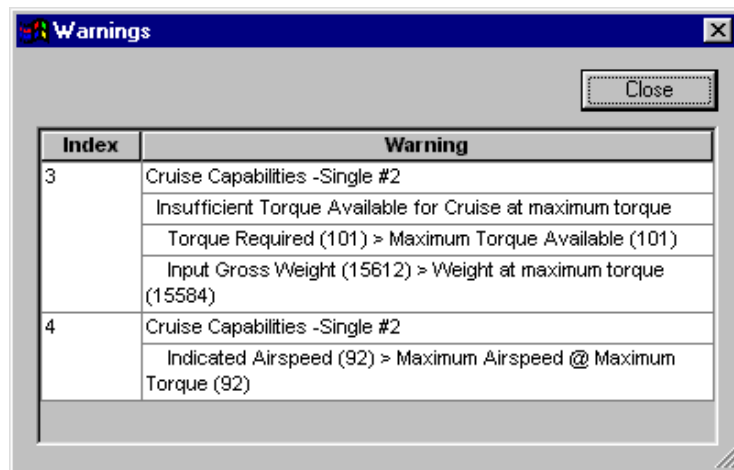


The warning messages associated with the single engine #1 field are displayed to the right.

It appears that the torque available is slightly less than the max torque available. It also provides the same message on indicated airspeed as discussed above.



The warning messages for the single engine #2 field are the same as those for single engine #1.



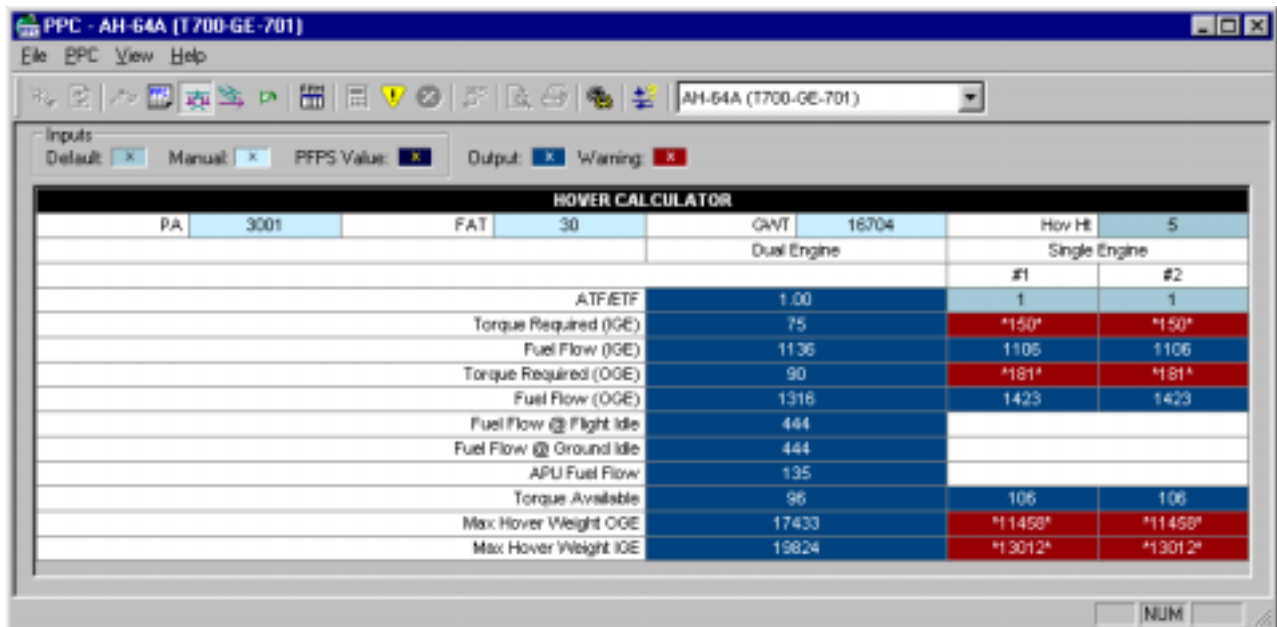
The final calculations to be conducted will be in the Hover Calculator page. This page provides additional information about hover performance that is not available in any other performance section.

Press the Connect button on the toolbar to reconnect the PPC program to CFPS. Press the Route view button on the toolbar. In Route view, left-click in the 'onload' row of TP#4. When highlighted, right-click and select the Hover Calculator option. Verify that an 'H' is now displayed in that row.

Press the "View Hover Calculator" button on the toolbar to view the Hover Calculator page. Verify that TP #4 information [2110 lbs (Onload)] is located in the title bar. You now have the information you need to conduct the calculation.



Disconnect the PPC program from CFPS. The title bar should display the words "Hover Calculator" instead of TP#4 information. Switch to the Additional Aircraft Inputs page via the toolbar button. Verify that the Dual Engine Limit row has the value "Dual Engine 30 Min." If not, change it to this value and press the Tab key. Close the page, return to the Hover Calculator page. The PA value of 3001 will remain for this calculation.



Dual Engine - the results indicate that dual engine hover OGE power is available after refueling at Mountain Home AFB. The percent torque required to hover OGE (90) is less than the maximum percent torque available (95). The input gross weight (16704) is less than the maximum gross weight OGE (17433).

Single Engine warnings:

Sufficient hover power is not available for either an IGE or OGE hover.

The percent torque required for an IGE hover (150) is greater than the maximum percent torque available (106).

The percent torque required for an OGE hover (181) is greater than the maximum percent torque available (106).

The input gross weight (16704) is greater than the maximum gross weight for both an IGE hover (13012) and an OGE hover (11458).

Note that messages 1-4 for single engine #1 are the same as those displayed for single engine #2, indicating that they have equal ETF values.

Index	Warning
1	Hover Capabilities - Single #1
	Insufficient Torque Available for IGE Hover at maximum torque Torque Required IGE (150) > Maximum Torque Available (106)
2	Hover Capabilities - Single #1
	Insufficient Torque Available for OGE Hover at maximum torque Torque Required OGE (181) > Maximum Torque Available (106)
3	Hover Capabilities - Single #1
	Insufficient Torque Available for Hover OGE Input Gross Weight (16704) > Maximum Gross Weight OGE (11458)
4	Hover Capabilities - Single #1
	Insufficient Torque Available for Hover IGE Input Gross Weight (16704) > Maximum Gross Weight IGE (13012)
5	Hover Capabilities - Single #2
	Insufficient Torque Available for IGE Hover at maximum torque Torque Required IGE (150) > Maximum Torque Available (106)
6	Hover Capabilities - Single #2
	Insufficient Torque Available for OGE Hover at maximum torque Torque Required OGE (181) > Maximum Torque Available (106)
7	Hover Capabilities - Single #2
	Insufficient Torque Available for Hover OGE Input Gross Weight (16704) > Maximum Gross Weight OGE (11458)
8	Hover Capabilities - Single #2
	Insufficient Torque Available for Hover IGE Input Gross Weight (16704) > Maximum Gross Weight IGE (13012)

Step 15 Evaluate the Data.

Departure (TP#1): sufficient power is available for and OGE hover and dual engine flight. However, there is not enough data to determine if sufficient power is available for single engine flight.

Cruise (TP#3): sufficient power is available for dual engine flight. Sufficient power is not available for single engine flight at a VTAS of 110 knots.

Mountain Home AFB (TP#4): sufficient dual engine power is available for both IGE and OGE hovering. However, sufficient power is not available for single engine flight.

Fairchild AFB (TP#8): sufficient dual engine power is available for an OGE hover upon arrival.

Step 16. Evaluate “what if” options.

The Commander has conducted a risk assessment on the lack of single engine capability and has decided that the risk is acceptable for the mission. Since conducting performance planning is quick and easy, you, as the planner, decide to conduct some “what if” planning to gain a better understanding of the power requirements for the flight.

Departure: you decide to use the Hover Calculator page to get additional information. You input the same values used in the departure section of the PPC page, verify the Additional Aircraft Input values, then initiate the calculation (results below).

HOVER CALCULATOR							
PA	4000	FAT	30	GWT	16704	Hover Ht	5
			Dual Engine		Single Engine		
					#1	#2	
ATF/TF			1.00		1	1	
Torque Required (IGE)			76		*153*	*153*	
Fuel Flow (IGE)			1141		1141	1141	
Torque Required (OGE)			92		*184*	*184*	
Fuel Flow (OGE)			1309		1488	1488	
Fuel Flow @ Flight Idle			434				
Fuel Flow @ Ground Idle			434				
APU Fuel Flow			135				
Torque Available			92		102	102	
Max Hover Weight OGE			16768		*11041*	*11041*	
Max Hover Weight IGE			19068		*12538*	*12538*	

The Warning button is active, indicating that some fields have attached warning messages. A review of the calculated values and the warning text messages indicates that single engine power is not available for either IGE or OGE hover flight.



A further review of the Warning text messages indicates that the input gross weight (16704) for OGE hover is much greater than the maximum gross OGE gross weight (11041).

Removing the entire Stores Weight (2186) would not provide sufficient single engine power for an OGE or IGE hover.



You then take the same conditions and input them into the Cruise calculator page and obtain the following results (see Cruise Calculator page below).

Warnings	
Index	Warning
1	Hover Capabilities - Single #1
	Insufficient Torque Available for IGE Hover at maximum torque Torque Required IGE (153) > Maximum Torque Available (102)
2	Hover Capabilities - Single #1
	Insufficient Torque Available for OGE Hover at maximum torque Torque Required OGE (184) > Maximum Torque Available (102)
3	Hover Capabilities - Single #1
	Insufficient Torque Available for Hover OGE Input Gross Weight (16704) > Maximum Gross Weight OGE (11041)
4	Hover Capabilities - Single #1
	Insufficient Torque Available for Hover IGE Input Gross Weight (16704) > Maximum Gross Weight IGE (12538)
5	Hover Capabilities - Single #2
	Insufficient Torque Available for IGE Hover at maximum torque Torque Required IGE (153) > Maximum Torque Available (102)
6	Hover Capabilities - Single #2
	Insufficient Torque Available for OGE Hover at maximum torque Torque Required OGE (184) > Maximum Torque Available (102)
7	Hover Capabilities - Single #2
	Insufficient Torque Available for Hover OGE Input Gross Weight (16704) > Maximum Gross Weight OGE (11041)
8	Hover Capabilities - Single #2
	Insufficient Torque Available for Hover IGE Input Gross Weight (16704) > Maximum Gross Weight IGE (12538)

CRUISE CALCULATOR					
PA	4000	FAT	30	GWT	16704
VIAS	94	VTAS	*110*		
		Dual Engine		Single Engine	
				#1	#2
ATF/ETF		1.00		1	1
Torque Required		53		*107*	*107*
Fuel Flow		886		764	764
Best Endurance Airspeed (KIAS)		63		63	63
Best Range Airspeed (KIAS)		103		91	91
88% Best Range Airspeed (KIAS)		110		91	91
Never Exceed Airspeed (KIAS)		162		162	162
Mach Limit Airspeed (KIAS)		170		170	170
Torque Available		78		104	104
Max Flight Weight		20669		16286	16286
Min Airspeed (KIAS)		15		38	38
Max Airspeed (KIAS)		120		91	91
Max Rate of Climb Airspeed (Vy) (KIAS)		64		64	64

A review of the warning text messages for single engine cruise capabilities indicates that the aircraft can not sustain level flight at single engine capability.

The percent torque required (107) is greater than the maximum percent torque available (104).

The input gross weight of 16704 is slightly greater than the weight at maximum torque (16288).

The weight difference between 16704 and 16288 is only 416 lbs. This is good information in case an engine quits.

Index	Warning
1	Cruise Capabilities -Single #1
	Insufficient Torque Available for Cruise at maximum torque
	Torque Required (107) > Maximum Torque Available (104)
2	Cruise Capabilities -Single #1
	Indicated Airspeed (94) > Maximum Airspeed @ Maximum Torque (90)
3	Cruise Capabilities -Single #2
	Insufficient Torque Available for Cruise at maximum torque
	Torque Required (107) > Maximum Torque Available (104)
4	Cruise Capabilities -Single #2
	Indicated Airspeed (94) > Maximum Airspeed @ Maximum Torque (90)

In essence, we now know that it would be possible to jettison just a few of the expendables in order to sustain single engine flight. Lets conduct another Cruise Calculation with some different values. Change the cruise TAS from 110 to 90 and change the cruise weight to 16288.

CRUISE CALCULATOR			
PA	4000	FAT	30
VIAS	75	VTAS	90
		GWT	16288
		Dual Engine	
		#1	#2
ATF/ETP	1.00	1	1
Torque Required	46	92	92
Fuel Flow	807	665	665
Best Endurance Airspeed (KIAS)	62	62	62
Best Range Airspeed (KIAS)	102	92	92
90% Best Range Airspeed (KIAS)	110	92	92
Never Exceed Airspeed (KIAS)	165	165	165
Mach Limit Airspeed (KIAS)	170	170	170
Torque Available	78	103	103
Max Flight Weight	21000	17722	17722
Min Airspeed (KIAS)	13	35	35
Max Airspeed (KIAS)	121	92	92
Max Rate of Climb Airspeed (Vy) (KIAS)	63	63	63

We now know that, when we burn 416 lbs of fuel we will be able to sustain single engine flight if we fly at a TAS of 90 knots.

Cruise: a final review of the Cruise Calculator data for TP #3 indicates that dual engine flight capability is available but not single engine flight.

A review of the warning messages indicates that the gross weight only has to be reduced by 28 lbs. (15612 – 15584).

In addition, the torque required is only slightly higher than the torque that is available (101 vs 101).

An indicated airspeed of 92 knots cannot be sustained at the max torque available (92%).

Lets conduct another calculation using a gross weight of 15584 and a TAS of 100 knots.

The results (displayed below) indicate that single engine capability will available shortly after a little fuel is burned off at 83 knots IAS.

Index	Warning
1	Cruise Capabilities -Single #1
	Insufficient Torque Available for Cruise at maximum torque
	Torque Required (101) > Maximum Torque Available (101)
2	Cruise Capabilities -Single #1
	Indicated Airspeed (92) > Maximum Airspeed @ Maximum Torque (92)
	Input Gross Weight (15612) > Weight at maximum torque (15584)
3	Cruise Capabilities -Single #2
	Insufficient Torque Available for Cruise at maximum torque
	Torque Required (101) > Maximum Torque Available (101)
4	Cruise Capabilities -Single #2
	Indicated Airspeed (92) > Maximum Airspeed @ Maximum Torque (92)
	Input Gross Weight (15612) > Weight at maximum torque (15584)

CRUISE CALCULATOR			
PA	5150	FAT	27
VIAS	83	VTAS	100
		GWT	15584
		Dual Engine	Single Engine
			#1 #2
ATP/ETP	1.00	1	1
Torque Required	46	93	93
Fuel Flow	797	667	667
Best Endurance Airspeed (KIAS)	61	61	61
Best Range Airspeed (KIAS)	100	91	91
90% Best Range Airspeed (KIAS)	108	92	92
Never Exceed Airspeed (KIAS)	163	163	163
Mach Limit Airspeed (KIAS)	167	167	167
Torque Available	77	101	101
Max Flight Weight	20803	16632	16632
Min Airspeed (KIAS)	10	33	33
Max Airspeed (KIAS)	121	92	92
Max Rate of Climb Airspeed (Vy) (KIAS)	62	62	62

A review of the fuel remaining upon landing at Lewiston Nez Pierce County airport shows 421 pounds. Using 333 lbs. as a minimum fuel reserve upon landing only leaves 88 lbs. of fuel that could be subtracted from the amount taken at Mountain Home AFB. Not enough to bother removing.

The PA at Lewiston Nez Pierce is the lowest PA along the route. In addition, the FAT is among the lowest. You wonder if single engine cruise flight will be available upon departing from Lewiston Nez Pierce. With a forecasted PA of 1100 you conduct the calculations using the Cruise Calculator and obtain the following results (see below).

CRUISE CALCULATOR			
PA	1100	FAT	34
VIAS	99	VTAS	110
		GWT	16608
		Dual Engine	Single Engine
			#1 #2
ATF/ETP	1.00		1 1
Torque Required	53		106 106
Fuel Flow	91.3		761 761
Best Endurance Airspeed (KIAS)	66		66 66
Best Range Airspeed (KIAS)	108		99 99
99% Best Range Airspeed (KIAS)	116		105 105
Never Exceed Airspeed (KIAS)	171		171 171
Mach Limit Airspeed (KIAS)	176		176 176
Torque Available	54		114 114
Max Flight Weight	21000		17805 17805
Min Airspeed (KIAS)	8		28 28
Max Airspeed (KIAS)	131		105 105
Max Rate of Climb Airspeed (Vy) (KIAS)	67		67 67

Both dual engine and single engine capability will be available upon departure from Lewiston. The gross weight of 16608 was derived in the following manner: (2517 – 2421 = 96, 16704 – 96 = 16608).

One final note you should be aware of when calculating the same displayed values using the PPC standalone method (not connected at all to CFPS) vs. the connected method.

**NOTE**

Data passed from CFPS to the PPC program is displayed as integer data. However, the actual values passed are at a precision in excess of 10 numbers beyond the decimal point. Therefore, a slight difference in calculated values may be displayed between a calculation made with data extracted from CFPS and a calculation with the same integer (displayed) values in PPC.

***Two final important cautions are highlighted***

**CAUTION**

Most FPMs only allow PA input down to a zero value. Barometric pressures greater than 29.92, combined with low altitudes/elevations (e.g., Death Valley is –242) can result in a negative PA.

**CAUTION**

CFPS inputs the altitude/elevation at designated turnpoints for PA calculations. Varying elevations between turnpoints are not considered. A careful map analysis should be conducted to identify the high elevation points along the route. The high points should be designated as turnpoints for performance calculations. *The intent is to make sure that pilots do not disregard higher elevations (e.g., mountains) between turnpoints.*

Step 17: Printing the CFPS and PPC data.

CFPS data can be printed in the form of time/distance/heading (TDH) cards. You, as the planner, have some options as to what is printed on the cards. The “Print Calculated Points” box allows you to choose what information will be printed.

To print the TDH cards, Press the File – Form Setup/Preview option to select the form to be used for printing. Highlight the form (default form for the AH-64A is the divert70 form) to be used, then press the preview button. This will enable you to view the form as it will be printed. Once you are satisfied with the preview, press the print button.

PFPS provides the capability for you to develop your own forms. The Print Server User’s Guide (provided in PFPS/Data/Release Notes/User’s Manual/printsrvr.pfd and the cardeditor.pdf provide information on the options available to you.

To print the PPC card you must have the PPC page calculated. Once calculated the Print Preview and Print buttons on the toolbar become active. To preview what will be printed, press the print preview button. Press the Print button when you are ready to print the PPC page.

The Hover and Cruise Calculator pages cannot currently be printed. However, displaying the Hover or Cruise calculator page and pressing the ALT – Print screen buttons at the same time will save the displayed page to the Clipboard.

Open PowerPoint, Word, or Paint, to a blank page and either right-click (mouse) and select the Paste option or select the Paste option from the Edit option of the main menu. This will copy the information in the Clipboard to the PowerPoint slide or other application. Once the desired pages have been pasted, select the Print option under the File menu.

This completes the information on the training exercise.

A summary is provided on the following page.

## **Summary**

The purpose of this training exercise was to provide an understanding of the capabilities of the PPC program when integrated with CFPS. Automated performance and mission planning reduces the time required to conduct premission planning. The ability to quickly analyze “what if” situations provides the aircrew with valuable information in rapid time.

The user can connect to PFPS, designate points, disconnect from PFPS, then use the values as a starting point for any calculations desired in the Departure, Cruise, Arrival, Hover Calculator, and Cruise Calculator.

The PPC and PFPS software programs provide a comprehensive premission planning capability. Your knowledge of your aircraft's tactical employment, operating characteristics, performance capabilities/limitations, and the requirements of the airspace you operate in, is essential in utilizing these programs to their fullest capabilities.

Questions on the use of CFPS, FalconView, and any other PFPS component should be emailed to the PFPS Mission Planning Software Support Facility at <http://www.mpssf.hill.af.mil>. If you would like to call, dial the toll-free number is 1-800 773-7739. Some major installations or organizations may also have a PFPS/AMPS support representative.

Questions on the use of the PPC/FPM software application should be emailed to: [aeromechanics@rdec.redstone.army.mil](mailto:aeromechanics@rdec.redstone.army.mil).