APP 6.0 Quick Start

AIRCRAFT PERFORMANCE PROGRAM



Version 1.0 January 2013



1 Introduction

1.1 Overview

1.1.1 The ALR Aerospace Flight Performance Program

The software utility Aircraft Performance Program (APP) was designed to provide engineers, aircraft operators and researchers with a tool that allows computing of customized flight performance.

Physics based flight equations are solved with high accuracy and numerical stability, using the proven APP computation algorithms. Years of experience and customer feedback make APP a reliable, efficient and versatile tool.

APP relies on tabulated input of the physical characteristics of an aircraft, such as mass, lift, drag and thrust. While APP can be used to analyse and optimize a given aircraft design, it does not estimate aerodynamics or propulsion data. Therefore, the user is always in full control over the results. Together with the extensive *Technical Reference* document, APP is a trusted tool and not a black box.

Since its founding in 1980, ALR Aerospace has a rich history of aerospace related activities, ranging from concept design of advanced fighter aircraft and light training aircraft, air traffic management, fluid- and aerodynamic engineering, up to supporting cutting edge solar powered aircraft projects. The *Aircraft Performance Program APP* has served ALR and its global partners and customers as a reliable, trusted and validated tool for all aircraft performance related questions. In its 6th major version, APP has been built from the ground up, but keeping the proven and reliable computation engine.



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Fig 1: The APP Desktop showing the Welcome Screen

1.1.2 An Integrated Package

The Aircraft Performance Program was designed to improve productivity during all phases in a design process. APP 6 is an integrated high performance program that allows computation and manipulation of aircraft point performance and aircraft mission performance data, originating from basic configuration, aerodynamic and engine properties. APP 6 contains all the tools needed to compute, organize, present, visualize and print the performance and mission data efficiently.

1.1.3 User Friendly GUI

APP 6 offers an intuitive Windows graphical user interface (GUI). The tabbed interface allows working with different computations opened at the same time, manipulating aircraft data and displaying the influence on flight performance almost instantaneously. Colored icons guide the eye and smooth the workflow.

Users new to APP will appreciate the *Welcome Screen* to quickly get started using the examples provided with APP. Experienced users can efficiently work with multiple aircraft and calculations without losing focus and overview.

High quality charting, printing and report generation capabilities are built into the software. Data can easily be exported to spreadsheet software.



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Aerodynamics	Data	Data CD0 DCL CDI CL CLmai	Chart			
Acrodynamics	+ Add			-		
Propulsion	× Del	Add Table Del Table	Ins Line	Del Line		
Stores		Altitude 0 [m]	M	ach [-]	CD0 [-]	
Configuration	Rename		1	03	0.021	
	Duplicate		3	0.5	0.0195	
			4	0.8	0.019	
	Import Export		5	0.85	0.019	
			6	0.9	0.021	
			8	1.05	0.039	
			9	1.1	0.041	
			10	1.3	0.04	=
			11	1.4	0.039	
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Ready						CAP NUM SCRL

Fig 2: Window GUI

1.1.4 Versatility

Due to its modular design, the Aircraft Performance Program can be used for nearly all flying vehicles. Whether you need to evaluate the turn rate of a high-tech fighter aircraft or the maximum glide ratio of a silent glider - due to its numerical capabilities, the program determines performance data within seconds. Even for rare cases like acceleration at a specified climb rate or other customized performance tasks are solved at a glance. At any time during input or output, a toggle between British and SI units is possible.

More than 50 output parameters are available to generate charts and spreadsheets. Without re-computation, the output format can be altered. Charts and spreadsheets can be copied into any Windows document or saved into a file. For maximum compatibility the spreadsheet module supports Microsoft Excel file format.

A *Mission Computation* supports mission definition and calculation. More than 20 mission segments can be combined in any order. Several optimizer modes evaluate maximum range, maximum endurance or maximum radius of action. Mission progress for user-defined time steps and output parameters is printed onto a spreadsheet or visualized on a chart.

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Fig 3: Graphical result of a mission computation



Fig 4: Graphical Result of a Point Performance computation



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1.1.5 How to Contact ALR

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Website: <u>www.alr-aerospace.ch</u> Email: <u>alr@alr-aerospace.ch</u>

1.1.6 Getting Help

Choose Help|Online Manual from the APP menu to open this manual in an Acrobat Reader shell.

Choose Help|Technical Reference from the APP menu to open the technical reference document in an Acrobat Reader shell.

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1.2 Installation

1.2.1 Hardware and Software Requirements

To use APP 6, your computer must have:

- Windows XP SP2 or higher operating system
- A Intel or compatible CPU
- A hard disk with about 20 MB of available disk space
- At least 64 MB of extended memory to run APP 6 smoothly
- A Windows-compatible mouse
- A minimum screen resolution of 1024x768 pixel, however a higher resolution is strongly suggested.

1.2.2 Installing APP on the Hard Disk

1. To start the installation, insert the program CD-ROM into your drive. An installation mask should automatically appear (if not, start it by double clicking the autorun.exe located on the CD-ROM).



Fig 5: Installation Screen

- 2. Install the device drivers for the software protection key WIBUKey by pressing the corresponding button.
- 3. Install the professional version of APP 6 by pressing the corresponding button.



4. The installation software will lead you through the installation process.

The installed program creates the "Aircraft Performance Program" program group. This group is found in the start menu and contains the APP executable file.

APP creates a folder "ALR Aerospace" in your User/AppData folder to save user settings, and a folder "APP 6 Professional Edition/Examples" in your document folder.

Consider that you cannot run APP without installing and connecting the WIBU protection key first, as described in the next chapter.

ALR Aerospace

2 Working with APP

2.1 Overview

This section will guide you through some examples of calculations possible with APP. It will show you how to load existing aircraft data from the examples provided with APP, demonstrate how to create performance results and explains the APP aircraft data model.

APP differentiates between performance charts (point performance) and mission performances. A point performance is flown at an imaginable single point in time, characterized by a clearly defined fuel mass, whereas mission performances are flown in the context of a mission (climb, accelerate, cruise, ...). Mission performance calculations take into account the steadily changing fuel mass over time. Section 2.2 provides a quick start tutorial, showing you how to calculate an existing mission and generate a performance chart.

2.2 Getting Started

When you start up APP for the first time, you are greeted with a welcome screen. You can always show the Welcome screen again by pressing the APP Welcome button in the toolbar. The welcome screen is the easiest way to open APP files, and create new performance calculations.

Welcome		×
ACET Aircraft -	Mission Computation	Performance Charts
Create or Edit an Aircraft Model	Create, Simulate and Optimize a Flight Profile	Create Performance Charts and Tables
	Do n	ot show again Close

APP uses three main file types:

Fig 6: Welcome Screen

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Name	File Extension	lcon
Aircraft	*.actf	
Mission Computation	*.mis	**
Performance Charts	*.perf	PERF

Each button on the welcome screen gives you the option to either create a new file, or load an existing file.

2.2.1 Mission Computation

Start APP, then click on the button Mission Computation, Open on the welcome dialog. A file dialog box opens. Navigate to the APP examples folder on your PC. You can find the folder in your *Documents* folder, under *APP 6 Professional Edition/Examples/.*

Open the folder *Light-Weight Fighter* and load the file *LWF Ferry.mis.* You should be presented with the following screen:

APP 6.0.1 - LWF Fern	y.mis		
<u>F</u> ile <u>E</u> dit <u>V</u> iew <u>V</u>	⊻indow <u>H</u> elp		
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LWF Ferry.mis	×		▼ Ana
Description	Mission Information Description		lyses
Select Aircraft			
Settings	Mission Name:	Author:	
Segment List	Ferry	ALR	
Computation	Comment: Example for a simplified ferry mission		
Result (Sheet)	See manual for details.		
Result (Chart)			
Ready			CAP NUM SCRL

Fig 7 Mission Computation Screen

For the impatient: Click on the *Run Computation* button in the toolbar to run the computation and immediately see the mission profile appear in the <Result (Chart)> tab.



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The vertical list on the left shows you the available tabs of the opened file. The individual tab pages let you change settings, perform computations and view results. Currently, the tab <Description> is active and corresponding entry in the tab list is highlighted. On the top, you can see the horizontal file tabs. Now, only the tab for our *LWF Ferry.mis* file is visible, together with the red mission computation icon.

Now click on the tab <Select Aircraft>. This page shows you the loaded aircraft file, in this case the generic *Light-Weight Fighter (LWF)* example aircraft form ALR.

Settings Aircraft Configuration	and Initial Flig	ht State, External Stol	res, Atmosphere
Initial Condition			External Stores
Configuration: Cruise,	, Dry	•	Configuration: No Stores
Altitude	0	[m]	Toggle State
Mach	0	Ð	
Velocity	0	[m/sec]	
Fuel Percent	100	[%]	
Fuel Mass	2000	[kg]	
Payload	0	[%]	
Mass	7	'000 [kg]	
Atmosphere			
ISA	•	Browse	

Fig 8: Mission Computation Settings Tab

The next tab, <Settings>, shows the initial configuration and the state of your aircraft (Fig 8). In the drop down menu Configuration, you select the basic aircraft configuration. The configuration determines for example the maximum payload the aircraft can carry and the maximum fuel capacity. The first three fields set the start point of your mission. This can be at either at an airport, where the Altitude Field stands for the departure airport altitude, or it can be already in-flight. In latter case, you need to define your initial speed, using either the Mach or the Velocity field.

Note: If your start your mission in-flight, make sure that the selected velocity corresponds to a valid flight state. If the velocity is chosen to small, the aircraft will stall, and if it's chosen too high, the aircraft will break apart. In either case, the computation will not start correctly.

The next fields, Fuel Percent and Fuel Mass, you set the initial fuel load. A value of 100% corresponds to total fuel including the available external fuel tanks (if present in the selected external stores configuration). The Payload field lets you select the percentage of payload. This value stays constant over the duration of your mission. A payload can either be passengers, cargo, or special mission equipment. To see how much payload your aircraft can carry, select type *100* into the field and watch the difference in the field Mass. This field shows your take-off mass, including fuel, payload and the mass of external stores (if selected).



Note: Be careful to set plausible values for Fuel Percent and Payload. An empty tank will come to your attention rather quick, as APP cannot fly an aircraft without fuel. But you may only notice much later in some too optimistic performance figures that your aircraft is flying along without any payload.

If you prefer to enter values in the British system, switch the unit system from [2] to [1] using the unit buttons [1] [2] [3] [4] in the toolbar, or selecting the menu View | Unit 1

Having completed the <Settings> tab with the initialization data, switch to the <Segment List> tab (Fig 8).

Mis: Miss	Mission Segments Mission Flight Profile					
Segr	ments					
+	<u>A</u> dd	× Del Insert Re	eplace			
		Segment Name	Configuration	Segment stops at:		
•	1)	Takeoff	TOL, Reheat	Velocity -	75.0678816	[m/sec]
	2)	Acceleration	Cruise, Reheat	or at:	_	
	3)	Climb at Mach	Cruise, Dry	None	• 0	[]
	4)	Cruise at Mach	Cruise, Dry			
	5)	Descent at Mach	Cruise, Dry	Time Step	1	[sec]
				Integrate z-Position Power Setting Thrust	100 43850.6	[%] [N]
				Climb Angle	0	[deg]
				Climb Speed	0	[m/sec]
				dT	0	[K]
				Engine Revolution	0	[mqn]

Fig 9 Mission Computation Segment List Tab

You can see that the mission is made out of 5 segments. The black triangle next to the segment *Takeoff* denotes that this is the currently selected segment. All the data on the right side corresponds to that segment. The segment end condition is shown under Segments stops at. If that condition is reached, APP switches to the next segment. For the *Takeoff* segment, APP will automatically determine a stop condition. If you click on the *Climb at Mach* segment, you will see that the stop condition is *Altitude > 11000m*. When the aircraft reaches 11000 Meters, the climb segment stops, and the *Cruise at Mach* segment starts.

The first flight state of a new segment is always the last state of the previous **segment.** That means the cruise segment will be calculated at a Mach number of 0.8, set by the stop condition in segment 2) *Acceleration*) and at an altitude of 10000m, set by segment 3) *Climb at Mach*.



Note: While it is possible to select any kind of stop condition, the user is ultimately responsible that the choice made is logical and feasible for the aircraft to fly. For example, descending to an altitude that is higher than the current altitude will lead to an error. Also, climbing to an altitude that is higher than the aircraft's ceiling altitude will eventually lead to an error, because the aircraft will run out of fuel trying to unsuccessfully climb to that altitude.

Computation Select Options and Perform 0	Computations	
Computation Single Mission Parameter Study Run	Optimizer Adv. Computation Optimizer No Optimization Range Optimization Endurance Optimization Radius-of-Action Optimization	Optimizer Settings
	Radius-or-Action Optimization	

Now, click on the <Computation> tab (Fig 10).

Fig 10 Mission Computation Tab

The Computation box provides two computation modes, *Single Mission* and *Parameter Study*. The *Single Mission* selection calculates one mission profile. The more advanced *Parameter Study* calculates a range of mission based on varied parameters (specified in the <Adv. Computation> tab).

The tabs on the right side provide options for the computation. The optimizer is useful to automatically change the stop condition of a segment in order to reach a target fuel value at the end of a mission, e.g. "cruise for X nautical miles, so that at the end of the mission, there is 5% fuel left". The optimizer will then determine X.

Note: The optimizer does not change the flight condition (speed, altitude) of the aircraft. To optimize these parameters, choose segments such as *Climb at best rate*, or *Cruise at best SR*

Now click the *Run* button, or press the *Run Computation* button in the toolbar. After a short moment, the computation should be. APP outputs results in two ways: in tabulated and in graphical form. These can be found in the tab <Result (Sheet)> and <Result (Chart)>, respectively.

Fig 11 Mission Computation SheetFig 11 shows the sheet tab. The first drop down box lets you control the level of detail, from a description of the mission (*Mission Description*)



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up to an output of values at each computed time step (*Detailed Output*). The default selection, *Brief Output*, shows computed values at the beginning and end of each segment. The second drop down box controls the selection of output values, by loading predefined lists.

Note: To change the number of displayed output values, open the options dialog (either through the toolbar button , or by choosing View | Options. Open the tab <Mission Param.> and add or remove desired values from the list on the right side. The list on the left side shows all the available output values. If you would like to save the list for future use, press the *Save* button. Your saved list will now also appear in the second drop down box in the <Result (Sheet)> tab. When you are done, just close the options dialog, and the sheet will adapt immediately to the new output values without having to recalculate the mission.

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<u>File Edit View </u>	Window	Help											
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Ferry.mis	- m		[0][4]	(G) = 1									- 2
Description	Missio	n Computation Sheet											Idiyo
Colored Alignmeth	Brief Ou	itout	•				•		Sheet	>> Excel >>			
Select Aircraft		Δ	B	C	D	F		G	H		, 	ĸ	
Settings	1	App 6.0.1	D	C	U			0	Project Fil	es	J	N	
Segment List	2												
	3	Date (Time):							Cruise, Dry				
Computation	4	Thursday, December 06, 2012 (14:	21:23)						Configuratio	n File:		standard	
Result (Sheet)	5	5 11 M							Aerodynam	ic File:		cruise	
Result (Chart)	0	File Name							Evol File:			dry thrust	fuel flow
	8	leity							r der i lie.			ury or remeat	
	9								Cruise, Reh	eat			
	10	Flight Data							Configuratio	n File:		standard	
	11	Altitude	0	[m]					Aerodynam	ic File:		cruise	
	12	Mach	0	[-]					Thrust File:			reheat thrust	
	13	Fuel Percent	100	[%]					Fuel File:			dry & reheat	fuel flow
	14	Payload	0	[%] [km]									
	16	Time	0	[KIII] [sec]					Configuratio	n File:		standard	
	17	Mass	7000	[ka]					Aerodynam	ic File:		to flaps 27°	
	18			1.101					Thrust File:			tol reheat thr	ust
	19								Fuel File:			dry & reheat	fuel flow
	20												
	21	_							TOL, Dry				
	22	-							Configuratio	n File:		standard	
	23	-							Aerodynam	ic File:		to flaps 27°	
	24	-							Thrust File:			dry thrust	fuel Renu
	25	-							ruel rile.			dry & reneat	Idel Ilow
	27		Time	Sea. Time	Distance	Sea. Dist.	Altitude	Mach	Velocity	Fuel Percent	Fuel Mass	Sea. Fuel I	Power Set
	28		[sec]	[min]	[km]	[km]	[m]	EI.	[m/sec]	[%]	[kg]	[kg]	
	29	Initial Settings	0	0	0	0	0	0	0	100	2000	0	
	30	Takeoff (TOL, Reheat)	0	0	0	0	0	0	0	100	2000	0	
	31	Stop at Velocity: 75.0679 [m/sec]	12.9013	0.215021	0.490452	0.490452	0	0.220597	75.0679	98.1931	1963.86	36.1381	
	32	Acceleration (Cruise, Reheat)	12.9013	0	0.490452	0	0	0.220597	75.0679	98.1931	1963.86	0	
	33	Stop at Mach: 0.8 [-]	50.6824	0.629686	7.03668	6.54623	0	0.8	272.235	92.1075	1842.15	121.711	
	34	Stop at Altitude: 11000 [m]	50.0024	7 64615	120 11	113 073	11000	0.8	212.235	32.10/5 78.2166	1642.15	277 8/1	
	36	Cruise at Mach (Cruise Drv)	509 451	1.04015	120.11	113.073	11000	0 800021	236.062	78 2155	1564.31	211.041	94
	37	Stop at Seg. Dist.: 800 [km]	3898.39	56,4824	920.11	800	11000	0.800021	236.062	35,9592	719,184	845,125	83.
	38	Descent at Mach (Cruise, Drv)	3898.39	0	920.11	0	11000	0.800021	236.062	35.9592	719.184	0	
	39	Stop at Altitude: 0 [m]	4082.66	3.07104	964.784	44.6739	0	0.800019	272.242	35.3775	707.55	11.6343	-
	•												F
Peady													
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Fig 11 Mission Computation Sheet

Fig 12 shows the <Result (Chart)> tab.



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Fig 12 Mission Computation Chart

There are multiple ways to store your results. The sheet and chart can each be saved in the APP sheet format file (*.vts) or chart format (*.vtc). Using File | Print, you can save data in PDF format using your preferred PDF printer (must be installed separately). The sheet provides the additional option to export into an Excel or compatible shreadsheet software.

Hint: If you would like to extract the numerical values from a chart you can:

- Click on the chart, then type Ctrl-C (copy). Then use Ctrl-V or paste in a spreadsheet software.
- Click in a line in the chart to activate it. Then press and hold Ctrl while clicking on the point of interest. APP should display a dialog box showing the value.

2.2.2 Performance Chart

Start APP, then click on the button Performance Chart, Open on the welcome dialog. A file dialog box opens. Navigate to the APP examples folder on your PC. You can find the folder in your *Documents* folder, under *APP 6 Professional Edition/Examples/.*

Open the folder *Boeing 747* and load the file *Cruise Efficiency Chart.perf.* You should be presented with the following screen:



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APP 6.0.1 - Cruise	Efficiency Chart.perf		
<u>F</u> ile <u>E</u> dit <u>V</u> iew	Window Help		
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🖌 😹 Cruise Efficien	ncy Chart.perf 🗾		▼ A
Description	Chart Information		a y se
Select Aircraft	Description		, and the second s
Settings	Chart Name:	Author:	
Generative	Cruise Efficiency Chart	ALR	
Computation	Comment:		
Result (Sheet)	Example for a cruise chart.		
Result (Chart)	See manual for details.		
Ready			CAP NUM SCRL

Fig 13 Performance Chart Screen

For the impatient: Click on the *Run Computation* button in the toolbar to run the computation and immediately see the performance chart appear in the <Result (Chart)> tab.

The vertical list on the left shows again the available tabs, similar as in the mission computation file.

Note: The shown example calculation is of the type *Point Performance Computation*. Please see Section **Error! Reference source not found.** for more information about Performance Charts. The user interface for all performance chart calculations is similar. The main differences are usually found on the <Computation> tab, where the parameter for the selected computation have to be specified.

Click in the tab <Select Aircraft>. As you can see, this page is identical with the page in the mission computation file. It will now show the 747-100 as the loaded aircraft.

Continue to the <Settings> tab. In the settings tab, the state of the aircraft needs to be fully defined. *Performance Charts* are different from *Mission Computations* in the way that the state of the aircraft will not change from the values set in the settings page. For example, if you set the Fuel Percent to 100%, all values will be calculated at that mass. If you want to calculate cruise performance, 100% fuel mass is not realistic (since that is only the case at take-off or after an in-flight refuelling). You might want to choose 80% for the beginning of a cruise, 50% for mid-cruise charts, and 20% to calculate end of cruise performance.



Same holds for other values, you need to define Altitude, Mach/Velocity, Payload etc. The values that are being calculated of course depend on the type of computation selected in the <Computation> tab.

The Configuration dropdown box shows the configurations the aircraft file provides. The configuration selected here can set your maximum fuel mass, as well as maximum thrust and aerodynamic properties. Make sure you select an appropriate configuration. For example, to perform a cruise computation, make sure that you don't select a take-off configuration, or if you are performing supersonic computations with a combat aircraft, select a configuration with sufficient (i.e. reheat) thrust.

Initial Condition External Stores Configuration: Cruise Altitude 0 Mach 0	No Stores 🔹
Configuration: Cruise Configuration: [] Altitude 0 [m] Mach 0 [1]	No Stores 🔹
Attitude 0 [m] Toggle State	
Attude 0 [m]	
Mach 0 [J	
Velocity 0 [m/sec]	
Power Setting [%]	
Thrust [N]	
Fuel Percent 50 [%]	
Fuel Mass 71735.6333 [kg]	
Engine Revolution 0 [rpm]	
Propeller Beta 0 [deg]	
Load Factor 1 [-]	
Pull-Up Rate 0 [deg/sec] Atmosphere	
Tum Rate 0 [deg/sec] ISA	Browse
Tum Radius -1.#IND [m]	
Acceleration 0 [m/sec2]	
SEP 0 [m/sec]	
Climb Angle 0 [deg]	
Climb Speed 0 [m/sec]	
Payload 80 [%]	
AoA [deg]	
Lift Area [m2]	
dT 0 [K]	
Mass 295265.953 [kg]	

Fig 14 Performance Chart Settings Page

Now select the next page, <Computation>. This page is specific for each kind of computation chart. For the example point performance computation, you can see a *Select Computation* box (Fig 15). The dropdown box Computation defines the equation or flight state to be calculated. Currently, a *Cruise* computation is performed. The flight states are computed at all the values given in the X-Range and the Parameter tables. No click the Run Button and compare the values in the <Computation> page (Fig 15) with the result shown in the tab <Result (Chart)> (Fig 16). As you can see in the resulting Chart, the values from the *X-Range* are plotted on the *X-Axis*, and the *Parameter* values



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correspond to each of the curves. On the *Y-Axis*, you may select and output value that is of interest to you.

Computation Select Computation Type and Parameter				
Select Computation	X-Range		Parameter	
Computation Cruise	Min 0	[-]	Min	D [m]
	Max 1	[-]	Max	1 [m]
X-Range Mach	Delta 1	[-]	Delta	1 [m]
Parameter Altitude	Insline	Del Line	Insline	e Del Line
		ach []		
	1	0.3	1	
🔊 Run	2	0.31	2	3048
	3	0.32	3	6096
	4	0.33	4	9144
	5	0.34	5	12192
	6	0.35	6	
	7	0.36	7	
	8	0.37	8	
	9	0.38	9	
	10	0.39	10	
	11	0.4	11	
	12	0.41	12	
	13	0.42	13	
	14	0.43	14	
	15	0.44	15	
	16	0.45	16	
	17	0.46	17	
	18	0.47	18	
	19	0.48	19	
	20	0.49	20	
5 54	Range from File		Range from	n File
		•		•
Save Computation Setting	Save Range		Save Ran	nge

Fig 15 Point Performance Computation



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Fig 16 Cruise Point Performance Chart

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3 Example Aircraft

APP includes example aircraft for selected classes of aircraft.

The directory with the APP examples is created during installation of APP. You can find the folder in your *Documents* folder, under *APP 6 Professional Edition/Examples/.*

3.1 Airbus A320

Aircraft File: A320.acft

Propulsion	2x high bypass turbofan
------------	-------------------------

Span	34.10 m
Length	37.57 m
Wing Area	122.4 m ²
OWE	43100 kg
Fuel Mass	21480 kg
MTOW	73500 kg

Configurations:

• Cruise

3.2 Boeing 747

Aircraft File:	Boeing 747-100.acft
Propulsion	4x high bypass turbofan
Span	59.6 m
Length	70.6 m
Wing Area	510.967 m ²
OWE	358000 lbs
Fuel Mass	316300 lbs
MTOW	735000 lbs

Configurations:

- Cruise
- Climb
- T/O, clean
- T/O, Flaps 10
- T/O, Flaps 20

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• T/O, Flaps 30

3.3 Light-Weight Fighter

Aircraft File:	LWF.acft
Propulsion	1x low bypass turbofan
Span	8.53 m
Length	14.4 m
Wing Area	18 m ²
OWE	5000 kg
Fuel Mass	2000 kg
MTOW	8401 kg

Configurations:

- Cruise, Dry
- Cruise, Reheat
- TOL, Dry
- TOL, Reheat

3.3.1 Radius-of-Action vs. Combat Time Chart

The example *Light-Weight Fighter/LWF Combat Time Variation.mis* demonstrates how to model a complex combat mission, including weapons release. The Optimizer mode is set to *Radius-of-Action*, and the *Parameter Study* mode will change the time the aircraft spends in combat. As a result, a chart is generated that will plot the combat time on the x-axis and the radius-of-action on the y-axis.

3.4 Light Single Engine Piston

Aircraft File: SEP.acft

Propulsion 1x piston, constant speed propeller

Span	10.38 m
Opan	10.00 m

Length 8.14 m

Wing Area 18 m²

OWE 1001 kg

Fuel Mass 151 kg



User Manual

TOW 1400 kg

Configurations:

- Cruise at Best Power
- Cruise at Best Economy

3.5 Small UAV

Aircraft File: UAV.acft

Propulsion	1x piston, fixed pitch propeller
Span	5.71 m
Length	4.61 m
Wing Area	3.4258 m ²
OWE	188 kg
Fuel Mass	42 kg
MTOW	275 kg

Configurations:

Cruise