blacksky
AltAcc2C Instructions

This instruction manual is for the **blacksky AltAcc2C** an integrating accelerometer and barometric altimeter data acquisition and recovery system for rocketry.

This package contains:

1. 1 each **AltAcc 2C** in antistatic bubble bag
2. Flight Analyzer Windows™ Software, Version 1.04
3. RS-232 interface cable
4. 2 ea 10K resistors
5. Airframe mounting label
6. This Instruction Manual

In addition, you will need:

1. Fresh, tested 9V alkaline battery.
2. Two type 194 automotive lamps or equivalent for testing.
3. Jewelers screwdriver.
4. 5/32" (4mm) drill bit.

The following items are optional but recommended.

5. Digital Multimeter
6. **blacksky** HiRMI electric matches
7. **blacksky AltAcc** Remote Operation Control
8. **blacksky AltAcc** Palm Adapter
9. **blacksky AltAcc** Housing
10. **blacksky AltAcc** Beeper
11. **blacksky AltAcc** CPR Adapter
12. **blacksky E-Jecter** Ejection Charge Holder
13. **blacksky ARRD** Advanced Retention and Release Device

AltAcc QUICK FUNCTION REFERENCE
MAIN ALWAYS TO MAIN, DROGUE ALWAYS TO DROGUE

MODE	ARM AND LED	MAIN	DROGUE	FUNCTION DESCRIPTION
Altitude Display in feet	Flashes thousands then hundreds	NO	NO	§Reset power §The peak altitude will be flashed three times then to standby
Standby	Single Flash	NO	NO	§Self-check OK §Launch Trigger OFF §Igniters safe
MAIN Deploy	ARMED Double Flash	MAIN AT PEAK	NO	§Launch Trigger ON §At rest data recorded

DROGUE-to-MAIN	ARMED Triple Flash	MAIN AT 600, 1200 OR 2400 Feet	DROGUE-FIRES AT PEAK	§Launch Trigger ON §If continuity lost after the other terminal fires at peak §If peak is detected in <6 sec from launch, MAIN and DROGUE FIRE
Launch Trigger	ARMED On Solid in Flight	YES	YES, (if selected)	§Launch Trigger by acceleration detection of greater than 1 g for .25 sec
Data Transfer	NOT ARMED Single Flash	NO	NO	§Data cable between **AltAcc** and RS-232 PC computer port. §During transfer, LED on for about 30 sec.
Other Modes				
Data Storage Only	ARMED Double Flash	10K RESISTOR	NO	§Launch Trigger ON §At rest data recorded §No recovery, data only
Backup Drogue Only	ARMED Double Flash	10K RESISTOR	DROGUE FIRES AT PEAK	§Launch Trigger ON §At rest data recorded §Drogue connected to Main, fires at peak.
Backup Main at Low Altitude	ARMED Triple Flash	MAIN FIRES AT PROGRAM ALTITUDE	10K RESISTOR	§Launch Trigger enabled §At rest data recorded

1 *ALTACC* INSTALLATION AND CHECKOUT

> THE ALTACC IS RELIABLE ONLY WHEN INSTALLATION AND OPERATION INSTRUCTIONS ARE FOLLOWED OR CORRECTLY ADAPTED. THE ALTACC MUST BE SECURED TO THE ROCKET AIRFRAME BE ORIENTED CORRECTLY AND HAVE A KNOWN GOOD BATTERY FOR IT TO WORK PROPERLY.

1.1 INSTALLATION – Install the *AltAcc* with the supplied self-adhesive label. The label is on the outside of the airframe and the *AltAcc* mounts behind it inside of the airframe. FIGURE 1 illustrates *AltAcc* mounting.

1.1.1 <u>Select the mounting location of the *AltAcc*</u> in your rocket by positioning it on the inside wall of the airframe. The mounting location must clear the nose cone or coupler and not be exposed to ejection gasses.

1.1.2 <u>Place the *AltAcc* label on the outside of the airframe</u> at the location selected, and use a center punch or other sharp instrument and mark the four **:** label locations: *top mount hole; LED; ARM; and lower mount hole*.

1.1.3 <u>Drill each marked location with a 5/32" drill</u>, peel off the *AltAcc* label backing and apply the label over the drilled holes. Use a sharp hobby knife to trim the holes in the label.

1.1.4 <u>Install the battery, loosen</u> the screw on the battery clip, install a **fresh** 9V alkaline battery, and tighten the clip and screw. The LED will flash the last peak altitude; first thousands then hundreds of feet repeat twice then single flash. **Make sure that the red jumper is installed between J1 Pin 1 and Pin 2**

1.1.5 <u>The Main recovery altitude is set at 600 feet</u>, change the altitude with the procedure in Section 3.1.7.

> *USE CAUTUION WITH THE RECOVERY CHARGES. ALWAYS WEAR EYE PROTECTION WHILE PREPARING, CONNECTING, AND CHECKING OUT THE RECOVERY SYSTEM.*

1.1.6 **Prepare and connect your ejection charges**. ***Disarm the AltAcc by turning the ARM screw counter-clockwise (DO NOT remove the screw).*** Loosen the Terminal Block screws (DO NOT remove) and insert the stripped electric match leads into the Main/Drogue Terminal Block and tighten the screws.

1.1.7 **Check the *AltAcc* recovery Mode** by gently tightening the **ARM** screw, **DOUBLE—MAIN ONLY**, **TRIPLE—DROGUE to MAIN**. ***DISARM THE AltAcc BEFORE MOUNTING***
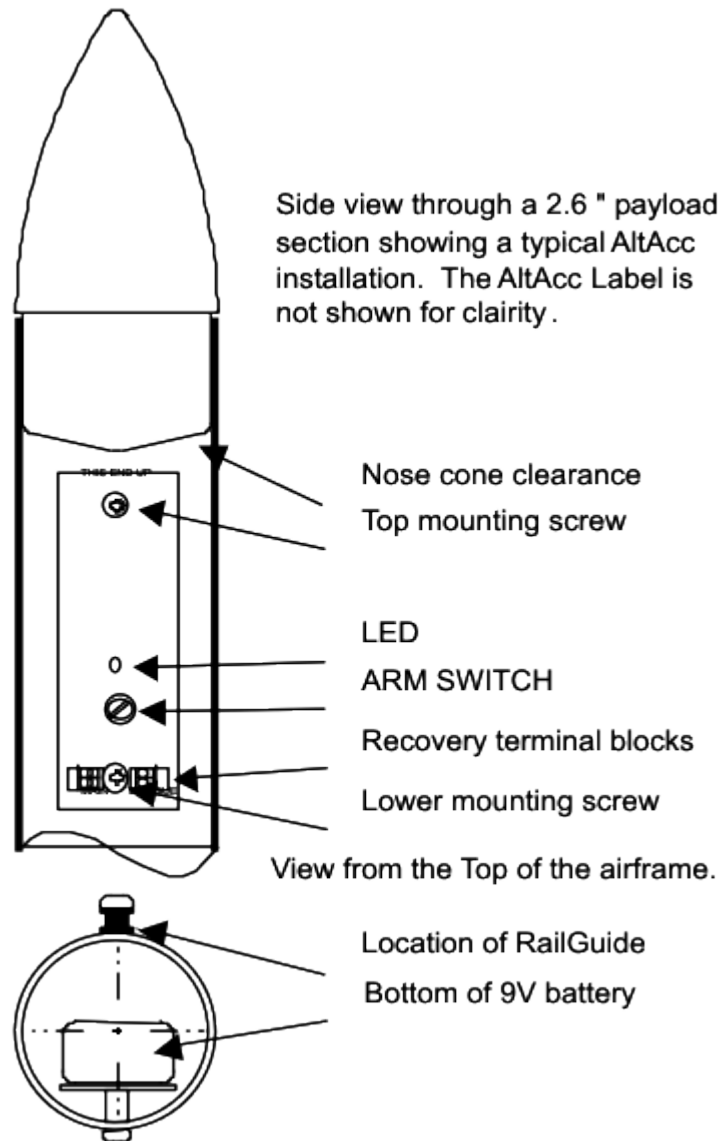
Side view through a 2.6 " payload section showing a typical AltAcc installation. The AltAcc Label is not shown for clairity.

Nose cone clearance
Top mounting screw

LED
ARM SWITCH
Recovery terminal blocks
Lower mounting screw

View from the Top of the airframe.

Location of RailGuide
Bottom of 9V battery

FIGURE 1 – *AltAcc* Installation

1.1.8 **Mount the *AltAcc* in the rocket** by removing the screws from the standoffs, positioning the ***AltAcc*** behind the top and bottom mount holes and mounting the AltAcc to the inside of rocket with the screws.

1.1.9 **ARM the *AltAcc* ONLY when the rocket is mounted on the launcher, is vertical or can be elevated at a rate of less than 10° per second**. Check the LED flashes to confirm the recovery mode and you are ready to fly.

1.1.10 **Read the Peak Altitude** by removing the AltAcc from the rocket and resetting the power by removing and replacing the red jumper. The last flight recorded will flash out the altitude, first thousands of feet then hundreds of feet.

1.1.11 **Recover the *AltAcc* data by using the Flight Analyzer** software and begin doing real rocket science.

1.2 ALTERNATE INSTALLATION. If desired, the ***AltAcc*** can be wired to operate remotely per FIGURE 2. Available from blacksky is an optional ***AltAcc 2A Power Panel*** with Power, ARM, LED and Serial data connector, and comes with an 18-inch cable.
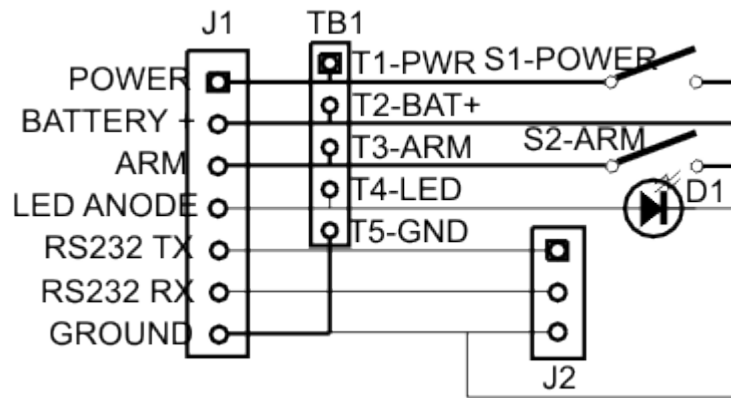
FIGURE 2. *AltAcc 2A* Power Panel

1.3 **QUICK *ALTACC* FUNCTIONAL CHECK** is shown in Figure 3 and is used for a quick checkout of the *AltAcc.* The test simulates the at-rest, thrust, and coasting flight acceleration. This procedure takes practice to get consistent results and *is simply a functional test* of the operation of the *AltAcc.*

1.3.1 <u>**Attach Type 194 bulbs**</u> (an automotive type lamp that has wire leads) to the MAIN and DROGUE terminals. Install the battery, the LED should flash once every two seconds. Tighten the ARM screw and the LED will flash three times per second.

1.3.2 <u>**Hold blacksky *AltAcc* for at least 15 seconds at a 45-degree angle**</u> with the "This End Up" arrows pointing down. This produces a skewed at rest value to allow flight detection. The skewed value is on the order of –0.7g relative to the normal orientation.
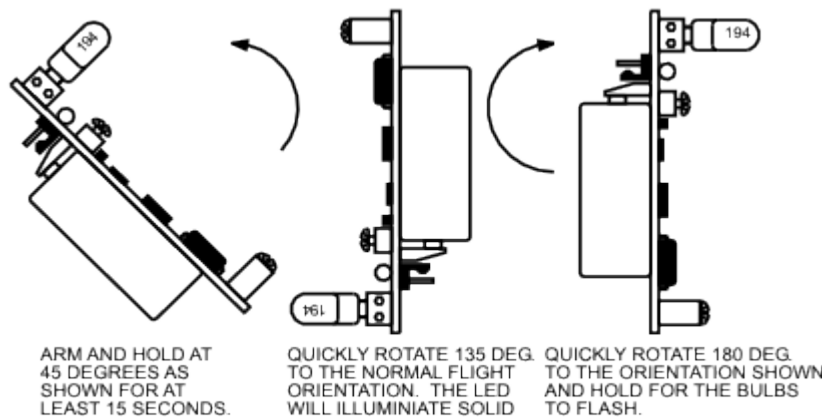

ARM AND HOLD AT 45 DEGREES AS SHOWN FOR AT LEAST 15 SECONDS.

QUICKLY ROTATE 135 DEG. TO THE NORMAL FLIGHT ORIENTATION. THE LED WILL ILLUMINIATE SOLID

QUICKLY ROTATE 180 DEG. TO THE ORIENTATION SHOWN AND HOLD FOR THE BULBS TO FLASH.

FIGURE 3. Quick Checkout of the *AltAcc*

- <u>**Quickly rotate the *AltAcc* 135 degrees**</u> (in less than a ¼ second) until it is right side up until the LED goes solid ON. This motion simulates launch and flight under thrust. The change in acceleration detected is about 1.5g and represents the rocket under power, enough for Launch Detect.

- <u>**Quickly rotate the unit 180 degrees**</u> (in less ¼ second) until it is upside down to simulate the motor burnout and coast phases of flight. The acceleration now measured is about –1g relative to the normal orientation.

- <u>**Hold upside down until the bulbs briefly flash**</u>. If done correctly, the Drogue bulb will flash in about 10 seconds followed immediately by the Main bulb. This happens because the AltAcc detects minimum velocity or peak altitude, fires the Drogue and then fires the Main because it is below the 600 foot AGL Main deployment altitude.

2   HOW THE ALTACC WORKS

To get the most out of your *AltAcc,* knowing how it works is important. The operations and functions of the *AltAcc* are described as they would occur in set-up and flight. For a quick reference to the *AltAcc* functions, see the *AltAcc* OPERATION QUICK REFERENCE. FIGURE 2 illustrates the key components of the *AltAcc.*
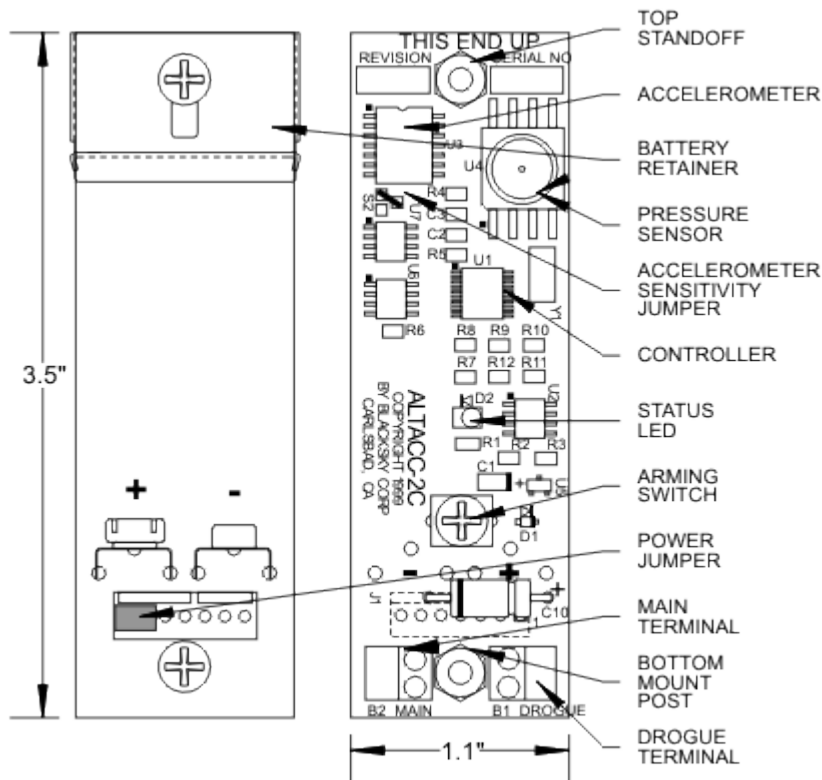
FIGURE 2 – Key Components of the *AltAcc*

2.1 Power Up -- When a 9V battery is installed, *and the jumper is installed between J1 Pins 1 (one) and 2 (two)*, the controller boots up and checks each sensor to make sure it's working. If not ARMED, the *AltAcc* is in standby mode and flashes the LED once every two seconds. If any error is detected the LED will not flash and the *AltAcc* cannot be armed.

2.2 MODE SETTING -- The *AltAcc* acceleration sensitivity is set with S2 and the recovery mode is set with an electric match or a resistor connected to the MAIN or DROGUE terminals. See the *AltAcc* OPERATION QUICK REFERENCE for a summary of settings.

2.2.1 Acceleration Sensitivity is set with a jumper at S2. The installed jumper provides ±25 g sensitivity. Removing the jumper changes the sensitivity to +50 g's.

> **THERE IS A PERMANENT 50K OHM SHUNT ACROSS THE MAIN AND DROGUE TERMINALS FOR E-MATCH SAFETY.**

2.2.2 Main -- When an Ejection Charge is connected to the MAIN terminals and the ARM SWITCH is tightened, continuity is sensed across the MAIN terminals and deployment is set for MAIN firing. The LED will flash twice every two seconds.

> **THE MAIN IS ALWAYS CONNECTED TO THE MAIN, DROGUE IS ALWAYS CONNECTED TO THE DROGUE TERMINALS.**

2.2.3 Drogue/Main -- When an Ejection Charge is connected to both the DROGUE and MAIN terminals, and the ARM SWITCH is tightened continuity is sensed across both terminals and sets deployment for MAIN and DROGUE. The LED will flash three times per second. If only the DROGUE is connected, the LED flashes once every two seconds and the *AltAcc* will not arm.

2.2.4 Data Acquisition Only -- The *AltAcc* may be used for data acquisition only by connecting a 10k ohm resistor across the MAIN terminals and tightening the ARM SWITCH. This sets the *AltAcc* for data

acquisition by providing the MAIN sense circuit with continuity.

WHEN EJECTION CHARGES ARE CONNECTED AND THE ALTACC IS ARMED, AVOID ABRUPT MOTIONS. ARM THE ALTACC ONLY WHEN THE ROCKET IS IN POSITION TO LAUNCH.

2.3 *ALTACC* **FLIGHT --** *AltAcc* Flight begin when the charges are attached and the *AltAcc* is ARMED. ARM checks continuity, set recovery mode and starts *AltAcc* at-rest data acquisition and waits for the Launch Trigger. When launch is detected, the *AltAcc* is Triggered, data is stored and processed in real-time for recovery actions.

2.3.1 <u>At Rest Acceleration and Altitude</u> -- When the *AltAcc* is installed in the rocket and armed on the launch pad, the Accelerometer and Pressure sensor data is continuously stored in controller memory to get the at-rest sensor values.

2.3.2 <u>Launch Trigger</u> -- When the rocket is launched and 1 g of acceleration (relative to the at-rest values) is sensed for 0.25 seconds, the *AltAcc* switches to Flight. Data is now stored in non-volatile memory for 4.25 minutes. During this time, the LED remains ON, and goes out at 4.25 minutes.

2.3.3 <u>Peak Detection</u> – After Launch Trigger, the positive acceleration values (during motor burn) and negative acceleration values (coast) are integrated (added) to detect minimum velocity. When the integrated value reaches zero the rocket is at minimum velocity and the MAIN or DROGUE deployment system is fired.

IF PEAK IS DETECTED <6 SECONDS FROM LAUNCH TRIGGER, BOTH CHARGES WILL FIRE.

2.3.4 <u>Post Peak Low Altitude Deployment</u> -- After firing at peak, pressure sensor data is compared to the at rest pressure data during the descent. When the set recovery altitude is detected, the Main is fired. The default setting for low altitude deployment is approximately 600 feet. Other altitudes, 1200 and 2400 feet can be selected for MAIN parachute deployment.

2.4 COMMUNICATION – *AltAcc* communicates through a serial cable from the *AltAcc* to a DB9 connector connected to the RS232 serial port of a Personal Computer (PC) or, by using the Palm Adapter to connect to a palm top computer with the Palm OS.

2.4.1 <u>Flight Analyzer</u> software runs in Windows™. Included is the DOS based DataPro or Palm DataPro software. Section 3 provides details for these applications.

2.4.2 <u>Terminal Commands</u> may be used with the *AltAcc* and a terminal emulation program. These commands are case sensitive.

- /B – Babble mode streams the data to the terminal.
- /R – Sends contents of EEPROM to the terminal.
- /CC – Clears the EEPROM.
- /L – Sets the Main Deployment altitude to 600 feet.
- /M – Sets the Main Deployment altitude to 1200 feet.
- /H – Sets the Main Deployment altitude to 2400 feet.

7   POST FLIGHT DATA RECOVERY AND ANALYSIS

ALTACC CALIBRATION IS NOT NECESSARY PRIOR TO FLIGHT. CALIBRATION IS USED FOR DATA REDUCTION ONLY AND DOES NOT CHANGE FLIGHT PERFORMANCE.

AltAcc data capture and analysis is done using the supplied software used with Flight Analyzer for Windows™, DataPro for DOS, or DataPro for PalmOS

7.1   USING FLIGHT ANALYZER is used with Windows 95™ or higher and is loaded into a Personal Computer. Flight Analyzer software provided with the *AltAcc* allows data transfer and graphical display of your *AltAcc* Data for real rocket science.

7.1.1   Install the Flight Analyzer into your computer.

- Insert Disk 1 into the 3.5" drive of your computer.
- From ÿ **Start** button, select **Run**, enter **a:\setup.exe,** click OK.
- Follow InstallShield instructions displayed to install Flight Analyzer and Disk 2. Installshield will automatically create a directory in Programs called blacksky that contains Flight Analyzer.

3.1.1

Open the Flight Analyzer from the ÿ Start button, select **Programs**, then **blacksky**, then

Flight Analyzer will open and reveal the following display (NOTE, wallpaper graphic not shown for clarity):

File contains the dropdown file save and load menu.
> **Save** Data File…saves the currently loaded data file
Load Data File…loads a saved file
Load Calibration File…loads a saved Calibration File
Load Parameter File…loads a saved Parameter File
Change Directory…changes the directory path
Printer Setup…sets up your printer

Edit contains drop down edit routine for flight log.

Comm allows you to capture data and configure the data port
> **Configure Port**…the utility for changing the serial port
Capture Data…downloads data from the *AltAcc*
Calibrate AltAcc …creates an *AltAcc* calibration file
Clear Data Buffer…clears the *AltAcc* memory
Live Data…downloads live data from the *AltAcc*
Main Deploy…allow setting of Main Deployment altitude

Graph opens a table to customize the graphical display when a data file is open.

Help opens a description of the FlightAnalyzer

Opens a saved flight data file.

Sets the length of the graphically displayed data file

Downloads data from your *AltAcc*

Starts the graphical display of a loaded flight file

Begins display of live data from *AltAcc*
(Needs the correct Cal File to work properly)

Begins calibration routine for the *AltAcc*

Main Deployment altitude setting for the *AltAcc*
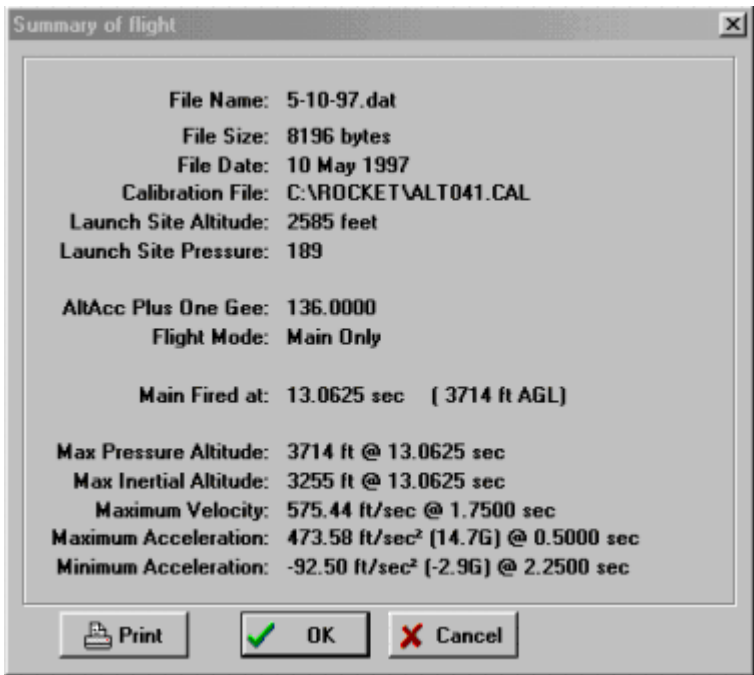
3.1.2 Quick Use of Flight Analyzer

§Connect the *AltAcc* serial cable between a RS-232 port on your computer and the *AltAcc;* install a 9V battery (***watch polarity***); Power Jumper installed; the *AltAcc* is **NOT ARMED**.

§Start Flight Analyzer and from the Menu select **Comm**, set your serial port (typically COM1 or COM2) and click OK.

Click on this button and the **Save Captured Data** box will appear, Type in your file name. Make your file name something that you can remember, such as *Pro38-Flight-1*. Click on **Start** and the Communications Status box will show "Transferring Data" and data transfer percentage.

§

Summary of flight ✕

File Name:	5-10-97.dat
File Size:	8196 bytes
File Date:	10 May 1997
Calibration File:	C:\ROCKET\ALT041.CAL
Launch Site Altitude:	2585 feet
Launch Site Pressure:	189
AltAcc Plus One Gee:	136.0000
Flight Mode:	Main Only
Main Fired at:	13.0625 sec (3714 ft AGL)
Max Pressure Altitude:	3714 ft @ 13.0625 sec
Max Inertial Altitude:	3255 ft @ 13.0625 sec
Maximum Velocity:	575.44 ft/sec @ 1.7500 sec
Maximum Acceleration:	473.58 ft/sec² (14.7G) @ 0.5000 sec
Minimum Acceleration:	-92.50 ft/sec² (-2.9G) @ 2.2500 sec

🖨 Print   ✓ OK   ✕ Cancel

When the data transfer is complete, the Selected Data File box displays the "Summary of Flight box". Clicking **Print** to print, **OK** to accept or **Cancel** to reject.

If you accepted the data, click on this button and a graph will appear showing the Velocity, Acceleration and Pressure Altitude.

§The Value and Timing can be displayed by placing the cursor on the curve of interest, and left clicking. Index lines will appear on the curve that may be moved right to left using the keys. Shifting from one curve to the next is done with the ▲▼ keys. Numbers are displayed in the upper left corner are the data value (altitude, velocity or acceleration) and time from launch.

§Zooming in on an area is done by placing the cursor in the graph area, holding down the left button and dragging the box to the area of interest.
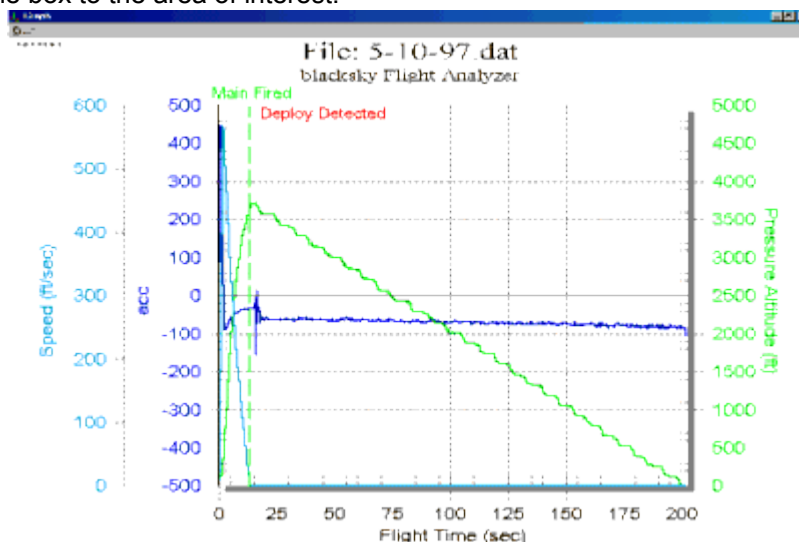
2.1.1 Downloading the Second Flight

Repeat 3.2.3 to download the second flight. Be sure to name the file before clicking **Start**.

2.1.2   Adjusting Graph Parameters
The normal Graph display provides Speed, Acceleration and Pressure Altitude. It is possible to customize the graph to display the data in other units, such as miles per hour, Mach or SI units.

- Click on **Graph** to display a table containing the controls for the graphical display. Changing the title of each graph is done in the **Title** column. Changing the **Formula** changes the units displayed. Normally, the units are displayed in English units, with Channel 1 being the Acceleration and Channel 2 being altitude in feet.

- EXAMPLE: to display acceleration in Meters per second per second, edit **Title** to read *Acceleration (Meters/sec-sec)* and the **Formula** for Channel 1 becomes *Ch1*9.8.*

2.1.1   Look at Stored Files in the Flight Analyzer

Click on this button and select a saved flight file from the list and the Selected data file box displays the Summary of Flight information box.

2.1.2   Calibrate Flight Analyzer for your *AltAcc*
There is a default calibration program loaded in the Flight Analyzer. However, to get the best possible data reduction, run the Flight Analyzer Calibration Program for your *AltAcc* and use this program for displaying your data.

§Connect the *AltAcc* serial cable between a RS-232 port on your computer and the *AltAcc;* install a 9V battery (*watch polarity*); Power Jumper installed; the *AltAcc* is *NOT ARMED*.

Click on this icon and a display will come up that shows a table with the calibration information.

§Enter your altitude and the barometric pressure (check your weather channel or call your airport for the pressure).

Click on this icon to begin barometric calibration.
Minus One Gee Average Hold the *AltAcc* upside down and click on the icon (hold the *AltAcc* as still as possible until data is sampled, about 45 seconds.

Zero Gee Average Lay the *AltAcc* flat (on its battery holder) and click on the icon, data sampling takes about 45 seconds.

Plus One Gee Average Hold the *AltAcc* right-side up and click on the icon (hold the *AltAcc* as still as possible until data is sampled, about 45 seconds

§Click on **OK** and a **Save As** box will appear, name the calibration file using the *AltAcc* serial number and click on **Save**.

§When analyzing data, go to **File** and **Load Calibration File** to open the file display of the calibration files. Select the calibration file for the *AltAcc* data to be analyzed and click on **Open**. Subsequent Flight Data File loaded will use this calibration file for analysis.

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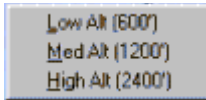
§Load your Data File and the new calibration file will be used.

2.1.3   Set Main Deployment Altitude
§Connect the *AltAcc* serial cable between a RS-232 port on your computer and the *AltAcc;* install a 9V battery (*watch polarity*); Power Jumper installed; the *AltAcc* is *NOT ARMED*.

Select this Icon to bring down the Main Altitude Deployment altitude menu.

Click on the altitude desired and the value will be loaded into EEPROM. The battery may be removed and the altitude will remain set until changed.

2.2 ProRead using the Palm OS

Instead of taking your laptop to the field, *AltAcc* flight data can be displayed and saved on most of the **Palm OS** hand held computers. Many flights can be stored on you **Palm** for later download to Flight Analyzer. All that is required is your *AltAcc*, the blacksky **Palm Adapter** (a X-modem gender changer) and your **Palm**.

2.2.1   Load the Palm Software To use the **ProRead** software, you must load it into the **Palm**.
- Open your **Palm** Desktop and click on **Install**.
- Click on **Add** and direct to C: / Program Files / Flight Analyzer / Proread.prc.
- Highlight **Proread.prc** and click on **Open** .
- Click on **Done** and the next time you Hot Synch, the Proread program will load into your **Palm**.

6.1.1   Use the Palm to Download and Display *AltAcc* Data The **Palm** can download and display *AltAcc* data. The data displayed uses the default Cal program loaded in Proread.prc.

- Connect the *AltAcc* serial cable to the Palm Adapter gender changer and the Palm Serial Cable; install a 9V battery (*watch polarity*); Power Jumper installed; the *AltAcc* is *NOT ARMED*..
- Open the **ProRead** program from the **PalmOS** Main Menu.
- Tap on Read and the *AltAcc* data will down load to your Palm.
- When the download is complete, name your Flight Data File.
- To display data, highlight the Flight Data File you wish to display and tap on Info , the data will be displayed with the default Cal file.
- The second flight can be downloaded from the AltAcc with the Read button, be sure to select a different name for this file.

12.1.1   Down Load Data to Flight Analyzer

- Open Flight Analyzer on your PC.
- Connect your Palm to the COM port and open Palm ProRead.
- On the Palm, tap on Send.
- Download data into Flight Analyzer per 3.1.3.
- You may now display the flight data using Flight Analyzer.

17.1 PRODATA for DOS-- The *prodata* software suite runs in DOS and allows you to look at the *AltAcc* Flight data in detail and create your own analysis tools. Prodata includes the following executable programs:

proread.exe -- Reads the *AltAcc* data and creates a data file.

> **proclear.exe** -- Clears the **AltAcc** memory.
> **probate.exe** – Makes calibration file (prodata.cal) for the **AltAcc** .
> **produce.exe** -- Reduces **AltAcc** data to flight performance data.

In addition to the four executable files are the following data files:
prodata.nit -- Default values for the PC RS-232 serial communications port, calibration file and user output preferences.
prodata.cal -- This file is created by probate.exe and contains calibration reference values for the sensors.

17.1.1 Installation of *prodata* -- You must install **prodata** onto your hard drive.
§Make a directory labeled "**prodata**" on your hard drive.
§Insert the Disk 2 **prodata** diskette into the 3.5" floppy drive.
§Copy the contents of the **prodata** file to the **prodata** directory.

17.1.2 <u>Using the RS-232 Serial Port and DOS</u> -- For proper serial port operation, *proread, proclear and probate* must be run in native DOS only. If using Windows, you must exit and restart in Windows and run from the C: prompt.

17.1.3 <u>*AltAcc* Calibration</u> AltAcc sensor calibration data is acquired with the *probate* program. *Probate* creates a file called *prodata.cal* or a user selected name. *The prodata.cal file is required for data reduction.* The calibration does not effect the flight performance of the **AltAcc** as the data is used only with the *produce* program to reduce flight data.

17.1.4 <u>*AltAcc* Clearing</u> Clearing the *blacksky* **AltAcc** with *proclear* between flights assures that old data will not be read and interpreted causing flight data errors. It is not necessary if using the *blacksky* **AltAcc** for recovery only.

17.1.5 <u>*AltAcc* Reading</u> Reading data from the *AltAcc* uses the *proread*. It is necessary to name each *proread* file to allow it to be reduced. The name of each file is described as (eight characters).dat.

17.1.6 <u>*AltAcc* Data Reduction:</u> The **AltAcc** is processed using the *produce* routine. The data is reduced from a file named when the **AltAcc** data was read with *proread*. Following are descriptions of the commands and how to use the **AltAcc** data files.

Usage: produce [-cFILE] [-fFILE] [-oFILE] [-nFILE] [-zVAL] [-gVAL] -a -q -h FILE where:

-c FILE	-> Calibration File produced by Probate
-f FILE	-> **AltAcc** data file produced by proread
-n FILE	-> Override default init file prodata.nit with FILE
-o FILE	-> Output file for produce results
-z VAL	-> One Gee Value (Overrides Cal File One Gee)
-g VAL	-> Gain Override (Overrides Cal File Gain Factor)
-F FMT	-> if FMT = c or C or x or X then print comma separated values (ala an Xcel csf file) Otherwise print a table of data with headers (default)
-a	-> Force all the data out, even after touchdown
-b	-> be quiet about it
-h	-> help (this list)
FILE	-> FILE == **AltAcc** data file produced by proread

Examples of produce data reduction operations are shown below.

a)   To simply reduce the flight data through minimum velocity deployment with **prodata.cal**, type:

produce [S] **yourname.dat** [ENTER]

b)   To reduce the flight data through minimum velocity deployment with **prodata.cal** and store the reduced data, type:

produce [S] **-o** [S] **yourname.flt** [S] **yourname.dat** [ENTER].

c) To reduce the flight data through minimum velocity deployment with a different *.cal* file and store the reduced data, type:

produce [S] *-c* [S] *yourname.cal* [S] *-o* [S] *yourname.flt* [S] *yourname.dat* [ENTER]

d) To reduce the flight data through minimum velocity deployment and generate an EXCEL or Lotus type comma separated variable (.csv) file to be exported to a spreadsheet program for graphical display, type:

produce [S] *-F* [S] *C* [S] *-o* [S] *yourname.csv* [S]*Yourname.dat*[ENTER]

e) To reduce the entire flight data set and generate an EXCEL or Lotus type comma separated variable (.csv) file to be exported to a spreadsheet program for graphical display, type:

produce [S] *-F* [S] *C* [S] *-o* [S] *yourname.csv* [S] *-a* [S]*yourname.dat* [ENTER]

e) If option *-o* was used, the named file (*yourname.flt*) can be displayed by using the DOS editor, word processor or a word processor program or scrolled through by typing:
type [S] *yourname.flt* [S] *| more* [ENTER]

AltAcc Warranty, Terms and Conditions

Reasonable care has been exercised in the design, fabrication and testing of the *AltAcc* by blacksky, its employees, vendors and subcontractors. Blacksky warrants the *AltAcc* for a period of 90 days from the date of purchase. Blacksky will repair or replace any *AltAcc* at its discretion during the warranty period. *Damage to the AltAcc resulting from rocket flight or recovery failures is not warranted under any circumstances. AltAcc* recovery modes are used for experimental purposes only and shall not be used where failure would cause injury or property damage. The purchaser and user of the *AltAcc* accepts all risks and responsibilities for its testing, installation and use. The *AltAcc* purchaser or user shall not hold blacksky Corporation, its employees, vendors and contractors liable for any consequential or incidental damages resulting from its use. First time use of the *AltAcc* signifies acceptance of these terms. Any modifications made to the *AltAcc* by the user or connection of equipment not provided or manufactured by blacksky Corporation shall make this warranty void

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AltAcc2C Specifications

PARAMETER	METRIC (subject to change without notice)
1. Recovery Modes	•Main only with inertial acceleration integration to detect minimum velocity, equivalent to peak altitude.
	•Drogue with inertial acceleration integration to peak followed by programmable Main at user selected barometric low altitudes.
3.Flight Safety Features	•The AltAcc will not arm if continuity is not detected across the Main or Drogue and Main terminals.

- A 50K ohm shunt is across the Main and Drogue terminals.
- If peak altitude is detected within 6 seconds, both Drogue and Main outputs will be fired.
- If continuity on either Drogue to Main opens in flight, the other output will be fired at peak.

5.Altitude Display	Status LED flashes peak barometric altitude in thousands and hundreds of feet to 16K feet (metric values must be converted).
6.Low Altitude Recovery	Programmable 600, 1200, and 2400 200/-0 feet (180, 360, and 720 +60/-0 meters).
7.Mach Sensitivity	Insensitive to Mach+ velocities during ascent.
8.Acceleration Measurement Range	+ 25 g's and + 50 g's. Acceleration can exceed set point without damage, however, some data will be lost..
9.Acceleration Resolution	0.25 + 0.05 g and 0.5 + 0.1 g
10.Lift-Off Detection	≥ 1.0 g for 0.25 seconds
11.Velocity Timing Error at Peak Altitude Detect	+ 2 seconds based on acceleration integration. The peak detected is the inertial minimum velocity.
12.Maximum Time of Flight to Deployment	Limited to 4.25 minutes. At altitudes >100,000 feet (>30,000 meters) rocket instability will cause acceleration integration errors occur.
13.Maximum Velocity to Peak	No theoretical maximum velocity within the data limits.
14.Pressure Range	2.8 to 14.7 PSI (20 to 105 kPa)
15.Pressure Resolution	0.05 + 0.01 PSI (0.40+ 0.1 kPa)
16.Pressure Altitude Range/Relative Accuracy	•0 to 15K is + 105 feet (0 to 4570 + 30 meters) •15.1 to 30K is + 420 feet (4610 to 9140 + 120 meters) •> 30.1K data may not be valid.
4.Data Digitization	8 bit A-to-D converter.
5.Digital Filter	8 sensor samples captured and averaged in 0.062 seconds
6.Data Storage Rate	16 averaged samples per second for each sensor.
7.Flight Storage Time	4.25 minutes
8.Output Type	RS-232 on 7-pin 0.1" spacing connector.
9.Cable Description	3-pin header, 4ft cable to DB9M serial port connector.
10.Input Voltage Range	+7 to +14 Volts (if 9V battery not used.)
11.Standby Current	<5mA average current.
12.Preflight Current	<5mA average current.
13.Igniter Continuity Current	<0.5ma @ 9V (with 9V battery installed)
14.Main/Drogue Output	0.1 sec, > 1.5 A @ 8.5 V (with fresh 9V alkaline battery),
15.Temperature Range	32° TO 158° F (0° to 70° C)
16.Dimensions	1.1" Wide x 3.5" Long x 1.5" High (30. x 91 x 38mm)
17.Weight without battery	1.3 oz (37gms)
18.Weight with battery	<2.8 oz (78gms) (9v alkaline)
19.Battery Holder	9V holder mounted on backside of board.
20.Arming Switch	Screw-down, mounted on front of board.
21.Status LED	Daylight visible LED mounted on front of board.
22.Output Terminals	Dual, two pole 3.5mm terminal blocks, 24 to 18 ga wire.
23.Mounting Screws	6-32 stainless steel, phillips pan head, typical 3/8" long