

# PAT4

## User Guide

Draft

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## ***Overview of PAT functionality***

The Wildlife Computers Popup Archival Transmitting (PAT) tag is designed to track the large-scale movements and behavior of pelagic fish and other animals which do not spend enough time at the surface to allow the use of real-time satellite tags.

PATs are best-suited for large pelagic animals. PATs have been deployed on a variety of species, including large tuna, marlin, and sharks, as well as swordfish and sea turtles. The PAT tag is attached to the animal via a tether. Generally, the researcher determines the best tether design and attachment method.

The PAT is designed to be towed by the study animal for a period of time. During this phase, the PAT records and summarizes depth, temperature and light-level data. These data provide the following information about the tagged animal

- Its environmental preferences in terms of depth and temperature
- Information on its oceanographic environment in terms of depth-temperature profiles
- Its geographic location derived from times of sunrise and sunset

In addition, a full archival record is maintained in non-volatile memory. Thus, should the PAT be recovered, you have the same detailed data that are collected by a conventional archival tag.

### ***What it does***

The PAT archives depth, temperature, and light-level data while being towed by the animal. At a user-specified date and time, the PAT actively corrodes the pin to which the tether is attached, thus releasing the PAT from the animal. The PAT then floats to the surface and transmits summarized information via the Argos system. Argos also uses the transmitted messages to provide the position of the tag at the time of release. The transmitted data are sent to the researcher by Service Argos. The data can be analyzed further by the researcher using Wildlife Computers PC-based software. The results provide the migration path taken by the study animal, depth and temperature preferences of the study animal, as well as oceanographic data in the form of depth-temperature profiles.

*It should be noted that the PAT must be freely-floating in seawater in order to effectively transmit to the Argos system. Transmissions from a PAT that is not floating in seawater and whose antenna is not clear of the water often do not reach the satellite uncorrupted.*

All aspects of the PAT's data collection and transmission are user-programmable.

Data from the PAT also offer insights into attachment failure and animal mortality. The PAT's on-board software includes a "Premature Release" feature. This feature monitors how long the PAT remains at a "constant depth." Constant depth readings imply the PAT is floating at the surface or sitting on the sea floor. Among the parameters set by the user are a threshold duration

and depth variance (in meters). The threshold duration is the longest time a healthy animal should remain at a constant depth, and the depth variance is the number of meters the depth may vary but still be considered “constant” (necessary to account for tidal effects). The PAT recognizes a “premature release” event when it has been at a “constant” depth for longer than the threshold duration.

When the PAT recognizes a premature release, it initiates its release process and begins transmitting, rather than waiting for its release date. This gives you immediate notification that something has gone wrong, the location of the event (via the Argos location of the pop-up site), and minimizes the chances that something will damage the tag between the premature release event and the programmed release date.

### ***What data are collected***

The PAT summarizes the data collected from its depth, temperature and light-level sensors into three types of messages. These messages are stored in non-volatile flash memory for later transmission, or for download if you recover the PAT tag. Any memory unused for the collection of these messages is available for recording the depth, temperature or light-level readings at pre-specified intervals. This is called the archival data.

#### ***Histogram messages.***

The histogram messages are composed of two halves, the first half contains the time-at-depth histogram, the second contains the time-at-temperature histogram for the same time period. The depth histograms are built by counting the number of depth readings (taken at 1 minute intervals) which fall inside 12 pre-specified depth ranges. The user sets these pre-specified depth ranges, and also the time over which these histograms are built (from 1 per hour to 1 per 24 hours). The temperature histograms are similarly built using the temperature data.

#### ***PAT Depth-Temperature (PDT) profile messages.***

The PDT profiles give you a broad idea of the water column through which the PAT tag is passing. The minimum and maximum temperatures recorded at each depth are determined over the same time period used for accumulating the histograms. The message then comprises of:

- The shallowest measured depth and its associated minimum and maximum temperatures
- The deepest measured depth and its associated minimum and maximum temperatures
- 6 further depths and their associated minimum and maximum temperatures. These depths are dynamically chosen to be roughly equally spaced from the shallowest to the deepest depths, and also to be generated for the depths which have the greatest number of readings

The PAT version 4 (PAT4) temperature sensor has a fast response. There is no appreciable lag in the measurement of temperature at any depth.

#### ***Location messages.***

The location messages are used to generate the track of your study animal from release to pop-off. The PAT tag processes the light-level data to correct for depth, and finds the times of dawn

and dusk. Sections of the light-level readings from dawn and dusk, the depths over which the light-level data were collected and a measurement of sea-surface-temperature (SST) form the location message. Note that both the dawn and dusk curves for a given day are included in a single location message (a change from the PAT version 2).

SST is defined as the mode of the temperatures measured for the shallowest “nighttime” readings. If there is more than one mode, the median of these readings is reported for the SST.

The SST is determined by scanning the once-a-minute readings taken over the 24 hours of the associated light-level readings the same location message:

- The data are scanned to find the shallowest reading.
- The data are scanned again to find the darkest reading for which depth is no more than one meter deeper than the shallowest reading
- The data are scanned a third time to find the subset of readings for which depth is within one meter of the shallowest reading, and the light-level is within 15 readings of the darkest shallow reading observed.
- Of this subset, the mode temperature (SST), its related depth, and most common hour of the day when this reading was observed is reported. If there are more than one temperature modes in the subset, the median temperature is reported instead.

### ***Status messages.***

These messages contain diagnostics regarding the PAT’s performance (e.g., number of messages transmitted and battery voltage). In addition, information about the reasons for transmissions prior to the pop-off date caused by a premature release and the state of the attachment pin prior to popoff (i.e., is the pin broken or intact) are included in the status message.

### ***Decoding the messages.***

Wildlife Computers provides several analysis programs, WC-GPE, HexDecode, Instrument Helper, and SATPAK2003, that decode and display both the messages relayed by Argos and data downloaded from a recovered tag.

### ***A word on version numbers***

The PAT’s on-board software can be upgraded. Code upgrades are generally distributed via email. PatHost will be upgraded in parallel. In order to keep the version of on-board software (PatWare) and PatHost working seamlessly together, please note the following:

- The PatWare version numbers are in this format: **x.yy**
- PatHost has version numbers in this format **a.bb.cccc**
- When attempting to communicate with a PAT tag use the following rules:
  - **a** must be the same as **x**

- o **bb** must be greater than or equal to **yy**
- It is best to use highest **cccc** available – see our web site [www.wildlifecomputers.com](http://www.wildlifecomputers.com) for the most up-to-date PatHost

Special care must be taken when communicating with PATs with different versions of PatWare. If you have some PAT2s and some PAT4s, you will need to use two versions of PatHost. All versions of PatHost will refuse to communicate with an inappropriate PAT tag, and tell you why.

## ***New Features Supported by PAT Version 4***

The Version 4 PatWare (on-board software) represents significant changes to the way the PAT is set up, deployed, and transmits data. New features have been added and others removed with the goal to simplify the use of the PAT while improving its flexibility and performance.

This section describes the changes.

### ***Configuration Changes (changes to the way you set up the PAT4)***

- PAT4 can be configured to pop off “N days after deployment”.
  - ‘N’ starts counting when the instrument first sees a depth reading of  $\geq 20$  meters (see Standby Command below).
  - The PAT continues to support a specific popoff date as well as premature release configuration and detection
- PAT4 does not allow you to choose the amount of memory for histograms, profiles, curves, or archival data.
  - PAT4 automatically calculates the necessary amount of space given the configured popoff date or deployment interval
- You do not need to “Re-allocate memory” with PAT4
  - PAT4 automatically re-allocates memory at the start of the deployment (see Standby Command below)
- You cannot set the Argos message “Repetition Rate”
  - PAT4 automatically randomizes the transmissions
- PAT4 does not support “Start with 3 days of only transmitting location data (Loc-3day)”
  - PAT4 has an improved method of ensuring a good light level curve for calibration is received.
- PAT4 does not support “Delayed Deploy”
  - All deployments are essentially “delayed deployments.” Data are not collected until a depth reading of  $\geq 20$ m is encountered.
- You cannot configure the number of outliers for premature release
  - PAT4 automatically picks a reasonable value based on the amount of time involved in premature release detection

### ***When PAT4 Receives a Standby Command (the process and LED flashes), it:***

- Blinks “ZZZ” in Morse Code on the LED to indicate it is going to go to sleep while waiting for a deep depth reading
- Blinks the LED on dim and looks for a depth reading of  $\geq 20$  meters. It repeats this every 11 seconds until such a depth reading is observed
- Blinks the LED brightly 5 times at a one-second interval when a depth reading of  $\geq 20$  meters has been observed
- Erases Flash, blinking the LED every other second
  - This takes several seconds, and allows another confirmation that the PAT recognized it should start collecting data.
- Allocates Flash memory, based on current date and projected deployment termination



- Starts collecting data and immediately begins premature release detection (if configured)

### ***During Deployment:***

- PAT4 generally operates in the same manner as the previous versions of PATs
- PAT4 blinks the LED at each wakeup until it has awakened 256 times
- Although PAT4 collects depth readings once per minute for premature release detection purposes, it only analyzes this data every 16 minutes (to preserve battery)
- If PAT4 finds erroneous external thermistor readings 5 or more times during deployment, it switches over to using the internal thermistor for the rest of this deployment. PDT and Hist records generated after the switch to the backup thermistor have a bit set indicating the switch.

### ***When the Popoff Date is Reached, or Premature Release Is Initiated:***

- PAT4 continues to collect and process data as “During Deployment” above, creating new LOC records which will be transmitted when their time comes
- The current state of the corrosion pin (broken or intact) is remembered, and the corrosion pin is turned on for 9 hours
- Data transmission begins after the pin has corroded for 9 hours
- LOC, Hist, and PDT messages are sent with their respective priorities
  - PAT4 begins transmitting the most recently collected data and moves backwards through the recorded data
- Priority is given to recent Hist and PDT messages in the case of a premature release
  - Hist and PDT messages recorded ‘PRTransmitDays’(a user-defined parameter) prior to the start of the premature release detection interval are transmitted for the first four days.
  - They are transmitted with the same priority as was set for normal Hist and PDT messages. Thus if 50 days of data were collected before a premature release with PRTransmitDays = 5; then the most recent Hist and PDT messages would be transmitted 10 times more often than the remaining Hist and PDT messages. (The same priority is applied to 1/10<sup>th</sup> as many messages).
- A status message is sent every 20 messages. This contains both “before corrosion” state of the pin, the current state of corrosion pin (broken or intact), and current depth and temperature readings.
- The most recently recorded LOC data is sent every 3 status messages
  - These will be the light level curves collected after popoff. Since the PAT is at the surface and Argos locations should be received, these messages will be very useful for the calibration of the light-level curves for geolocation
- Messages are randomly spaced between 54 and 66 seconds apart. The interval is recalculated after each transmission
- If the tag switched over to the internal thermistor, the most significant bit of the message type field for PDT and Hist messages is set. PDT and Hist records stored before PAT4 switched over to the backup thermistor do not have the bit set.

## ***Communication with the PAT***

User parameters are programmed into the PAT via a Windows-based program provided by Wildlife Computers called PatHost (actually, Pat4Host for version 4 PATs). PatHost must be installed on your PC. PatHost has been tested on Windows 2000 and Windows XP. Earlier versions of Windows may or may not work, depending on the configuration of your PC. We do not support other operating systems (e.g., UNIX) or Windows emulators.

Install Pat4Host on your PC from the distribution disk (or from our web site), following the prompts.

PatHost synchronizes communications with the PAT's on-board software. It sends and receives commands to the PAT. Parameters are downloaded from the PAT to your PC. Pat4Host allows you to modify those parameters. Once the parameters are set, they can be uploaded to the PAT.

The PAT is connected to your PC via either a **Blue Box** or **Cable Comm**, available from Wildlife Computers only. Both the Blue Box and Cable Comm connect to a serial port on your PC.

If your PC does not have a serial port, you will need to purchase a USB-to-Serial Port adaptor. Please note that these adaptors are not standardized, and some do not work with the Blue Box/Cable Comm. We have had problems with those made by Belkin. We recommend the Keyspan USA-19QW High Speed USB serial adapter. If you cannot get the Keyspan USA-19QW, the USA-19Q or USA-19HS should also work. Install the USB-to-Serial Port adaptor *before* connecting the Blue Box/Cable Comm.

Regardless of which Keyspan unit you use, if you follow the manufacturer instructions for installation, the adaptor should function properly and communication with the PAT tag will be possible.

Word of note: make sure you install the driver before plugging in the adaptor. Otherwise it sometimes confuses the laptop in the serial port assignment.

For laptop users, we suggest you set everything up on your new laptop before heading out to the field. The configurations of the new laptops are more complex, and one thing we've found is that sometimes the USB-to-Serial gets assigned to a COM port greater than 4. The new host program now supports these higher COM port numbers, but it is always advisable to make sure that your PC and all connections function properly before you leave the lab.

## ***Configuring PatHost to Your PC***

Each time you start PatHost, you will be greeted with a Welcome screen.



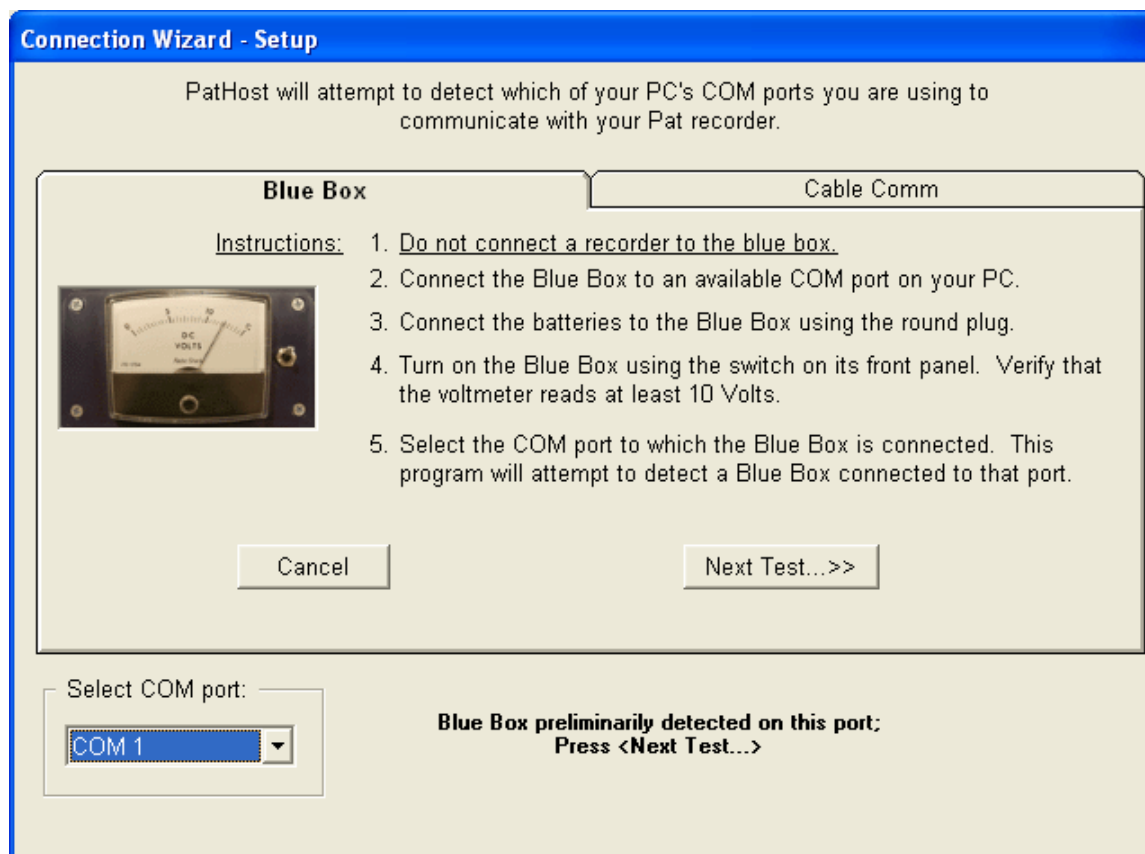
### ***Define which COM port to use***

The first time you run PatHost, you will need to configure the program by telling it which COM port to use to communicate with the Blue Box/Cable Comm. Click the Configure button to start the Connection Wizard.

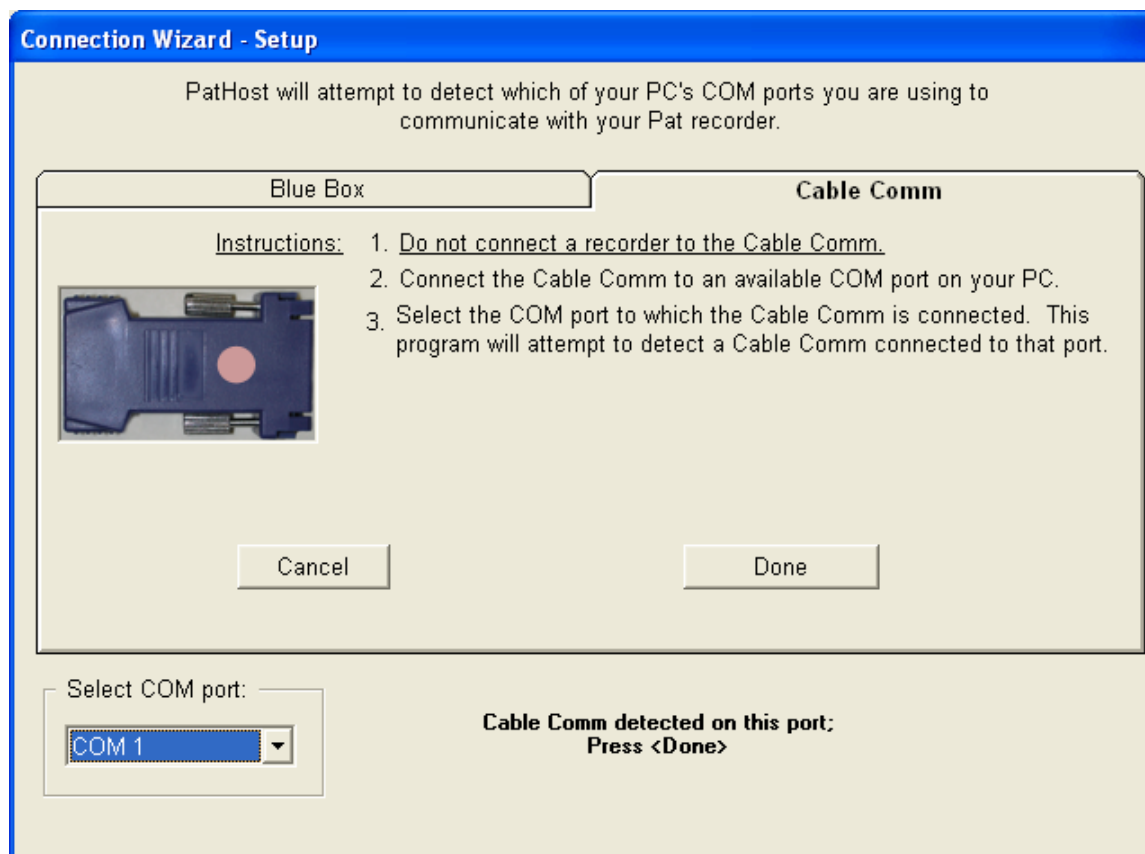
If you are using a Blue Box, follow the prompts on the Blue Box tab. If you are using a Cable Comm, follow the prompts on the Cable Comm tab.

Once PatHost is properly configured, you will be returned to Welcome Screen.

When using a Blue Box, follow the prompts on this tab.



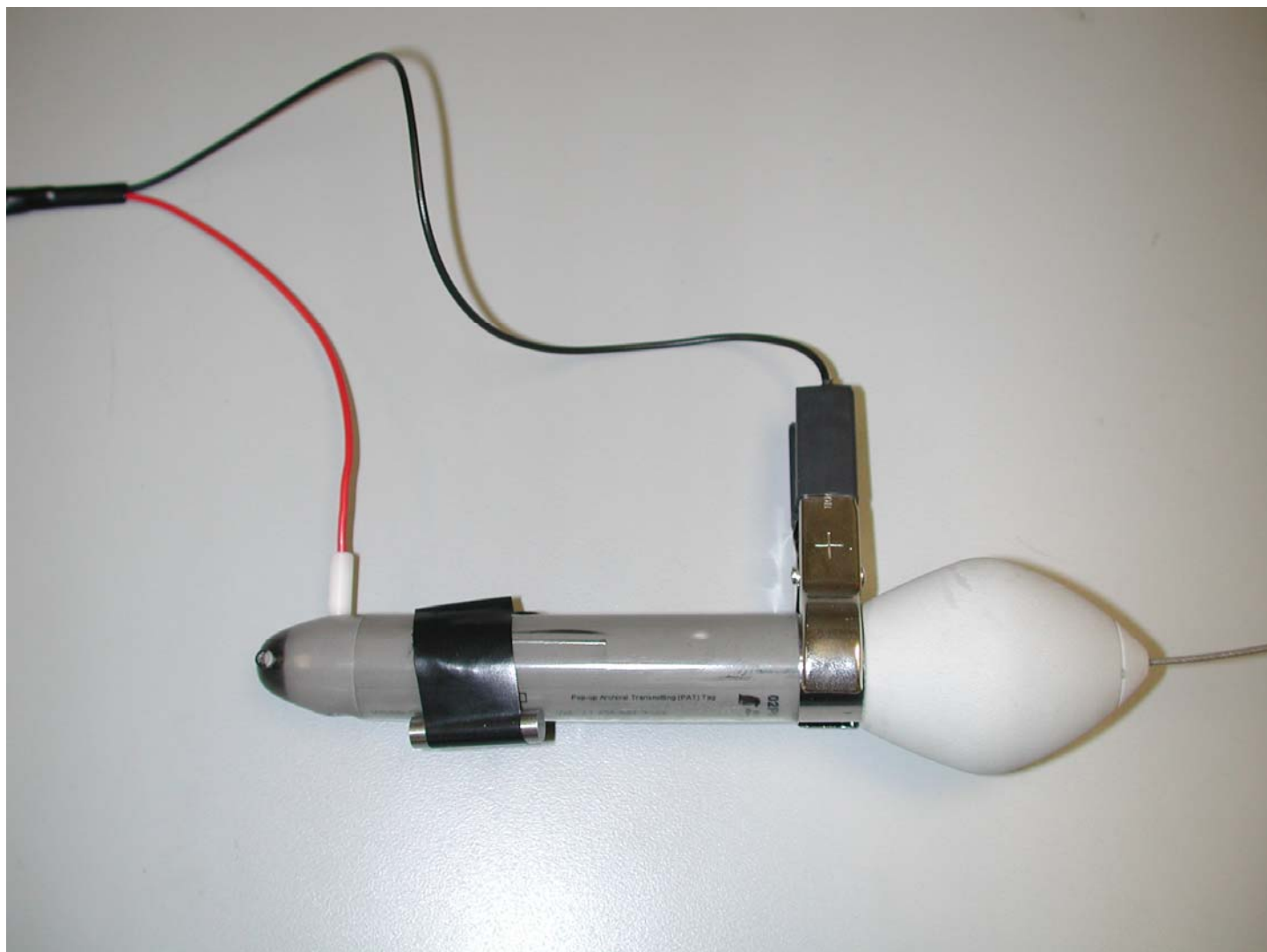
When using a Cable Comm, follow the prompts on this tab.



## ***Connecting the PAT to your PC***

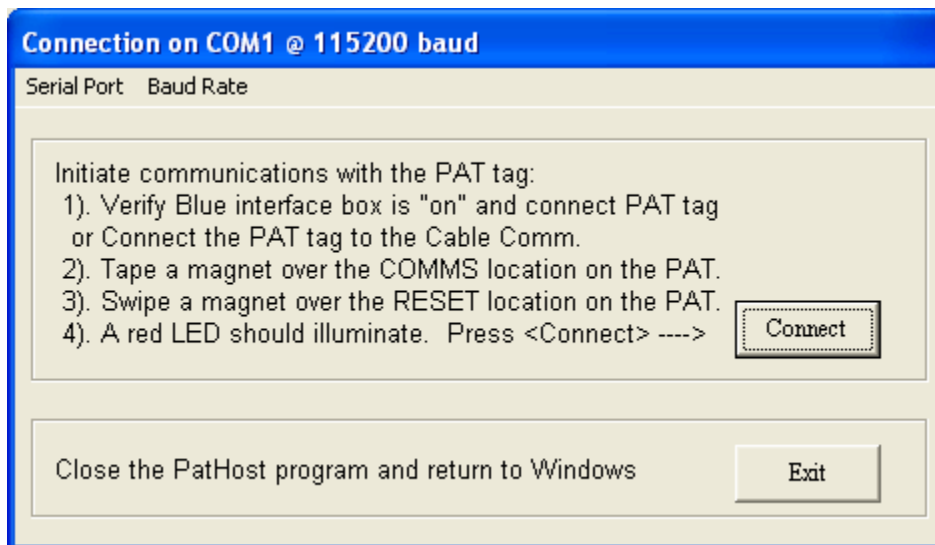
Connect the PAT Communications Adaptor to the PAT as shown below.

1. Tape a magnet as indicated by the “COMMS” word on the PAT label.
2. Attach battery clip so that the word “RESET” on the PAT label is visible and centered between clip jaws.
3. Push red wire on to the external pin (this is also the temperature sensor).
4. Connect the end of the PAT Communications Adaptor cable to Blue Box ribbon cable or grey cable from the Cable Comm.



## ***Initiate Communications with the PAT***

Follow the instructions displayed on the Connection screen. Note that if the cables between the PC, Blue Box/Cable Comm and PAT are connected correctly a LED on the PAT will glow. The LED must be glowing before clicking the Connect button. PatHost may display additional prompts if there are difficulties in establishing communications.



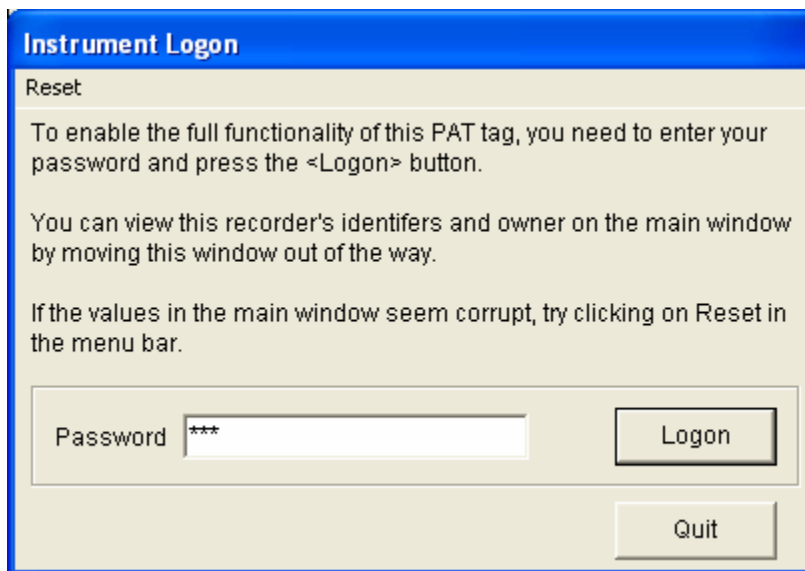
***IMPORTANT:*** Note that anytime the PAT is connected to your PC and the LED is glowing, power is being drawn from the PAT's internal battery. Do not leave the PAT connected for extended periods of time. Leaving a PAT connected for 3 days will drain the battery such that it will not have enough power left to transmit any data at the end of a deployment!

## ***Log onto the PAT***

After initial communications are established, you need to Logon to your PAT tag. You must correctly enter your password and log on as Owner in order to read and update information from the PAT. ***The default password for all PAT tags is PAT.*** The password is not case sensitive.

You can change your password any time after you have logged on as a user. Acceptable passwords include entries up to 31 characters. If you forget your password, you will have to return the tag to Wildlife Computers so we can reset it.

If you do not know the password, you will only be able to see the information on the General Tab (see below), and you will have to move the Instrument Logon window out of the way to do so. You cannot change any data on the General Tab, or access any of its functions. Your only option after viewing the General Tab is to click on Quit.



The image shows a software dialog box titled "Instrument Logon". It has a blue header bar with the title. Below the header, there is a "Reset" button. The main text area contains three paragraphs: "To enable the full functionality of this PAT tag, you need to enter your password and press the <Logon> button.", "You can view this recorder's identifiers and owner on the main window by moving this window out of the way.", and "If the values in the main window seem corrupt, try clicking on Reset in the menu bar." At the bottom, there is a "Password" label next to a text input field containing three asterisks (\*\*\*). To the right of the input field is a "Logon" button. Below the input field and "Logon" button is a "Quit" button.

**Instrument Logon**

Reset

To enable the full functionality of this PAT tag, you need to enter your password and press the <Logon> button.

You can view this recorder's identifiers and owner on the main window by moving this window out of the way.

If the values in the main window seem corrupt, try clicking on Reset in the menu bar.

Password

Logon

Quit



## Navigating through the Tabs

### General Tab - Parameters and Functions

**PatHost for Version 4.01 tags - Owner - 01P0235**

Menu: Password Time Resync Options Maintenance Help

Tabs: General Testing Data Collection Data Transmission Pop-up Date Exit Data Retrieval Audit Paths

**Identification Information**

|                   |                                                                                  |
|-------------------|----------------------------------------------------------------------------------|
| System id         | 01P0235                                                                          |
| User's identifier | ...                                                                              |
| Argos PTT number  | 20548 (41103 Hex)                                                                |
| Repetition Rate   | 60 (+/-6) seconds                                                                |
| PatWare Version   | 4.01e                                                                            |
| Owner             | Wildlife Computers<br>16150 NE 85th Street<br>Suite 226<br>Redmond, WA 98052 USA |
| Configuration     | Slow LL; no PinBrokeSensor                                                       |

**PAT's Date and Time**

GMT Date: 29 Jul 2004  
GMT Time: 17:22:52

Buttons: Re-Read Change...

**Last Deployment Information**

Bytes of Archived data: 0  
Bytes of Location messages: 0  
Bytes of Histogram messages: 0  
Bytes of PDT messages: 0  
Number of messages transmitted: 0

Buttons: Save Setup Recover Setup Create Report

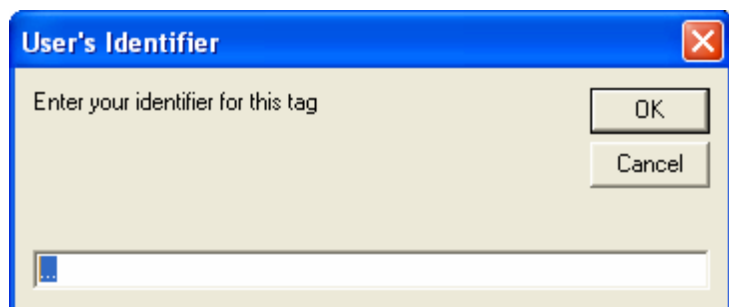
This screen displays basic information for the PAT. It also allows you to change the User's identifier ("..." is the default) and time. You can also create a report to archive the PAT's parameters, as well as save the parameters to be subsequently loaded into other PATs.

The **SAVE SETUP** button is useful if you are setting up a series of PAT tags and wish them all to have the same (or very similar) setup. Setup the first PAT tag and then click this button. As long as you don't leave PatHost, you can use the **RECOVER SETUP** button on subsequent PAT tags to set all of the user-configurable parameters to be the same.

**OWNER** will reflect the specific contact information for each individual user.

***Set User's Identifier***

The User's Identifier is for identification purposes only. Click the words "User's Identifier" to change this parameter. Acceptable identifiers include entries up to 31 characters.



## Set PAT Time and Date

It is important to accurately set the PAT time to GMT. Neglecting to do so will make subsequent data analysis more difficult. The time displayed on the General Tab screen is from the PAT's clock. This display can be refreshed (re-read from the PAT by clicking the **RE-READ** button on the General Tab screen.

There are two ways to set the PAT's clock. The best and most accurate way is to use the clock on your PC. First ensure the clock on your PC is accurate.

Click the **CHANGE** button on the General Tab screen to bring up the window to set the PAT's clock.

**Set PAT Time and Date**

Change GMT Offset

The PAT time and date need to be set Greenwich Mean Time (GMT), also known as Universal Time (UT). If you do not set this accurately, the location of your animal cannot be determined accurately when the PAT transmits its data.

The recommended ways to set the time are:

- 1) Synchronize a good watch with GMT using a known time signal (telephone or radio)  
Set the time and date below to values a little ahead of your watch  
When the time entered below matches your watch, press the  
<Update PAT Clock from Manual Entries> button

or

- 2) If your host computer has been synchronized recently to a standard time reference  
(either manually or using a 3rd-party program and your computer's modem)  
Press the <Update PAT Clock from your Computer's Clock> button

GMT Time and Date have been primed with values from your PAT recorder; these are probably wrong and need updating

GMT Time: 14:29:27

GMT Date: 24 Feb 2004

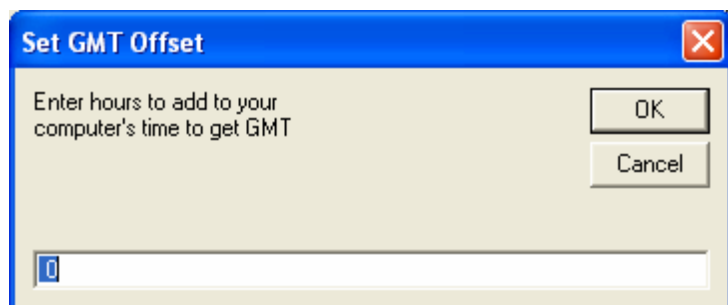
Update PAT Clock from Manual Entries

Update PAT Clock from your Computer's Clock  
using 8 hour offset

Cancel

If your PC clock is not set to GMT, select **CHANGE GMT OFFSET** at the top left of the screen.

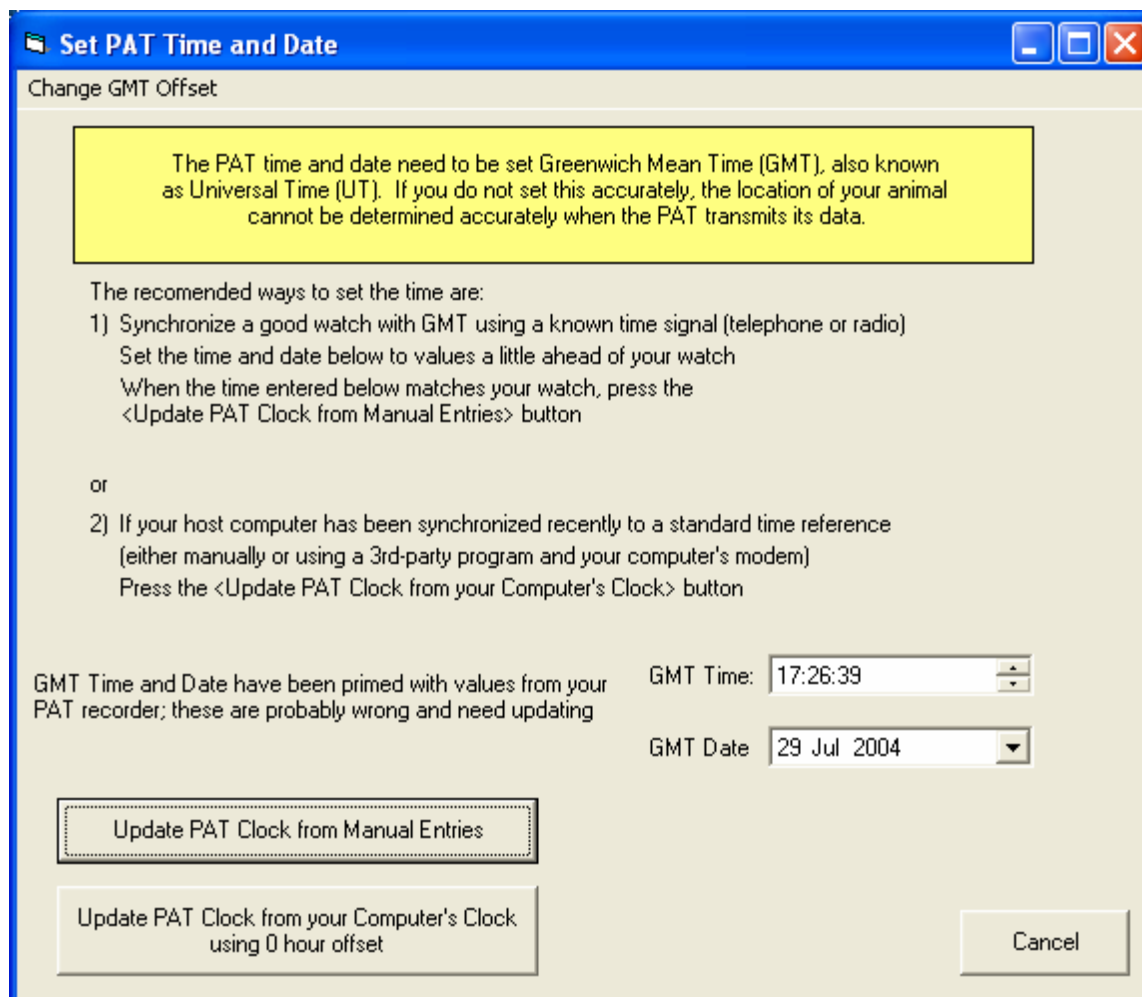
Use the *Set GMT Offset* dialog box that pops up to tell PatHost how to adjust the time on your PC to GMT.



Enter offset number and click **OK**, which will also update the offset number in the box at the lower left of the *Set PAT Time and Date* screen.

Click on the **UPDATE PAT CLOCK FROM YOUR COMPUTER'S CLOCK USING N HOUR OFFSET** to complete the clock update process.

Alternately, click on the **UPDATE PAT CLOCK FROM MANUAL ENTRIES** after entering the appropriate values where indicated.



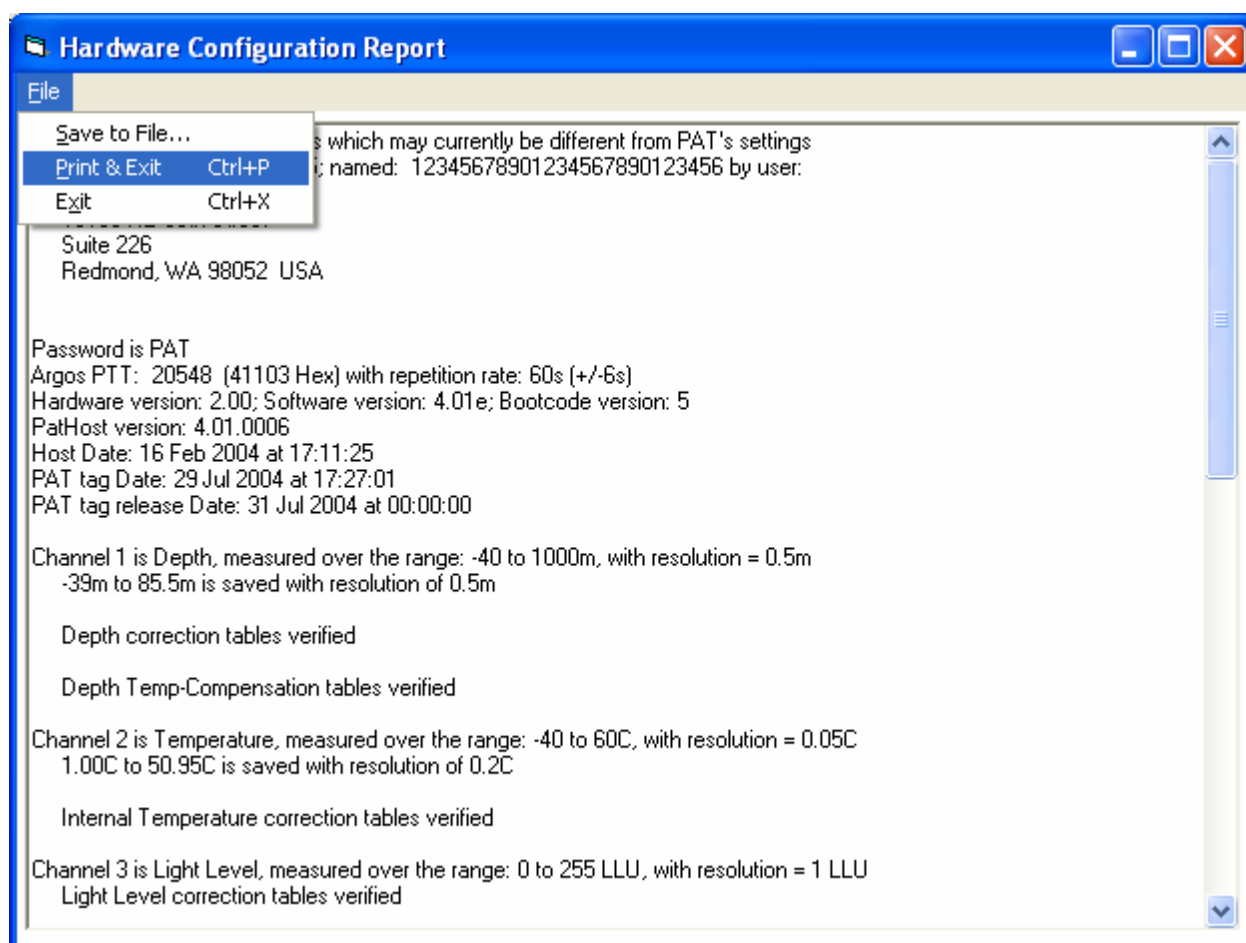
## Create Hardware Configuration Report

It is important to archive the configuration of the PAT (versions, parameters) prior to deployment so that they can be used to correctly analyze the data. Click the **CREATE REPORT** Button. The following screen will display the configuration of the PAT that is held by PatHost.

The *File* menu item allows you to save and/or print this report.

*You should always save a copy of the report and review all parameters before deployment. The success of your experiment depends upon the correct setup of all parameters.*

Note that selecting this configuration report function only displays the PAT parameters stored on the PC, not necessarily on the PAT, and does not perform any upload function. When running the report, the PatHost will indicate if the report shows a change from what is on the PAT. If so, be sure to save the changes when you exit or standby.



## Testing Tab – Verify Sensors, Corrosible Link, Argos Transmitter

The Testing tab allows you to verify the sensors, corrosible link (attachment pin) and transmitter are functioning correctly.

PatHost for Version 4.01 tags - Owner - 03P0428

Password Time Resync Options Maintenance Help

General Testing Data Collection Data Transmission Pop-up Date Exit Data Retrieval Audit Paths

**Test Sensors**

|                   |       |
|-------------------|-------|
| Depth             | 0.0   |
| Temperature       | 23.45 |
| Light Level       | 150   |
| Release Pin       | 0     |
| Battery Voltage   | 3.54  |
| Depth Temperature | 24.15 |

Test

**Test Corrosional Link**

Start Test

Click button to start corrosional link test. A voltmeter connected between the ground ring and the corrosional link should indicate about 3.5 Volts when test is active. Test stops after 1 minute, or if when another command is processed by the PAT tag

**Immediate Test of Argos Transmitter**

Bytes in test message: 8 *TestLength*

Transmit Lowest battery voltage in transmission = 3.39 Volts

**Unattended Test of Argos Transmitter**

Delay Between Transmitters = 2 seconds

Test Transmitter

**Test Sensors.** Click the **TEST** button to display the current readings of all the PAT sensors. Verify that they are reasonable values.

Depth: -5 to +5m (the depth will auto-zero during the deployment)

Temp: current temperature

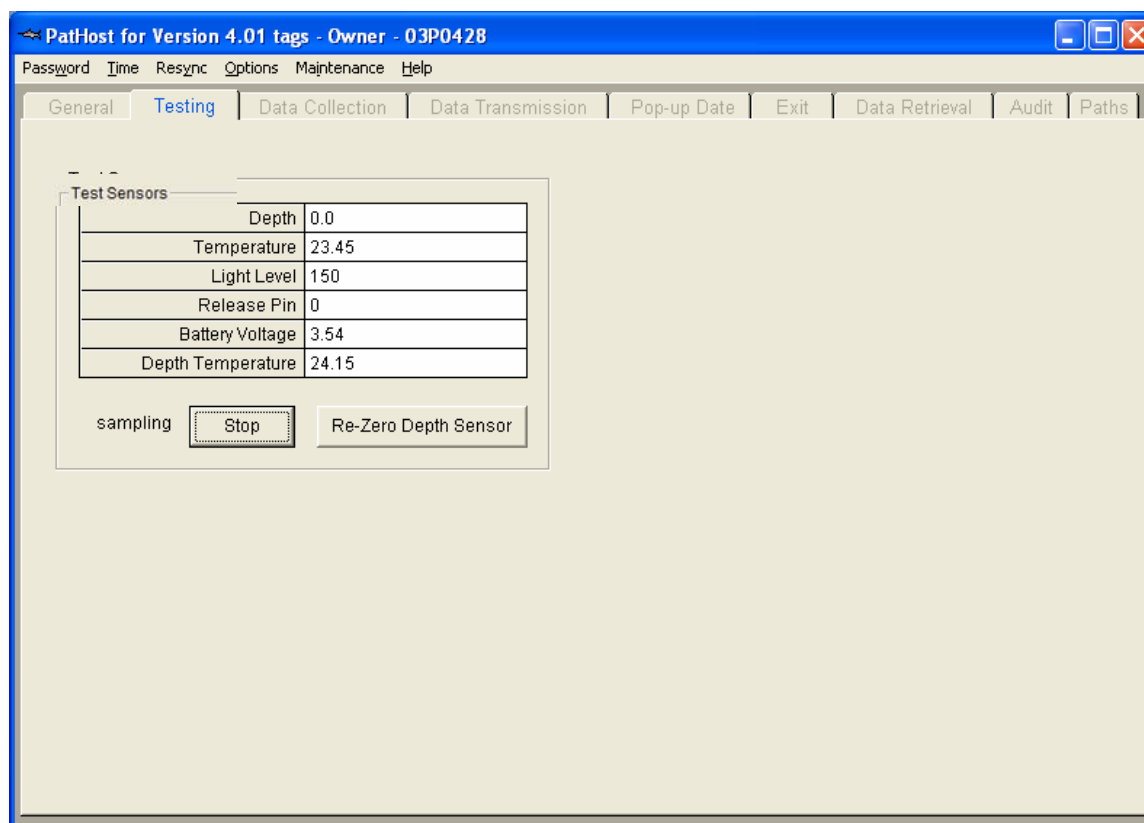
Light Level: ~50 (cover light sensor) to ~180 (bright room)

Release Pin: < 5 (indicating release pin is intact)

Battery Voltage: greater than 3.0V

Depth Temperature: current temperature

You can manually re-zero the depth sensor by clicking on the **RE-ZERO DEPTH SENSOR** button.



**Test Corrosional Link.** Click the **START TEST** button. Voltage can be measured between the ground ring (silver ring below the float) and the attachment pin.

**Immediate Test of Argos Transmitter.** Click the **TRANSMIT** button to immediately initiate a transmission. You can detect the transmission with an Argos uplink receiver, or any receiver that is sensitive to 401.65 MHz. You may need to hold the ground ring in your fingers during this test to ground the transmitter. The battery voltage during the transmission will be displayed. This should be 3.0V or greater when you are holding your fingers around the ground ring.

**Unattended Test of Argos Transmitter.** This is used to verify the operation of the Argos transmitter and to verify the correct setup of the PAT's Argos PTT id with Service Argos. It is not generally necessary to perform this test, as it is done in our lab prior to shipment to you. You may want to perform this test, however, if the PAT was not tested using your PTT id, or has been stored for several months. The tag will have to be placed in a reasonably large body of saltwater (e.g. a pool or lagoon) to correctly send test transmissions through the Argos satellite. The **DELAY BETWEEN TRANSMITTERS** ensures PATs are not transmitting at the same time when testing multiple PATs. Click **TEST TRANSMITTER** to initiate the test. Time this test for a time of day when you know satellites will be in view.

To determine when the satellites will pass overhead, we suggest using the web-based program called J-Pass 2.0 (<http://liftoff.msfc.nasa.gov/RealTime/JPass/20>) to calculate hours of satellite coverage for the Argos satellites.

To use the J-Pass 2.0 program:

On the Location tab, enter the latitude and longitude, and adjust the time for GMT

On the Control tab, select the drop-down selections: Satellites=Custom, Search Criteria=Custom, Start from=Today (or whatever your start date)

On the Satellite tab, select: Select method=manual select, Visual magnitude=no limit, then choose the NOAA 11, 12, 14, 15 and 16 satellites

On the Search tab, select: Minimum Elevation=20, Minimum Lit Duration=3 minutes, all times of day

Go back to the Control tab, and click Start.

Note that this program does not reflect the most recent Argos satellites (current info as of September 2003). Thus, actual satellite coverage will probably be a bit better. You can also contact Service Argos and see if they can provide more accurate hours of coverage (hours that include the most up-to-date details for all the satellites).



## ***Data Collection Tab – Program how data are collected***

The PAT has a total of 2 Mbytes of memory. This memory is first used to store the summarized data for transmission at popoff time. The remaining memory is used to store archival data.

The PAT collects data for the histograms at a fixed one minute sampling rate.

**PatHost for Version 4.01 tags - Owner - 01P0235**

Password Time Resync Options Maintenance Help Update PAT

General Testing **Data Collection** Data Transmission Pop-up Date Exit Data Retrieval Audit Paths

**Archival**

|                   |       |     |
|-------------------|-------|-----|
| Depth             | 10    | Sec |
| Temperature       | 10    |     |
| Light Level       | 10    |     |
| Release Pin       | never |     |
| Battery Voltage   | never |     |
| Depth Temperature | 10    |     |

PAT tag will "wake-up" to check if it is time to take an archival data sample every 10 Sec

**Transmitted Data**

Histograms

☒ Time-at-Depth

☐ Time-at-Temperature

Enter upper limits of histogram bins in meters

|  | Low   | High  |
|--|-------|-------|
|  | -40   | -1.   |
|  | -0.5  | 10.   |
|  | 10.5  | 50.   |
|  | 50.5  | 100.  |
|  | 100.5 | 150.  |
|  | 150.5 | 250.  |
|  | 250.5 | 350.  |
|  | 350.5 | 450.  |
|  | 450.5 | 550.  |
|  | 550.5 | 650.  |
|  | 650.5 | 750.  |
|  | 750.5 | 1000. |

Hours of data summarized in each histogram and PDT 12 Hist-Hrs

Histograms and PDTs start at hour 0 Hist-Offs

Read from file Save to file

Drift-Corr ☒ Enable automatic correction of depth transducer drift

**Archival.** You can set the sampling rate for the archival data. The archival data can be retrieved if the PAT is recovered (e.g., washes up on a beach). Click the light-colored boxes to change the sampling interval of the various channels. Generally you will want to sample only Depth, Temperature and Light Level during a deployment. The other three channels are available for testing purposes.

**Transmitted Data.** The histogram data shows the percentage of time the PAT was within certain depth ranges (Time-at-Depth) and temperature ranges (Time-at-Temperature). There are 12 available ranges (bins) for both depth and temperature. Set the upper limit for each bin. PatHost will calculate the lower limits. PatHost will also sort the bins numerically.

You can save these bin limits to a file for recall on a subsequent tag using the **READ FROM FILE** and **SAVE TO FILE** buttons.

You can set the number of hours of data that are summarized in each histogram (Hist-Hrs). PDTs use the same summary period as the histograms. Note that the duration of the deployment dictates the likelihood that all the collected histograms and PDTs are received by the Argos system.

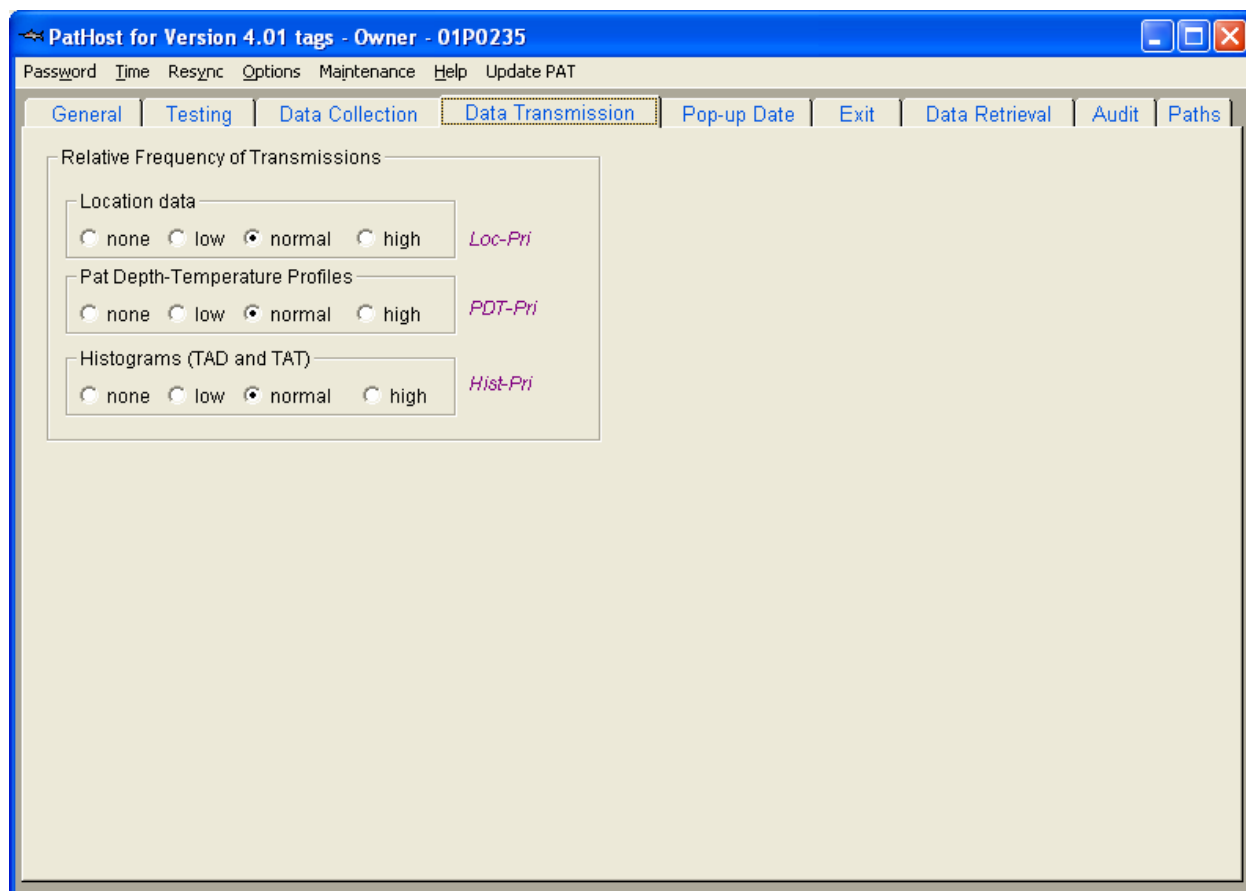
A PAT is expected to make 10,000 transmissions, of which about 1,000 will be received by the satellite uncorrupted.

If you set Hist-Hrs to 1, it takes 24 messages to store one day's worth of depth and temperature histograms, and 24 messages for the PAT Depth-Temperature Profiles (PDTs.) Thus, it would take just over 50 messages to cover a day's worth of data (24 histograms, 24 PDTs, one location message, a couple of status messages). In a perfect situation, 20 days of collected data would be received through Argos (1000 divided by 50). Given things never go perfectly, 10 days is a better estimate. Thus if you have a 10 day deployment, you can use one hour histograms. You can still use one hour histograms for longer deployments if your experiment needs that granularity of data and can have "holes" (times for which no data were received) in the dataset.

***Drift-Corr.*** The PAT will automatically correct for long-term drifts of the pressure transducer when this parameter is checked. *We recommend this box is always checked.*

### ***Data Transmission Tab – Program how messages are transmitted***

This tab allows you to set the relative priority you wish to give the various types of data. Setting the priority to “none” will suppress all transmissions of that type, and “low,” “medium” and “high” will transmit 1, 2 or 3 of these types of data respectively, before moving onto the next type.



## ***Pop-up Date Tab – Program when the PAT should release***

The PAT can be set up to release either on a specific date and time, or after a specified number of days after activation. Note that in both cases the release setting indicates the initiation of the “burn phase” during which the corrosible link is corroded away. The burn time is 9 hours. The PAT begins transmissions after the burn time is concluded.

### ***Release on a specific date***

Use the calendar and hour box to set the release date.

**PathHost for Version 4.01 tags - Owner - 01P0235**

Password Time Resync Options Maintenance Help Update PAT

General Testing Data Collection Data Transmission **Pop-up Date** Exit Data Retrieval Audit Paths

**Intended Release Setup**

☒ Release on specified date ☐ Release Specified days after tag goes deeper than 10 meters

July 2004

| Sun | Mon | Tue | Wed | Thu | Fri | Sat |
|-----|-----|-----|-----|-----|-----|-----|
| 27  | 28  | 29  | 30  | 1   | 2   | 3   |
| 4   | 5   | 6   | 7   | 8   | 9   | 10  |
| 11  | 12  | 13  | 14  | 15  | 16  | 17  |
| 18  | 19  | 20  | 21  | 22  | 23  | 24  |
| 25  | 26  | 27  | 28  | 29  | 30  | 31  |
| 1   | 2   | 3   | 4   | 5   | 6   | 7   |

Hour: 00

Release on: 31-Jul-2004 at 00:00

**Premature Release Setup**

The PAT tag thinks it has released prematurely or the fish has died if it stays at a constant depth (either the surface or the seafloor) for a long time. It will then corrode off its tether and start transmitting.

Hours permissible at a constant depth before PAT starts to corrode off its tether: 24 (PRHours)

PAT thinks it is at a constant depth even if depth varies within this range: 8m (PRError)

Release even if there are a few outliers (3 for PRHours = 24): ☒ (PROutlier)

Must be at surface to be a premature release: ☐ (PRSurf)

If PAT releases prematurely: Initially transmit the Histogram and PDT messages collected immediately preceding the premature release event with doubled priority. Number of days of messages to transmit with doubled priority: none (PRDPDays)

### ***Release after a certain number of days***

Note that midnight GMT is the start of a day. Thus, if the PAT is activated at 2200 GMT, it will consider it has been deployed for one day two hours later (at 00 GMT).

### ***Premature Release***

The PAT's on-board software includes a "Premature Release" function, which can offer insights into attachment failure and animal mortality. This function monitors how long the PAT remains at a "constant depth" and determines a premature release has occurred if it is at a constant depth for too long a period. When the PAT recognizes a premature release, it initiates its release process and begins transmitting, rather than waiting for its release date. This gives immediate notification that something has gone wrong, the location of the event (via the Argos location of the pop-up site), and minimizes the chances that something will damage the tag between the premature release event and the programmed release date.

***PRHours.*** Constant depth readings imply the PAT is floating at the surface or sitting on the sea floor. This parameter determines how many hours must be spent at a "constant" depth before the premature-release function is initiated. Set this to a value greater than the longest time a healthy

animal should remain at a constant depth. Set this to “never” if you wish to disable this feature completely (e.g., you are studying an animal who may be in very shallow water, thus the depth is expected to remain constant). You can set this to values between 24 hours and 192 hours (8 days).

**PRError.** This parameter is the number of meters the depth may vary but still be considered “constant”. This is necessary to account for tidal effects and the variability in the depth sensor (sometimes  $\pm 1$  meter). A tag resting on the bottom may still see its depth changing as the tide moves in and out. This parameter is the total range of depth that will be considered “constant”.

**PROutlier.** This parameter allows for unexpected depth outlier readings caused by unpredictable events, and ignores these readings. For a selected number of PRHours, an appropriate number of outliers are calculated and displayed in the description. *We recommend that this parameter always be enabled.*

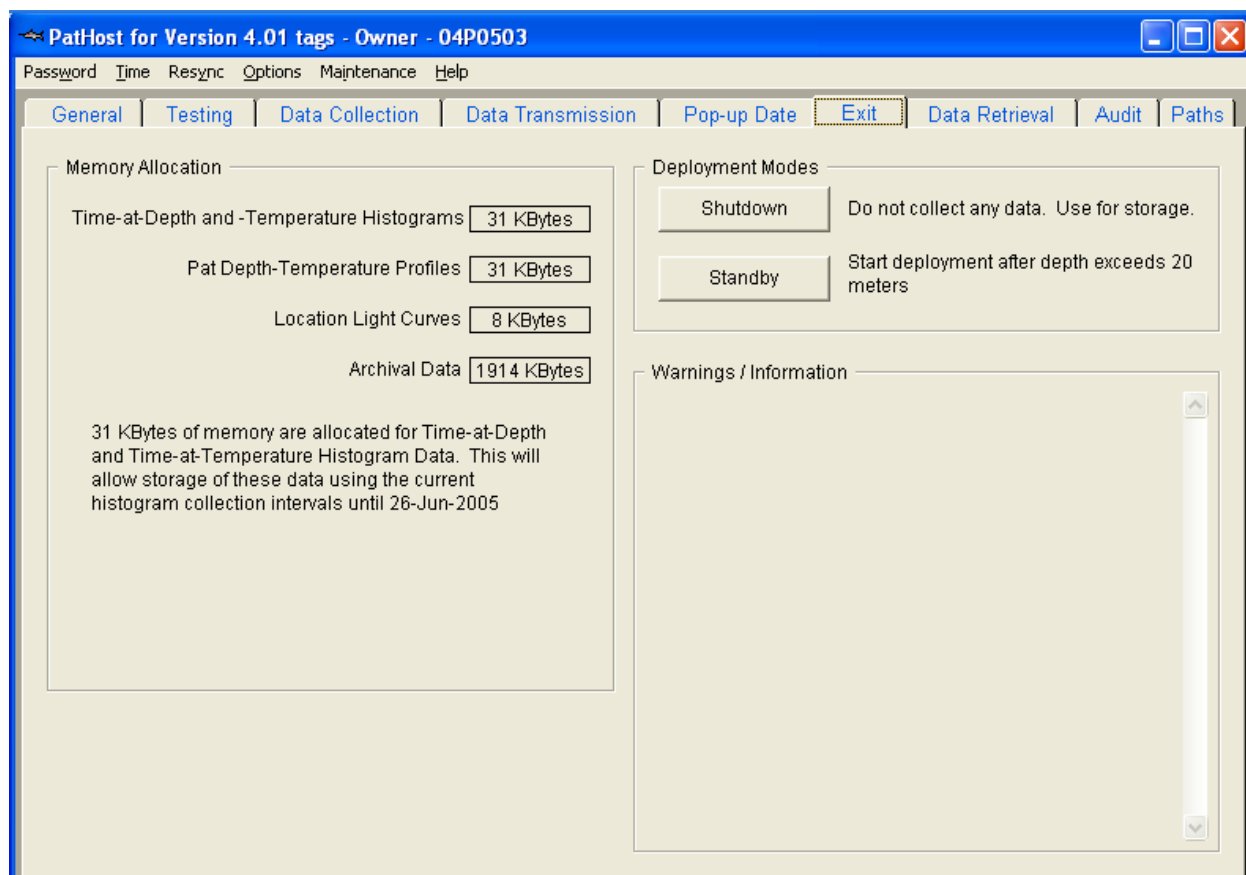
**PRSurf.** Enable this parameter if your study animal remains at a constant depth (e.g., a bottom fish), and a premature release should only be indicated if the PAT is at the surface for too long.

**PRDPDays.** The data collected during the days prior to the premature release might offer insight as to the cause of the premature release. This parameter allows you to set the number of days of data collected prior to the premature release event to be transmitted with a higher priority.

### **RD1800 Release Device**

Wildlife Computers has developed a mechanical guillotine, called the RD1800, that prevents the PAT from being dragged to depths that would crush it. The RD1800 instantly severs the tether when the depth exceeds 1800m. This releases the PAT so that it floats to the surface. The Premature Release feature eventually recognizes a “constant depth” situation and initiates transmission. Thus the PAT will transmit even in the event of attachment failures, animal mortality or unexpected animal behavior.

## ***Exit Tab – Shutdown or Standby the PAT***



### ***Memory Allocation***

This section summarizes how memory will be allocated when the PAT starts data collection based on current user-defined parameters. As you drag the cursor over each data category, PatHost will provide an informational message pertinent to that data type.

### ***Deployment Modes***

**SHUTDOWN.** This “turns off” the PAT. No data are collected, no sensors are monitored. The clock remains powered, however, and the parameters are maintained.

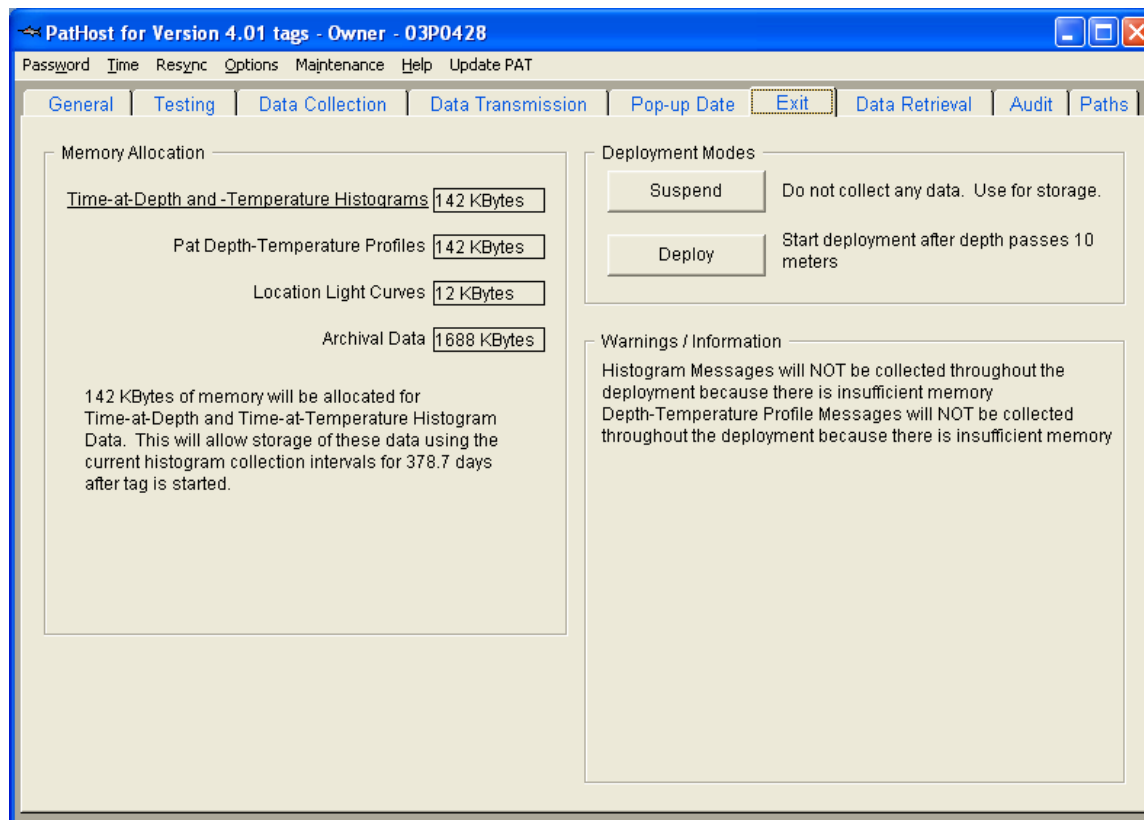
**STANDBY.** This prepares the PAT for deployment, but does not initiate data collection or premature release detection. When in standby, the PAT will blink “ZZZ” in Morse code to indicate it is going to “sleep”. It will “wake up” every 11 seconds, looking for a deep reading (pressure on the pressure transducer). The LED flashes faintly when the PAT wakes up looking for the deep reading.

### ***Activating the PAT***

- To activate the PAT, press on the depth sensor with your thumb through a wake up flash as described above and continue the pressure for > 5 seconds. The *LED will give 5 bright flashes at 1 second intervals* to indicate the tag is recognizing increased pressure. *If you release pressure before 5 seconds, the PAT will go back to standby mode.*
- After the PAT has recognized an increase in pressure over the 5 second period, the *LED will stay on for approximately 5 seconds*. This indicates the PAT is activated
- The PAT then erases memory and allocates memory based on the programmed criteria. *The LED will flash every other second during this 15-30 second period.*
- The PAT starts collecting data and begins premature release detection (if enabled) at the first whole minute after memory is erased and allocated. The LED will produce a *single or double blink (depending on the hardware configuration) 255 times at the sampling interval set for the archival data*. The LED will cease blinking after the 255 flashes.
- Note that there may be a delay after the 15-30 second activation flashes and the beginning of the double-blink sequence while the PAT waits for its clock to reach a whole minute.
- ***Be careful with magnets.*** Never put the magnet near the reset location indicated on the PAT label unless you want to shutdown the PAT. Passing a magnet over the reset location will shutdown the PAT. You will need to communicate with the PAT to put it in standby mode again.



## Warnings/Information



Generally this area of the screen will be blank. If, however, PatHost detects that current parameters will prevent either histogram or archival data from being collected for the full length of the deployment, a warning will be displayed. The user then has the option of changing either histogram or archival data sampling parameters. The PatHost does not require the user to make a change.

Other reasons for a warning to be displayed may include:

- if you have set up the tag to NOT transmit any of the particular types of data.
- if you set up the tag for a popoff date more than a year in advance. It will ask you to contact us before proceeding with the actual deployment.

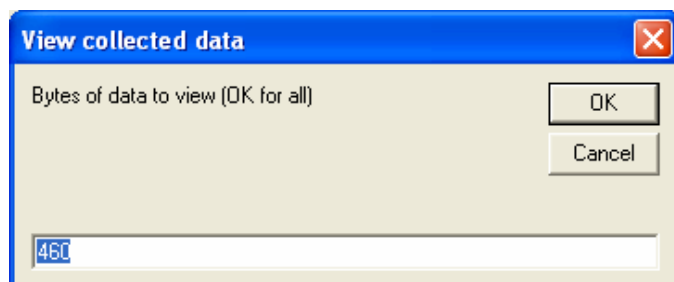
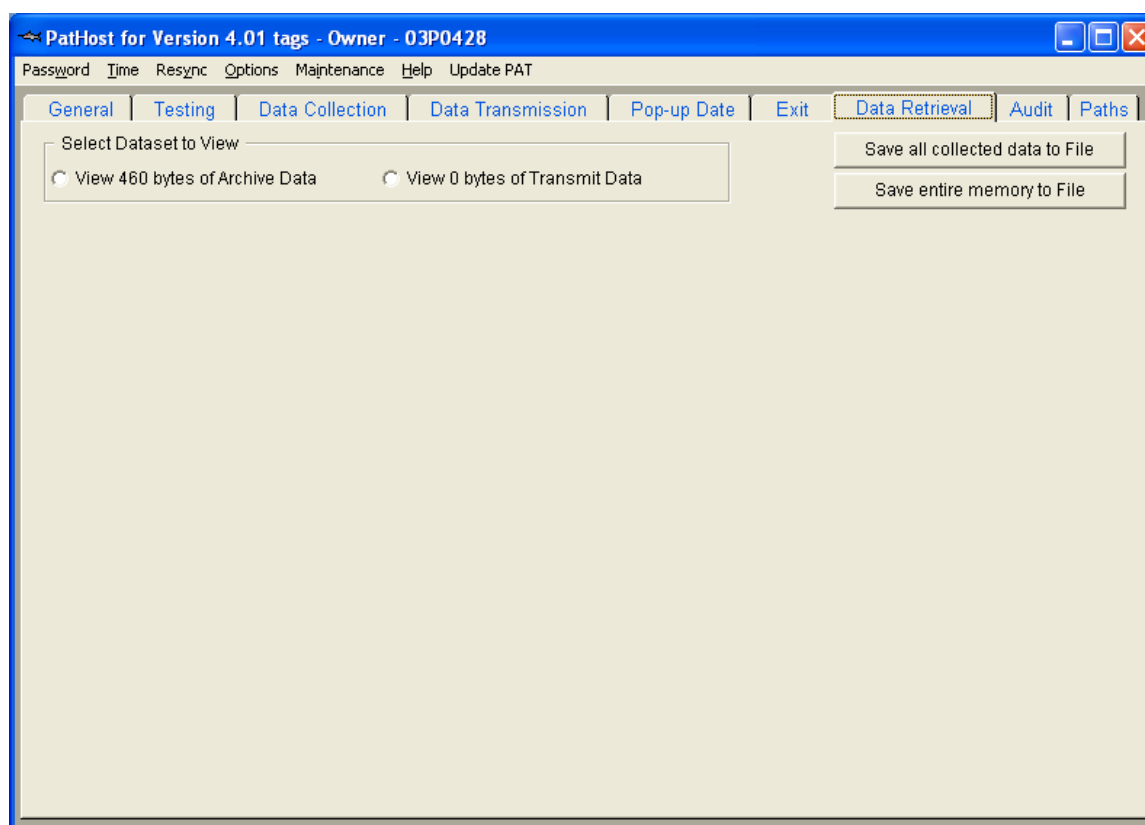
A major warning will be displayed if you set up the tag for a popoff date equal to the current date.

## ***Data Retrieval Tab – Download collected data from the PAT to your PC***

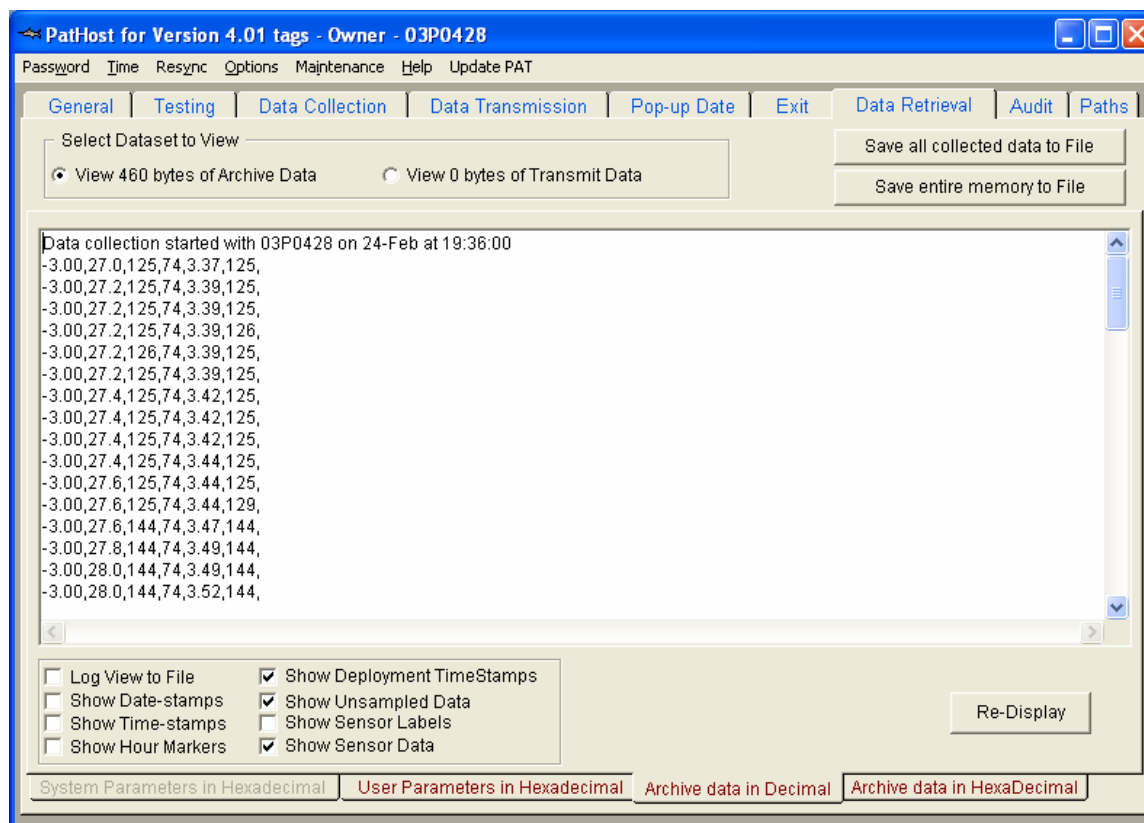
Both the archival and histogram data can be viewed by PatHost, and saved to a file. Viewing the data does not save the data to a file. Select to view either *Archive Data* or *Transmit Data*.

**SAVE ALL COLLECTED DATA TO FILE.** The PAT maintains a pointer that indicates address in memory where the collected data end. Pressing this button writes the data up to this pointer to the file. This is useful if you are testing the PAT and don't want to take the extra time to write the entire memory to a file.

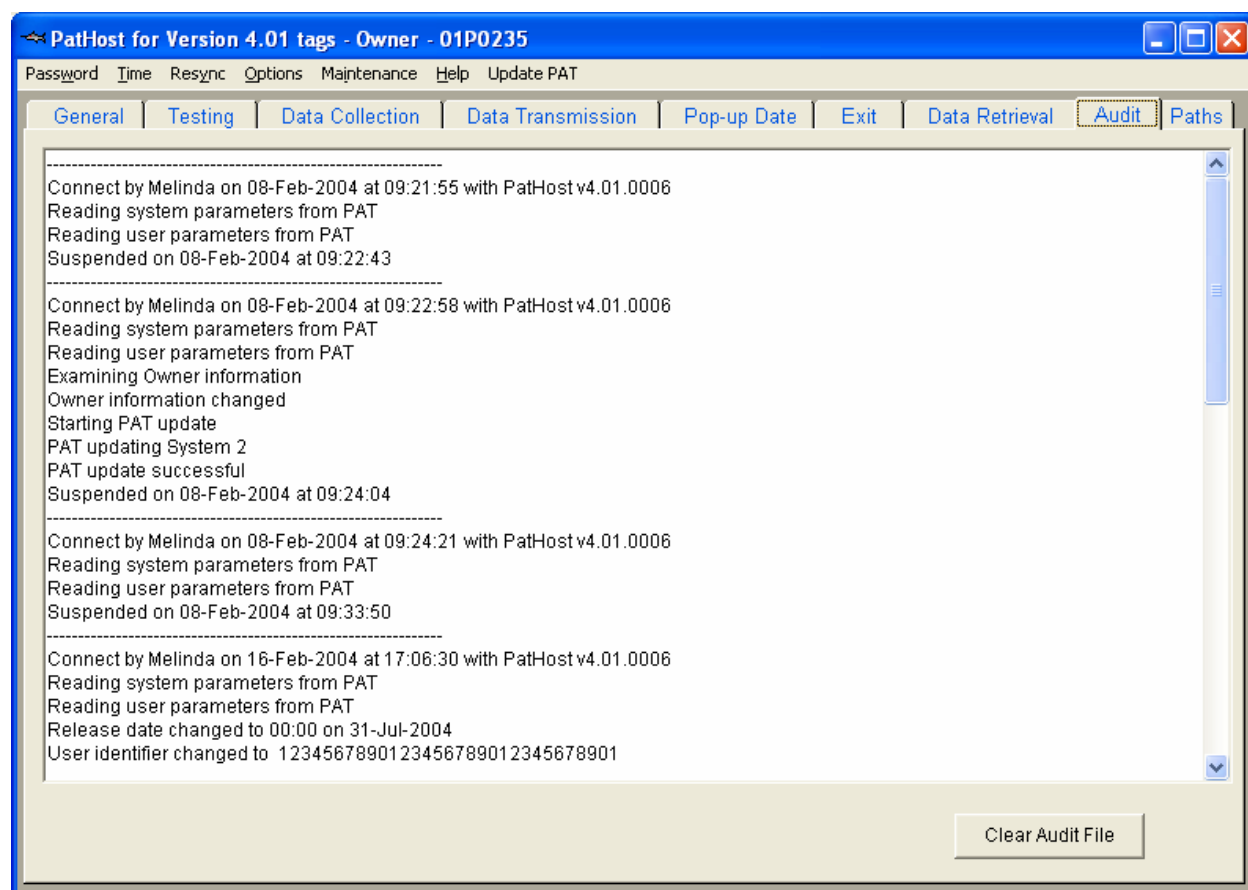
**SAVE ENTIRE MEMORY TO FILE.** Use this button for PATs that have been recovered after deployment. This ensures that, even if the pointer were corrupted, all memory is written to the file. You might even want to save the entire memory to a file twice to ensure the download was successful.



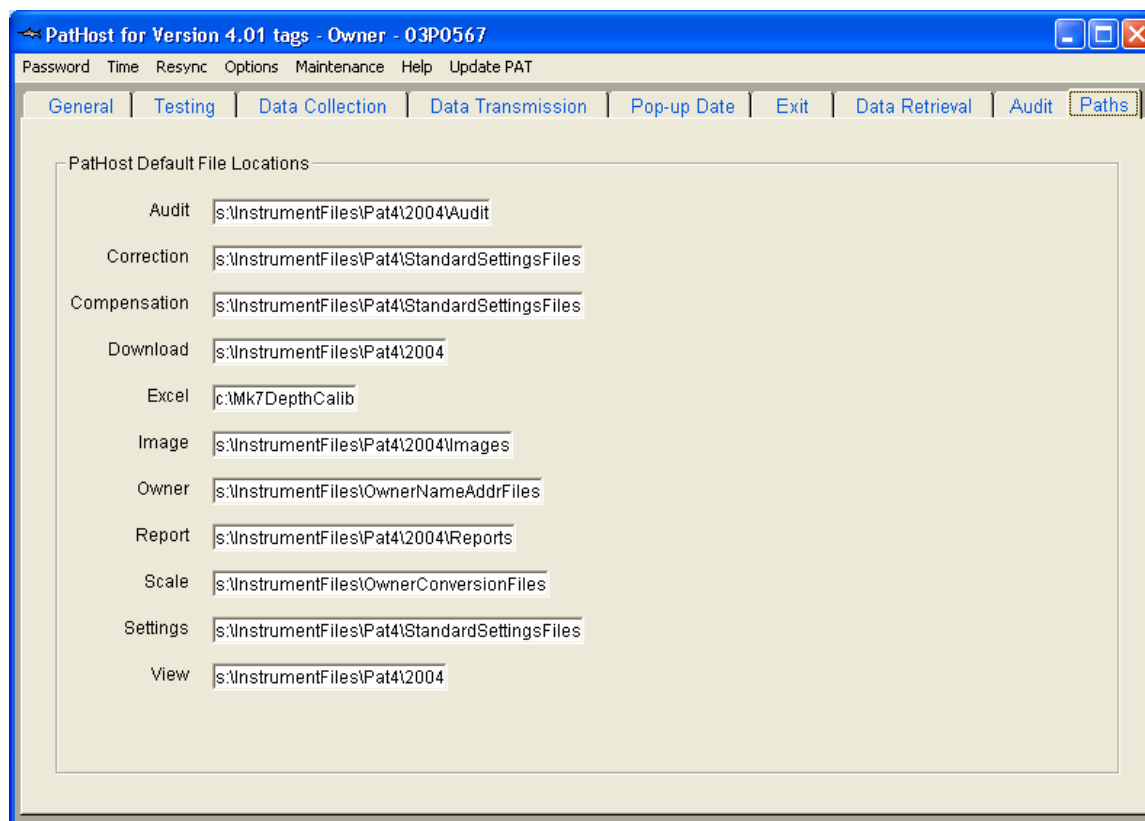
Your data output will look something like this.



## ***Audit Tab – See what was done during communications with PAT***



This audit trail is maintained on the PC used to communicate with the PAT tag. As long as you communicate on the same PC, additional sessions will be added to the record. If you change PCs, you will establish a new record on that second PC.

***Paths Tab – Default areas where the tag stores and retrieves information***

## Menu Functions

### ***Password: Change the Password***

You can change your password any time after you have logged on as a user. Acceptable passwords include entries up to 31 characters. If you forget your password, you will have to return the tag to Wildlife Computers so we can reset it.

**PatHost for Version 4.01 tags - Owner - 03P0428**

Menu: Password | Time | Resync | Options | Maintenance | Help | Update PAT

Sub-menu: Change Password | Log on

**Identification Information**

|                   |                                                                                         |
|-------------------|-----------------------------------------------------------------------------------------|
| System id         | 03P0428                                                                                 |
| User's identifier | Tuna 3                                                                                  |
| Argos PTT number  | 5760 (5A03F Hex)                                                                        |
| Repetition Rate   | 60 (+/-6) seconds                                                                       |
| PatWare Version   | 4.01e                                                                                   |
| Owner             | Wildlife Computers<br>16150 NE 85th St #226<br>Redmond, WA 98052 USA<br>+1-425-881-3048 |
| Configuration     | Slow LL; PinBrokeSensor                                                                 |

**PAT's Date and Time**

GMT Date: 24 Feb 2004  
GMT Time: 20:16:55

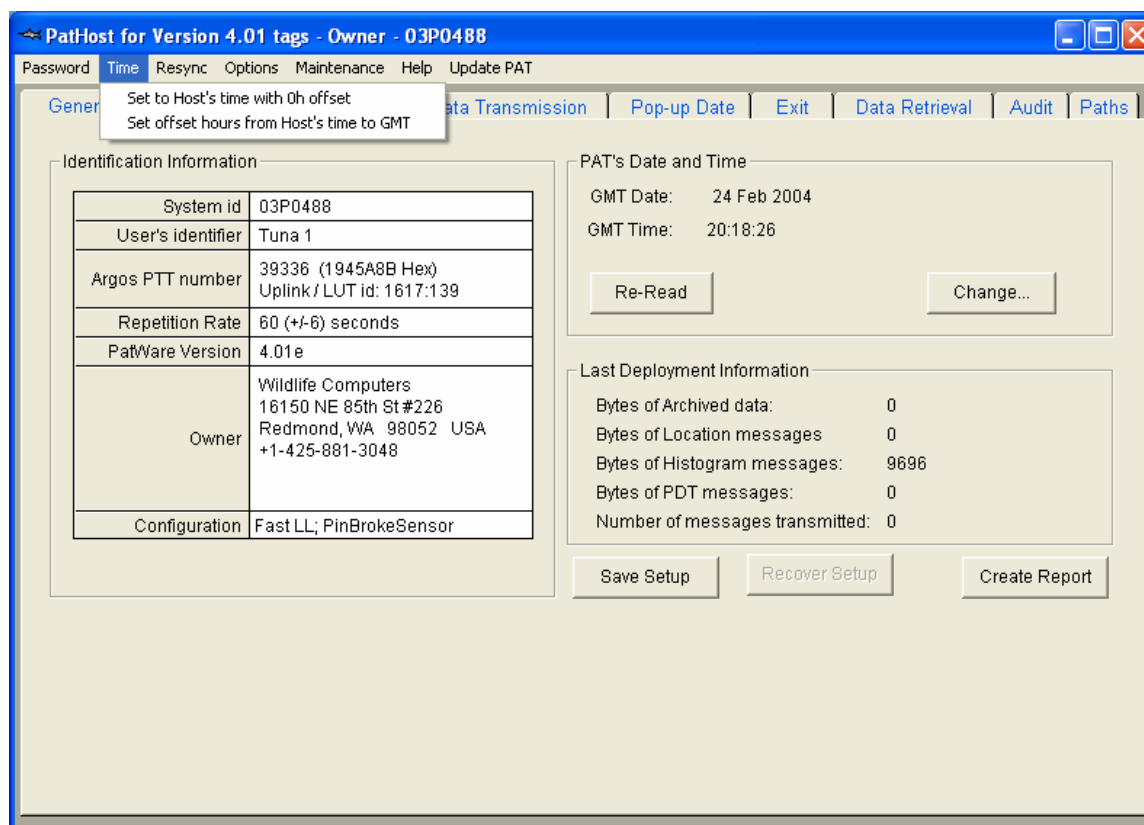
Buttons: Re-Read, Change...

**Last Deployment Information**

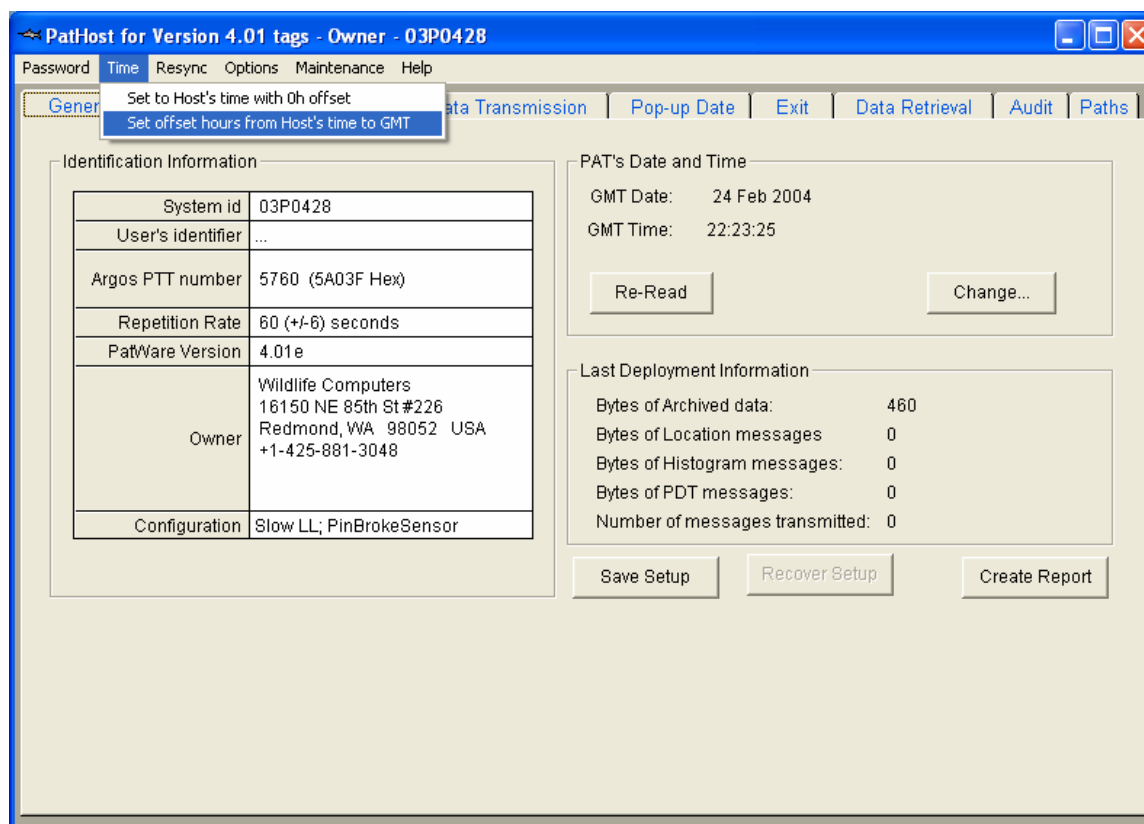
Bytes of Archived data: 460  
Bytes of Location messages: 0  
Bytes of Histogram messages: 0  
Bytes of PDT messages: 0  
Number of messages transmitted: 1

Buttons: Save Setup, Recover Setup, Create Report

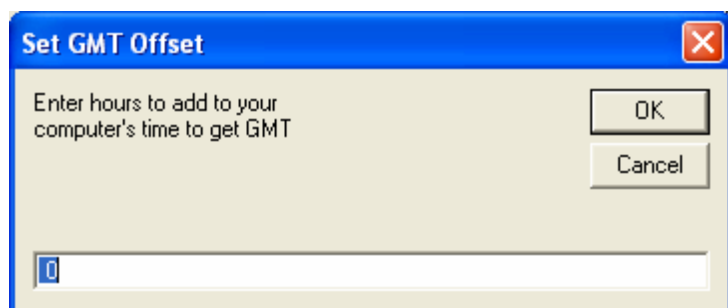
### ***Time: Set PAT Time and Date (alternate method)***



If your PC clock is not set to GMT, go to the *Time* menu function and select *Set offset hours from Host's time to GMT*.

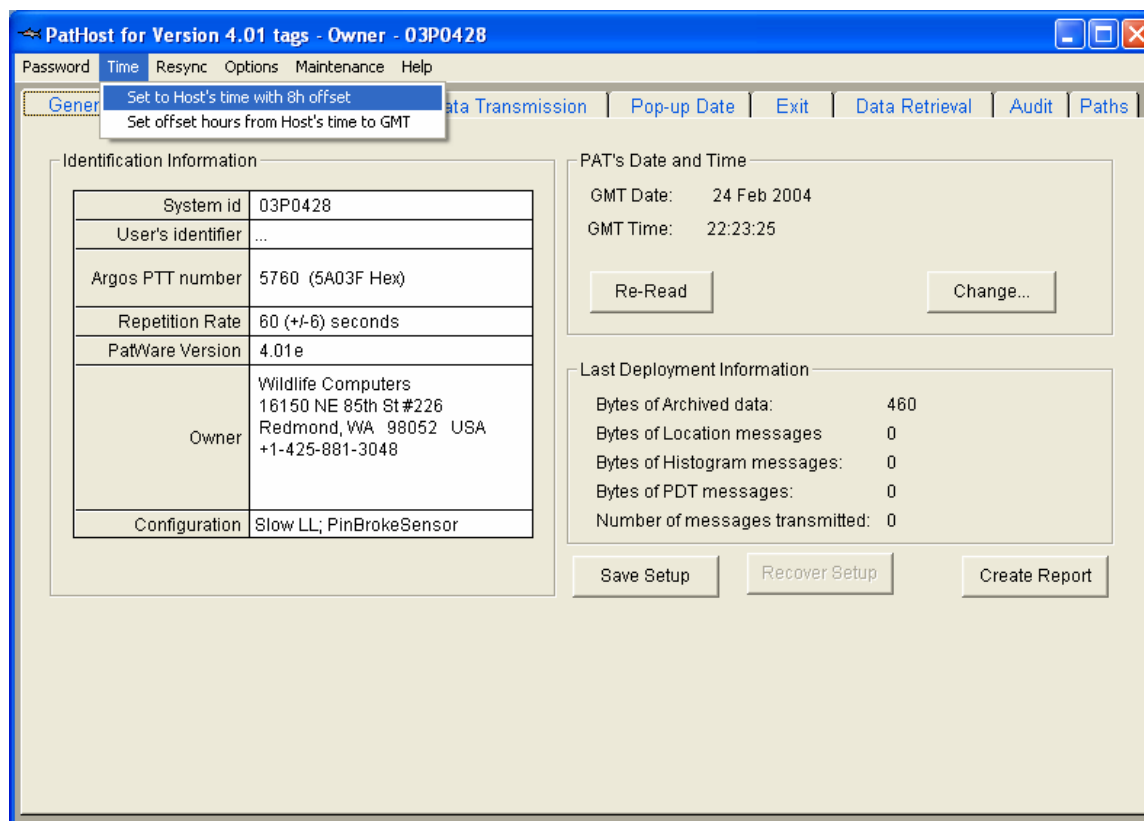


Use the *Set GMT Offset* dialog box to tell PatHost how to adjust the time on your PC to GMT.

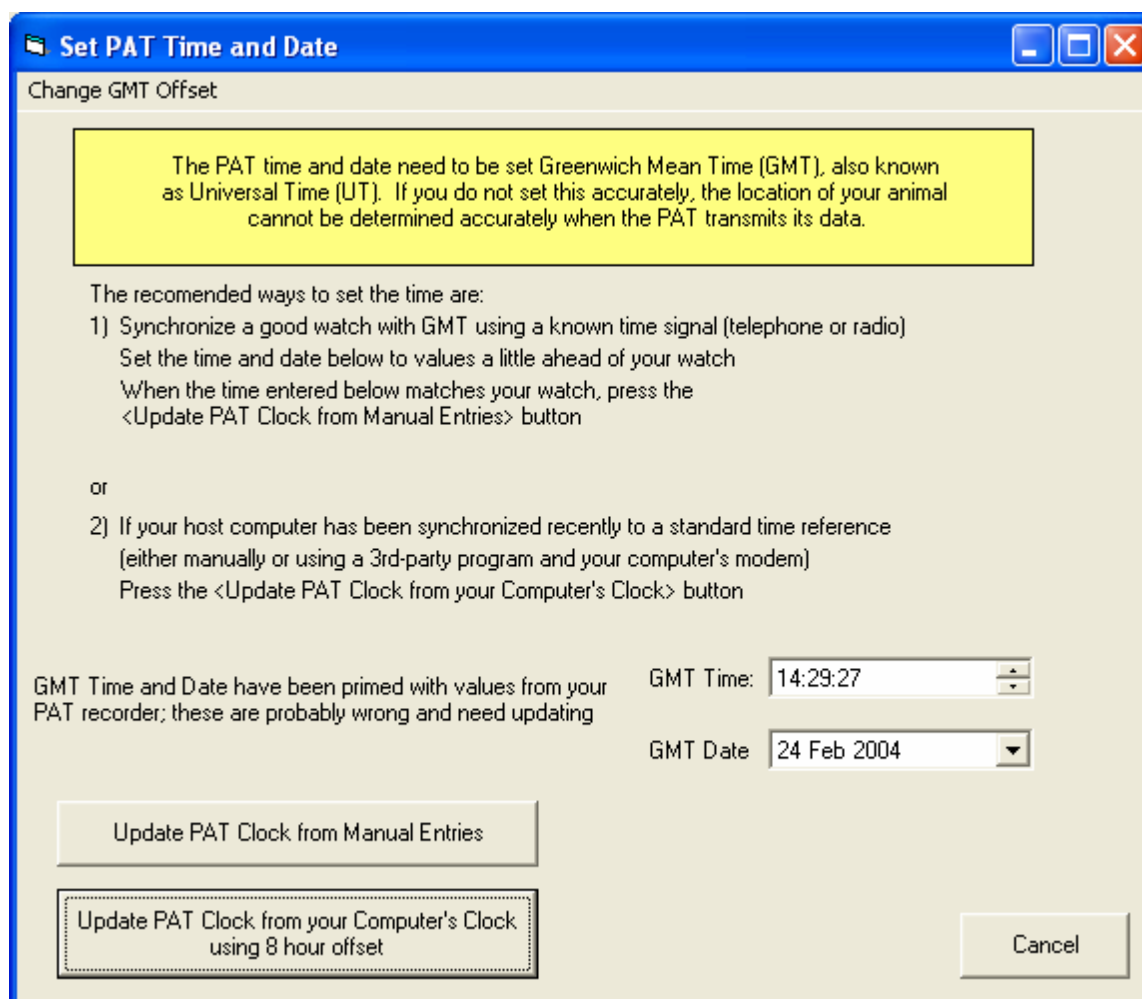




If your PC clock is already set to GMT, go to the *Time* menu function and select *Set to Host's time with nh offset*, where *n* is the number previously entered in the *Set GMT Offset* dialog box.



Then click the **CHANGE** button on the General Tab screen to bring up the window to set the PAT's clock.



## ***Resync: Resynchronize communications with the PAT***

Occasionally the PAT loses synchronization with the PatHost. If so, a message will pop up saying this has occurred. Click OK to acknowledge the message. Then select the *Resync* menu function. If this does NOT correct the problem, you will have to reswipe the magnet over the “RESET” on the PAT label and restart the PatHost program. You do NOT need to disconnect the tag to do this.

**PatHost for Version 4.01 tags - Owner - 03P0488**

Password Time **Resync** Options Maintenance Help Update PAT

General Testing Data Collection Data Transmission Pop-up Date Exit Data Retrieval Audit Paths

**Identification Information**

|                   |                                                                                         |
|-------------------|-----------------------------------------------------------------------------------------|
| System id         | 03P0488                                                                                 |
| User's identifier | Tuna 1                                                                                  |
| Argos PTT number  | 39336 (1945A8B Hex)<br>Uplink / LUT id: 1617:139                                        |
| Repetition Rate   | 60 (+/-6) seconds                                                                       |
| PatWare Version   | 4.01e                                                                                   |
| Owner             | Wildlife Computers<br>16150 NE 85th St #226<br>Redmond, WA 98052 USA<br>+1-425-881-3048 |
| Configuration     | Fast LL; PinBrokeSensor                                                                 |

**PAT's Date and Time**

GMT Date: 24 Feb 2004  
GMT Time: 20:18:26

Re-Read Change...

**Last Deployment Information**

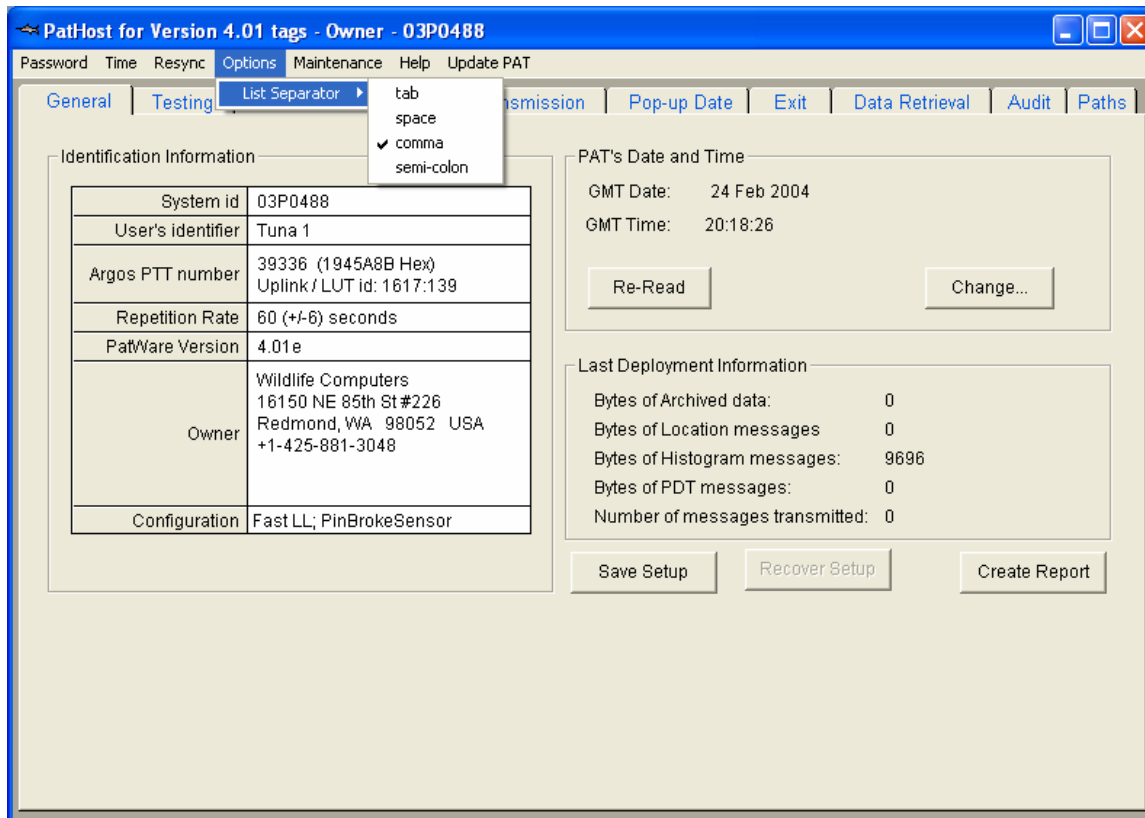
Bytes of Archived data: 0  
Bytes of Location messages: 0  
Bytes of Histogram messages: 9696  
Bytes of PDT messages: 0  
Number of messages transmitted: 0

Save Setup Recover Setup Create Report

### ***Options: Define List Separator for downloaded data***

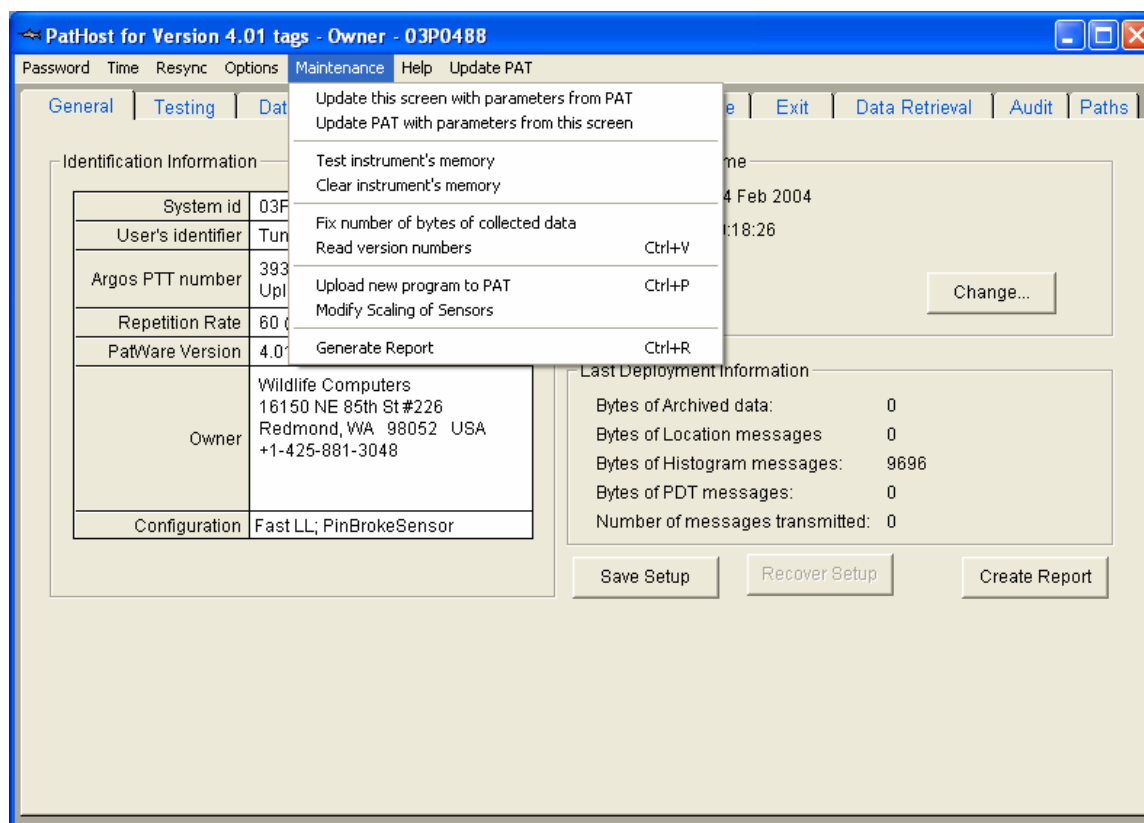
This selection determines the data format used on the Data Retrieval Tab. “Tab” separates the data into columns and is a good choice for data to be exported to Excel.

Wildlife Computers analysis programs utilize hex data and are not impacted by what is chosen from this menu list.



## ***Maintenance: Miscellaneous functions***

This menu function contains advanced features that should only be used when directed to by Wildlife Computers Technical Support staff. They are not features required for most deployments.



***Copy parameters from PAT to PatHost***

***Copy parameters from PatHost to PAT***

***Test PAT's memory***

***Clear (erase) PAT's memory***

***Fix number of bytes of collected data***

***Read version numbers***

***Upload new program (PATware) to PAT***

***Modify Scaling of Sensors***

***Generate Report***

## Help: PatHost Version number

PatHost for Version 4.01 tags - Owner - 03P0488

[Password](#)
[Time](#)
[Resync](#)
[Options](#)
[Maintenance](#)
[Help](#)
[Update PAT](#)

[General](#)
[Testing](#)
[Data Collection](#)
[About Wildlife Computers PAT tag...](#)
[Exit](#)
[Data Retrieval](#)
[Audit](#)
[Paths](#)

Identification Information

|                   |                                                                                         |
|-------------------|-----------------------------------------------------------------------------------------|
| System id         | 03P0488                                                                                 |
| User's identifier | Tuna 1                                                                                  |
| Argos PTT number  | 39336 (1945A8B Hex)<br>Uplink / LUT id: 1617:139                                        |
| Repetition Rate   | 60 (+/-6) seconds                                                                       |
| PatWare Version   | 4.01e                                                                                   |
| Owner             | Wildlife Computers<br>16150 NE 85th St #226<br>Redmond, WA 98052 USA<br>+1-425-881-3048 |
| Configuration     | Fast LL; PinBrokeSensor                                                                 |

PAT's Date and Time

GMT Date: 24 Feb 2004  
GMT Time: 20:18:26

Last Deployment Information

Bytes of Archived data: 0  
 Bytes of Location messages: 0  
 Bytes of Histogram messages: 9696  
 Bytes of PDT messages: 0  
 Number of messages transmitted: 0

About



**Wildlife Computers PAT tag Host**  
 Version: 4.01.0006  
 Revision Date: January 18, 2004  
 Wildlife Computers  
 16150 NE 85th Street, #226  
 Redmond, WA 98052, U.S.A.  
 Tel: +1-425-881-3048 Fax: +1-425-881-3405  
 email: tags@wildlifecomputers.com  
 web: www.wildlifecomputers.com  
 ftp: ftp.wildlifecomputers.com

Please note that this software is constantly being upgraded.  
 Please browse our web site for new versions of this software.

## ***Update PAT: Copy parameters from PatHost to PAT***

These functions are not generally used. PatHost will automatically update the PAT's parameters, or prompt you to do so, when necessary.

**PatHost for Version 4.01 tags - Owner - 03P0488**

Menu: Password Time Resync Options Maintenance Help **Update PAT**

Update PAT menu options: Update changed data, Update All

General | Testing | Data Collection | Data

**Identification Information**

|                   |                                                                                         |
|-------------------|-----------------------------------------------------------------------------------------|
| System id         | 03P0488                                                                                 |
| User's identifier | Tuna 1                                                                                  |
| Argos PTT number  | 39336 (1945A8B Hex)<br>Uplink / LUT id: 1617:139                                        |
| Repetition Rate   | 60 (+/-6) seconds                                                                       |
| PatWare Version   | 4.01e                                                                                   |
| Owner             | Wildlife Computers<br>16150 NE 85th St #226<br>Redmond, WA 98052 USA<br>+1-425-881-3048 |
| Configuration     | Fast LL; PinBrokeSensor                                                                 |

**PAT's Date and Time**

GMT Date: 24 Feb 2004  
GMT Time: 20:18:26

Buttons: Re-Read, Change...

**Last Deployment Information**

Bytes of Archived data: 0  
Bytes of Location messages: 0  
Bytes of Histogram messages: 9696  
Bytes of PDT messages: 0  
Number of messages transmitted: 0

Buttons: Save Setup, Recover Setup, Create Report

## ***LED Flash Patterns Summary***

- *PAT is standby, going to “sleep”.* LED blinks “ZZZ” in Morse code (long-long-short-short, long-long-short-short, long-long-short-short). This indicates that the PAT4 successfully received the “Standby” command is going to “sleep”.
- *PAT is sleeping, waking every 11 seconds to see if it should be activated.* LED blinks very dimly every 11 seconds. During the dim flashes the PAT wakes up and looks for a depth reading of  $\geq 20$  meters. If it does not measure a depth reading  $\geq 20$ m, it goes back to sleep. The PAT repeats this every 11 seconds until such a depth reading is observed
- *PAT has recognized a depth reading  $\geq 20$ m and is preparing to activate.* LED blinks brightly 5 times at a one-second interval. During one of wake-ups that occur every 11 seconds, the PAT measured a depth reading  $\geq 20$ m. It now checks that this pressure continues for 5 seconds, blinking the LED once a second. If the pressure stops before the 5 seconds (before the 5 bright blinks), the PAT will go back to standby.
- *PAT is activated, preparing to collect data.* LED blinks brightly every other second.
  - This continues for several seconds, during which time the PAT is erasing memory and preparing to collect data. This blink pattern allows another confirmation that the PAT is activated and will begin collecting data.
- *PAT is collecting data.* The LED will double-blink each time it wakes up to take a reading (normally once a second, unless you set the archival data to sample more frequently). The PAT waits for the first whole minute after activating before taking the first reading. The LED continues to double-blink at each wakeup until the PAT has awakened 256 times. After the 256<sup>th</sup> wakeup, the LED no longer blinks.



## ***RD1800 Release Device***

Wildlife Computers has developed a mechanical guillotine, called the RD1800, that prevents the PAT from being dragged to depths that would crush it. The RD1800 instantly severs the tether when the depth exceeds 1800m. This releases the PAT so that it floats to the surface. The Premature Release feature eventually recognizes a “constant depth” situation and initiates transmission.

### ***RD1800 Installation Instructions***

The RD1800 release devices are supplied pre-assembled, but not connected to the PAT tags. A short length of monofilament leader is inserted through the RD1800 to prevent it coming apart during shipment.

### ***Operation***

The RD1800 acts as a guillotine, severing whatever line passes through the radial holes when it is exposed to a depth of 1800-2000 meters. At these depths, water pressure overcomes an internal support within the RD1800. The center section of the RD1800 snaps down and generates the cutting action. The RD1800 has been tested with monofilament line between 0.5 and 2mm diameter.

### ***Installation***

*Caution: Do NOT remove center plunger from can. To do so risks damaging the internal O-ring or misaligning the assembly. This would compromise operation of the device.*

- Remove the short length of monofilament that was pre-installed in your RD1800.
- While taking care to ensure the center portion of the RD1800 doesn't pop out, thread the RD1800 over the monofilament tether that connects your PAT tag to your anchor. It can be placed anywhere on the tether, exact location will be up to the individual investigator. We recommend, however, that it be placed as close to the PAT as possible. You can use the short piece of excess monofilament that extends from the crimp to stabilize the RD1800, minimizing its movement. (See second photo.)
- If you usually cover your tether with additional heatshrink tubing, you will need to leave a gap around the RD1800. Be careful not to get the RD1800 excessively hot while shrinking the heatshrink tubing. There is an internal seal that could be damaged, and the monofilament may also be degraded where it passes through the holes in the RD1800.



## ***Recovered PATs***

It is surprising how often a PAT is recovered. If the PAT did not transmit, e.g., the fish was recaptured before the popoff date, you should be able to communicate and download the data via PatHost.

If you are contacted by an angler who has a PAT from a recaptured fish (the PAT has not popped off), you may want to instruct him to pass a magnet over the reset position to suspend the PAT.

If the PAT transmitted, the battery is probably flat and you will not be able to successfully communicate and download the data. Send the PAT back to Wildlife Computers, and we will download the data for you. Preferred shipping methods are DHL, Fed Ex, or UPS. The user is responsible for shipping and insurance costs.

Wildlife Computers  
16150 NE 85<sup>th</sup> St, Suite 226  
Redmond, WA 98052 USA

For further questions about the return process, please email to [tags@wildlifecomputers.com](mailto:tags@wildlifecomputers.com) or call +1 425-881-3048.

## ***Storing PATs***

Lithium batteries develop an oxide layer over their anodes to minimize self-discharging. This is called passivation. This process is exacerbated at high (30C+) temperatures. The passivation layer is “burned off” when current is drawn from the battery. Very little current is drawn from the PAT when it is suspended, so a passivation layer can form.

If the passivation layer is too thick, the battery voltage drops so low that the PAT cannot function.

PATs that will not be deployed for an extended period of time (more than one month) should be stored in a refrigerator or freezer (5 to -20C). This minimizes the battery passivation.

The PAT should be tested after storage, prior to deployment. It is not necessary to warm up the tag prior to proceeding with the test.

Establish communications with the tag. Go to the Testing tab in PatHost to test the sensors and check the battery voltage by performing immediate tests of the Argos transmitter. The battery voltage may be a little low initially, but should increase after several tests. The battery voltage displayed when testing the transmitter indicates the performance of the battery under a load. This should be 3.0V or above.

## Other Advice

1. Once a PAT is in standby mode, keep all magnets away from the reset position (indicated by the word **RESET** on the label). When a magnet is swiped over the reset position, ***the PAT is turned off***. The only way to turn it back on is then to re-establish communications via the PatHost program on your PC.
2. Do not use any metallic-based anti-fouling paint on the portion of the float that is above the water line when the tag is floating, or over the antenna. Any metals near the antenna will seriously compromise the transmissions.
3. Do not cover the following components with paint:
  - a. Ground ring (silver ring at the base of the float). It needs to be in good contact with the seawater during transmissions.
  - b. Light sensor (pink square).
  - c. Pressure transducer (black dot between the ground ring and light sensor).
4. Once a PAT is deployed and activated with the premature release functionality enabled, don't forget to turn it off if it is not attached to a fish within the PRHours period. A PAT sitting on a desk thinks it is at a constant depth.
5. Do not let any metal (e.g., metal leaders) come in contact with the PAT's corrosible link (attachment pin). There are two reasons:
  - a. The current for the corrosion runs between the attachment pin and the ground ring. The PAT will attempt to also corrode any metal touching the pin. The PAT is designed to corrode only the pin.
  - b. When dissimilar metals are in contact while in seawater, passive corrosion occurs. This may result in the weakening or breakage of the pin.
6. Do not allow paint, grease or silicone rubber to cover the corrosible link. The corrosible link must be in contact with seawater for it to corrode completely.
7. Note that the breaking strength of the corrosible link is 100 pounds of static pull. The corrosible link is designed to hold the PAT to the fish. It may not be strong enough to withstand the acceleration forces when fired from a spear gun.
8. The RD-1800 is designed to cut through monofilament. It may not sever metal leaders.
9. If you will be traveling on a commercial carrier with your PAT tags
  - a. We recommend that you have them in "Suspend" mode so that they can be safely packed in your checked baggage.
  - b. If you hand-carry a leadered tag, remember that the dart may not pass security screening. You may wish to carry a copy of your invoice identifying the tag as a scientific research instrument.

- c. We recommend that the user always take a laptop or other computer to the field location, even if the tags have been set up in advance, so that communication with the tag is possible on site if necessary.
- d. We strongly recommend that the user ALWAYS re-verify that the tag is still in the proper mode following travel to the field site.

## ***Summary of PAT4 manual changes***

18 October 2004 by MB:

Pages 8, 48. Corrected the threshold depth to trigger activation. Was 10 meters, correct value is 20 meters.