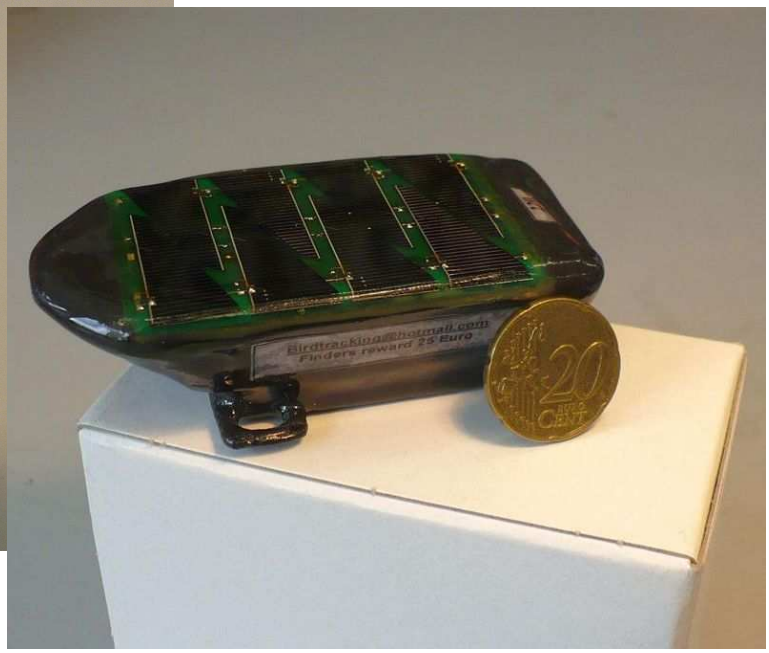
UvA Birdtracking System

University of Amsterdam



Birdtracking System

Table of Contents

Rev	Date	Author	Comment
1.0	23-01-2008	Edwin Baaij	Initial document
1.1	31-03-2008	Edwin Baaij	Added hardware setup
1,2	6-04-2008	Margriet Harms	General edit
1.3	15-04-2008	Edwin Baaij	Removed invalid parts, added new and corrected existing
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2.0	10-03-2011	Edwin Baaij	Total renewal for hardware 2.0, Firmware Fw2, birdtracking 4.45
2.1		Edwin Baaij	

Intermezzo

Montagu's Harrier

1 Uva Birdtracking System

1.1 Introduction

The University of Amsterdam birdtracking system (UvA-birdtracking system) is a birdtracking system characterized by light weight, solar-powered, high energy efficient Gps-devices, with two way wireless ZigBee (2.4 GHz) data communication to a groundstation network

This system has been designed to overcome some of the shortcomings in the existing commercial systems. One of its main advantages is the capability to measure and store short interval Gps fixes. Where existing ARGOS systems can only take 4 Gps measurements a day, this system can do 1 fix per 3 seconds.

Another advantage is the two-way wireless communication created by using a ZigBee 2.4Ghz data transmission network. Besides downloading data, the user can upload new settings, such as Gps and communication fix intervals. An onboard local clock synchronizes with the Gps time once a fix has been made. The user can opt to upload a time period in which low intervals (Gps and communications) will take over, thus saving energy.

The choice for local 2.4 GHz ZigBee Network wireless data communication has been made. This makes the system more flexible with respect to the user's need of frequent 2-way communication usage and also much lower in costs in comparison with satellite communication. This system works with its own base station and one or more field relay stations. With more field relay stations, the user can expand the area of reception to their needs. Each relay can, depending on the type of antenna used, cover a reception distance up to 6 km (flat-panel antenna).

1.2 Naming conventions

In our system we use the following naming conventions. Please make you self familiar with them.

- Birdtracking system
  This is the total system. So computer, birdtracking software, base station, all relay stations, antenna's and Gps-devices.
- Base station
  This is the main station of the system. It consists out of a computer (Netbook), connected to an interface box by a USB-cable. From this box a 15-meter cable connects the base module.
  The Birdtracking program, running 24/7 on the computer, will automatically control the data from and to Gps-devices.
- Birdtracking program
  Specially programmed software that controls and stores all communication and data-traffic from and to the Gps-devices. This is also the interface for the user to set all the parameters that make up a measurement scheme for their research.
- Relay station
  This is a relay-module with integrated antenna, powered by a separate battery box. Inside this box battery packs can be installed. They supply power for 100 up to 150 days of operation.
- Groundstation Network
  This is the wireless (ZigBee) network in the research area created by the base-module and all relay-modules. Gps-devices can join this network.
- Gps-devices (also called Gps-devices, Gps-loggers, Gps-Tags)
  These are our Gps-devices put on the birds. Each device has an unique ID number and can thus be singly addressed to download Gps data and to receive new settings.
- Firmware
  The Gps-device self is a tiny computer, also running software. Because it is inside a device it's called Firmware (Abbreviation FW). The firmware makes up all the features with which the user can create the measurement scheme of the Gps-device

1.3 System key features

- Device System activity On-Flight adjustable
  The Gps-devices in use on the birds can be uploaded with a new measurement scheme,
- Fast, user adjustable GPS fixing interval:
  The Gps-device can store 1 fix per 3-seconds to 1 fix per 65000/seconds. The user can upload this setting to the device.
- Pressure, temperature, and 3-D Acceleration sensor
  The Gps-devices are equipped with these sensors and can store their data. Pressure sensor is optional.
- Flash 4 megabyte memory
  On board flash memory. Can store up to 60000 Gps fix entries.
- ZigBee 2.4Ghz Wireless communication
  The Gps-devices are equipped with ZigBee communication. They can join a network, receive new activity settings and download their latest recorded GPS/Sensor data. The moments that a device tries to connect to the network to download date are also user adjustable.
- Extended, expandable area of reception
  By using multiple relay stations, the user can extend the area of reception to his needs.
- Solar powered

The Gps-devices are equipped with 4 high efficient solar cells that can yield in total up to 200mW of solar energy. A dedicated charging circuit efficiently stores the energy in a light weighted Lithium Polymer battery.

- Light weight Gps-devices
  Much effort has been taken to create light weight Gps-devices. The weight depends on the battery capacity selected (65mA or 240mAh) and the choice to assemble strap-eyes or not. Also, the user can choose for extra epoxy reinforcement for bigger and thus stronger birds.
  Dependent on these choices the weight varies between 12 and 18 grams.
- V-shaped Gps-devices
  The “V” shaping of the devices prevents the feathers of the birds from covering the solar cells more then conventional housing.
- Gps-device firmware
  The onboard microcontroller runs firmware that makes-up the device intelligence. Many features are already implemented. Many new are planned.

1.4 Principle of operations

The system consists of one base-station, one or more relay station(s) on the ground and (many) Gps devices in the sky. The base-station is the system coordinator and holds the data-collecting computer. The relay stations are important signal repeaters. Together with the base it establishes the area of reception.
The groundstation network is initialized and controlled by the base. It is always available for the devices to connect to. The devices are not connected to this network all the time. In most cases they will be out of the reception area, but besides that, too much energy would be involved to have them connected all the time. So the device stores all data in its internal memory. At a user given interval, the Gps-device itself initiates wireless communication and tries to join the network. If it succeeds, it reports “joined” to the base and waits for the base station Birdtracking program to issue commands. It does not start sending data without a request (command). So the base station computer takes control, sends the necessary commands and thus downloads the GPS data. But if the user has armed new settings for this device, it first starts uploading those settings. When all done, it ends communication for this device. The device will now continue logging data, if uploaded with new settings.

The energy supply is achieved by a solar panel, charging unit and battery. Although high efficient solar cells are used, they cannot yield and store enough energy to do GPS measurement and wireless communication continuously all the time. Moreover, solar yield depends strongly on the month of the year. So the user has to carefully setup the measurement scheme to avoid relatively long charging times, thus gaps in the data.

The memory of the device is pretty big but still can’t store all data producing sensors at full speed for a very long time (migration flight). Thus again the user has also carefully design the measurement scheme to avoid a full memory half way a migration flight.

The measurement scheme is mainly formed by tree tasks

1. Gps location data recording
2. Communication moments
3. 3D-accelero data recording

The timing of the tasks is done by so called ‘intervals’ and specify the seconds between each task. Many other setting can be made and will be explained later in the program manual.

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intermezzo

Griffon vulture charging up the Gps-device (thank you)

2 Handling the Gps-devices

2.1 Out of the Box

When received, all the Gps-devices have storage settings and the battery fully charged. With these settings, the Gps-device consumes very little power. However, we strongly recommend to keep the devices in daylight at the window bank. Other settings consume more energy and the charge status of the battery is not always know. So it's good practice to store them on the window bank.

Keep the devices away from any strong magnets. A magnet will reset the device. A device kept in reset will consume many times the power of the storage settings.

> ☝ ***Attention:***
> Do –not- store our device as Argos devices! No magnets near devices when stores. It will deplete the battery in a couple of days.
> Please read the whole manual carefully before using the devices.

2.2 Physical handling

The Gps-devices are strengthened with multiple layers of epoxy. You can handle them normally. The antenna is flexible so that the bird is still capable to mate. The antenna has been fixed in a special way to withstand the devices attempts to demolish it. Some tests have been done, however, the bigger the bird the more force it can apply.
Please do not squeeze the device hard between solar panel and bottom. To keep the device light weighted, they are hollow inside. If it dents, the solar cells might break and the solar energy yield can be disrupted.
Avoid dropping them on a hard floor.

2.3 Magnetic reset

The reset action will only trigger a communication event after a few seconds following the action. It will not reset or clear any settings that are currently in the device. More appropriate would be magnetic wakeup, but reset has become the name for this action.

But as this action forces the device to communicate it is the action to upload new settings to the device directly, rather than waiting for the next communication event. Of course new setting will only be uploaded if the user has set them out (armed) in the birdtracking program. The use of this program is explained later.

The reset action is applied by holding the magnetic reset key short at the right side when the device's front is pointing towards you (see photo 1). One second is long enough. Before doing this, the base-station (or the whole groundstation network) should be active and the Birdtracking software should be running.

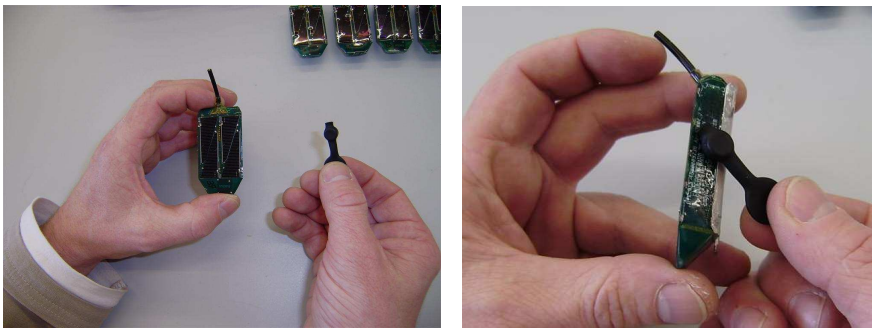


Photo 1. Magnetic reset

After the action, wait 1-20 seconds. That's the time it takes for the devices to join the network. How the birdtracking program signals a joined device, is explained later.

> ☞ If the device won't join, please consult the troubleshoot chapter.

> ☝ ***Attention:***
> Do –not- store our device as Argos devices! No magnets near devices when stores. It will deplete the battery in a couple of days.
> Please read the whole manual carefully before using the devices.

2.4 Mounting the Gps-devices

The devices are supplied with strap-eyes to mount them on the bird. Mounting should be done by experienced people and is beyond the scope of this manual.

However before putting any device on birds we advice to:

1. Have them fully charged
2. Uploading them with “save” settings. These depend on many factors. Please let us advice you which setting to use.
3. Test those settings –first- near the base station.

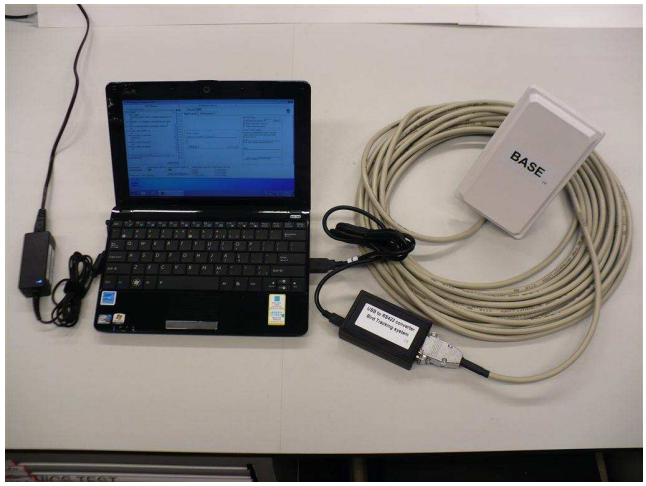
2.5 WARNING battery depletion

The device has been optimized for low energy consumption. However it will always consume energy. When the battery is low and the device is kept in the dark for some days, this might deplete the batteries.
Therefore always store the Gps-devices on a window bank. Normal daylight, it doesn’t even need to be sunny, yields enough energy to preserve the battery.
Depleted batteries can fail or will have a decreased capacity.

> ☝ ***Attention:***
> Do **not**, I repeat, do **not** store them as Argos devices! **No** magnets near devices. It will deplete the battery in a couple of days.

3 Birdtracking System Setup

The setup of the total system includes a hardware and software installation. A Netbook is included in the total system on which the software and drivers have already been installed.

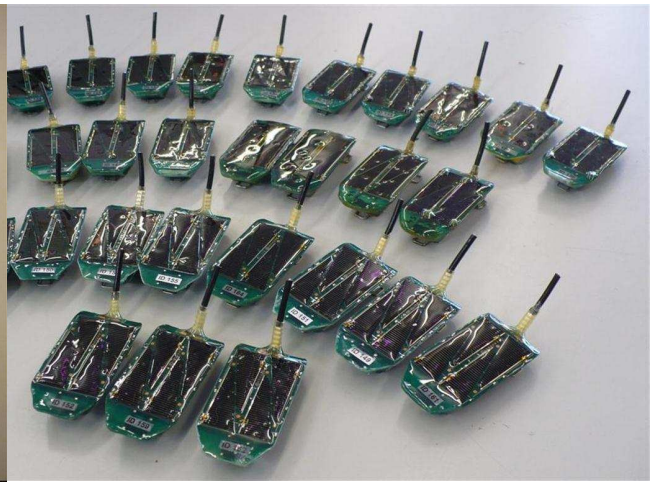


3.1 Components check

You should have:
Base-station:
- Netbook
- Usb-cable
- Usb-RS422 interface box
- Base-module with 15 meter cable attached

Relay-station (if ordered 1 or multiple):
- Relay-module with battery box
- 2 battery packs inside each box

Gps-devices:
- 1 or more Gps-devices
- 3 magnetic reset “keys” (shipped in the battery box of the relay)



3.2 Indoor, system test setup

To test and get familiar with this birdtracking system, we advise you to set it up indoors first.

Base-Station

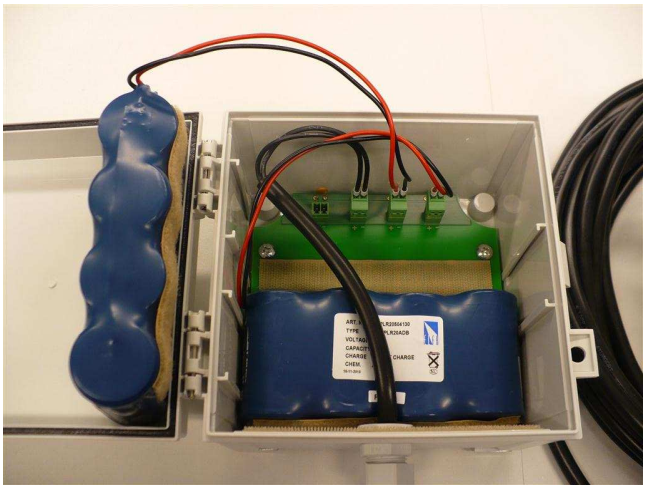
Setup the base-station as shown above. First install the lithium battery pack in the netbook. There are 2 locks on the back of the Netbook to fix the pack. Connect the Ac-adapter, Usb cable to the interface-box and the cable of the Base-module Also on the interface box.

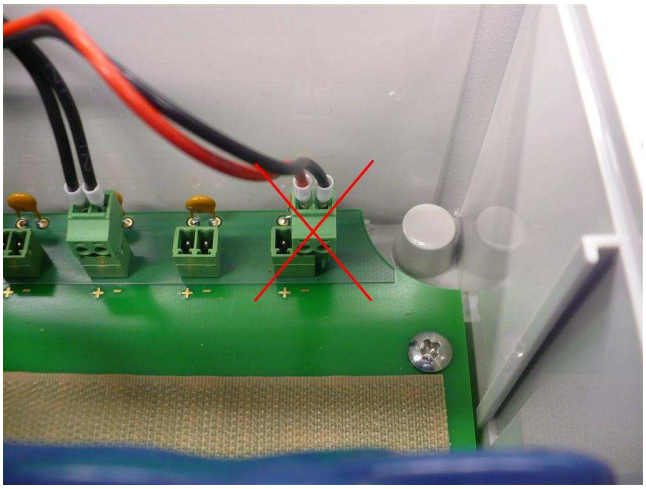
> ☝ ***Attention:***
> Don't use an Usb-hub or Usb-extension cables . connect the interface box directly to the netbook with the supplied Usb-cable.

Relay-Station
If ordered setting up this station is simply connecting the battery-pack connectors inside.

> ☝ ***Attention:***
> Indoor is very close distance. Please -don't- face the antenna's towards each other if distance < 10 meters. This will "oversteer" the reception amplifier.

Open the box with the lever on the side. You see two packs and three green connectors.





Connect all connectors to any of the available places. Verify that the connector is in line with its mating part.
The packs are fixed with Velcro tape.

When not using the system for a long period please disconnect all the batteries.
On two battery packs, the relay can operate for approximately 100 days.

If you replace the batteries always remove –both- packs. Tie a knot in the wires so you can't mix-up old and new packs.

3.3 Outdoor, system field setup

Before setting up the system outdoors, we strongly advice to create a setup on paper. Google earth is very nice tool to use for this.

> ☝ ***Attention:***
> The groundstation setup needs to be designed carefully to have coverage. Just putting the antenna's somewhere won't work and will probably result in weak/bad reception.
> Of course we can advise you.

Use Google Earth to mark the area where reception is needed. Then mark where the base-station will be. This station uses more energy then the relays and the netbook+Interface box needs to be at a dry place. So often it will be located indoors. Please investigate the surface of the area of reception (and the air-path from the base-station to it). Are there mountains, big trees, high buildings?

When locating, aiming the antenna's the following thumb rules must be taken into account:

- The wireless system works with low-power and high frequencies. The signal –only- works with "line of sight". This means big objects will reduce or totally block reception. Line of sight must be taken very literally, so you must be able to "see" the other antenna's. Be aware that trees with no leave might give you line of sight but when fully leaved probably will cause problems.
- The used antenna's are directional. They have an angle of reception of 70 degrees in the horizontal field and 30 degrees in the vertical field. The horizontal angle is the most important. In order give all relays good reception, each antenna need to cover the beam of at least 1 other relay. It doesn't have to be a full coverage (of course that the best) but don't push it too much to the limits.

- Height & distance. The relay are capable to relay the signal up to 6km. However this distance is not possible (or reliable) when the antenna(s) are located too close the ground. For 6km distances the relay need to be at 15-20 meters above ground level.

With the above, make a plan where to put the base antenna and how to aim (compass notation). If you have one or multiple relays, also plan where to put which relay (note ID number (98xx)) and also how to aim their antenna's. You need the ID number when testing the communication to each specific relay.
Make a 70 degrees paper cutout which you can lay on the screen or printout to see how the beams workout.

In some cases a setup is used with the first relay in the close proximity (<100m) of the base. Those two stations are then so close to each other that the "beam" thumb rule can be taken more freely.

Finally you need to setup the system in the field. Start of course with the base-station. Then the first relay. To test this connectivity, use the "Groundstation Network" features of the Birdtracking program (see Program Manual). You might need 2 persons: one behind the computer one in the field; communicating by mobile phones or walkie-talkie. If the relay doesn't have a connecting, the person in the field can alter the direction.

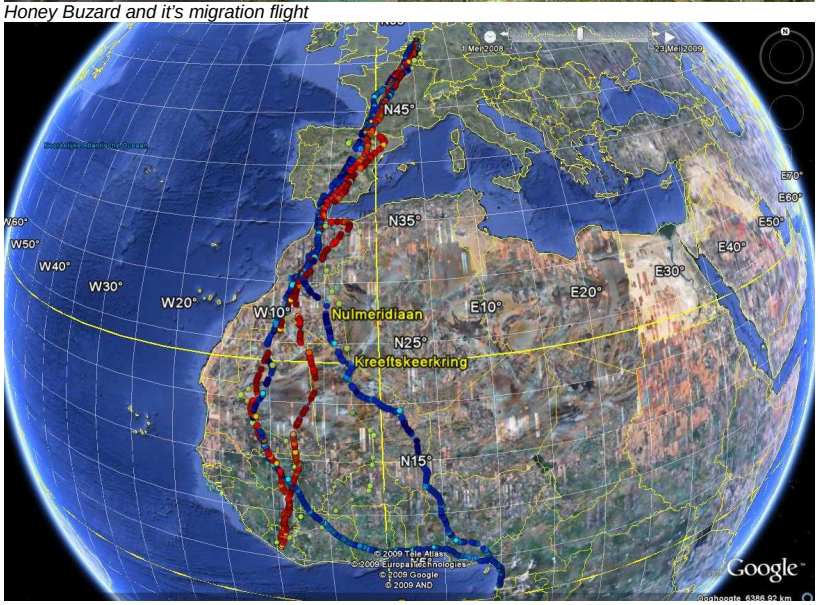
Beside the main factors mentioned above, there are more factors on which the reception range/distance between two groundstations depend.:

- Rainy weather, fog, moist in general
- Surface of the ground: salt water / forest
- Interference Wi-Fi , wireless camera's, cheap wireless china equipment

So if you have problems with connectivity between you're relays, all these factors need to be judged to take the right actions. Of course we can assist.

Intermezzo:

Honey Buzard and it's migration flight



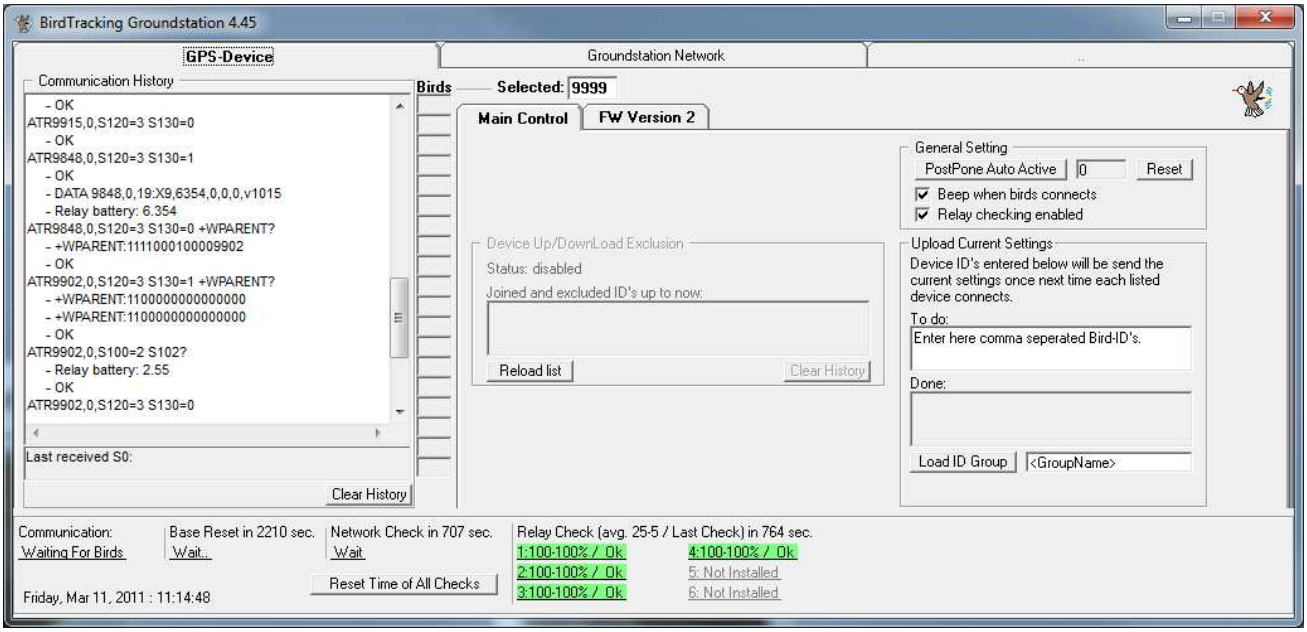
4 Birdtracking Program

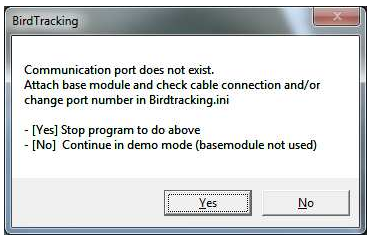
4.1 Principle of operation

At start-up the program automatically initializes and checks the base station module. After this, the software just waits for Gps-devices to connect. To maintain the wireless network, it performs checks to the base station itself and to all the relays in the field. If errors occur, it tries to restore the network by reinitializing the base station. The relay can reset themselves by a so called watchdog. The ground station software checks them every ~15 minutes. If this check is no longer performed or received by the relay-station, it will reset itself after ~ 30 minutes.
When a Gps-device connects a series of commands are automatically sent to the connected device. These commands will upload new settings (if set out) first, followed by the download of the logged data. Then communication is ended. The program waits for the next device.The computer and program needs to be running always to collect data at any given time.

4.2 Starting up the program

The program can be started by clicking the Birdtracking icon on the desktop. Make sure you have setup and USB-connected the base-station before starting the program. The following window will open:





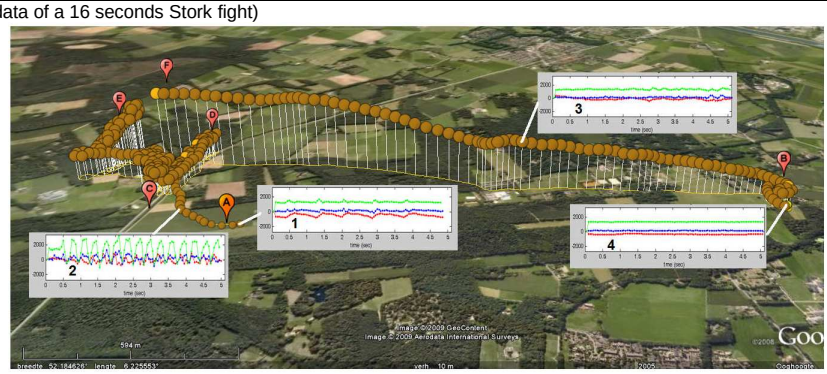
If the base-module is not connected to the computer, the message at the right side will be shown. If the base module is connected check the whole chain (hubs, other cables). See troubleshoot for solutions.

After the startup the program initializes the base module. In the status bar under the Communication and Base Reset label the current status in shown in yellow. After the base is done, the Network Check follows in ~10 seconds. The Relay check will take a while before this check will run. You can run it manually. Later more about this.

The program and wireless network is now ready for Gps-devices to join.

If during Base Reset or Network Check errors occur, the Birdtracking program tries to resolve those errors for a number of retries. See troubleshoot if errors persist.

Intermezzo (accelero data of a 16 seconds Stork fight)



16 minuten uit het leven van een ooievaar: 1: loopt rond en pikt in de grond, 2: klapwiekt, 3: zweeft, 4: staat op nest

5 Program Manual

This manual first handles the normal use of the program. The GUI (graphical user interface) had been created by using many tab-pages. If a navigation path is mentioned in the next chapters it is written down by placing the tab-names between forward slashes, as if it is a directory tree.

Example: you can find the option “Use Gps Fence” in /Gps-Device/FW-Version/Settings/Gps-Fence/

The program shows two main tabs:

1. GPS-Device
2. Groundstation Network

5.1 GPS-Device tab

The Gps-device self is a tiny computer, also running software. Because it is inside a device it’s called Firmware (Abbreviation FW). The firmware makes up all the features with which the user can create the measurement scheme of the Gps-device. On this moment, the Gps-devices have version 2 inside. Hence the tab “FW version 2”

The Gps-device tab shows left the Communication (Com) History. All data from and to the device is listed here. Note, that only the last 10 pages are shown. Right beside are the “Bird lights”. When a Gps-device connects, the ID is placed inside and light is lit green. When communication event is done, the light is dimmed, but the ID number is kept inside. In this way, the user can see that this ID has made contact.
When the list is full and or all the lights are occupied, the user may choose to “Clear History” This will only clear the Com-History and Bird lights dialog. The Com-History is logged so no information is lost.

At the Bottom there is a big Status Bar, showing the status of the groundstation network checks, the countdown of each interval and what the program is currently doing. The specific status of the relay checks is explained later.

In the middle, the Gps-Device tab shows two other tabs

1. Main Control
2. FW Version 2

- *The Selected ID field is advanced use; skip for now.*

5.2 Main Control

The most important use in this tab is the “Upload Current settings frame”. When a Gps-devices joins the network, birdtracking will look if the ID of the device has been entered in the “To Do” list. If that is the case then all the device settings that the user has made in the FW Version 2 tab, will be uploaded first. The user can list many ID’s separated by comma. Please not that all these devices will be given the same settings.
When a device is uploaded, Birdtracking removes the number from the To do list and lists it under Done.

- *The Load ID group option is advanced use; skip for now.*
- *The General settings is advanced use; skip for now*
- *Device Exclusion is advanced use; skip for now*

5.3 FW version 2

5.3.1 Main Activity

It is called main activity because it has a “fall-back-to” function with respect to the Gps-fence use. This will be explained later. For this firmware version, the main activity is also the only activity that has time-blocks.

The main activity setting has two time blocks for each of the 3 tasks that run inside the device;
Gps, communication (Com) and 3D-Acceleration sensor (Acc) tasks. For each block, a start time must be specified when the parameters for this task become active. Note that for each task, the time in block 1 must earlier then the time in block 2. The program corrects wrong entries and the field is then colored purple. This signals the user to correct it’s mistake.

☝ ***Attention:***
Times used in are GPS (UTC) times !
So be aware of your time-zone when creating block times.

The interval field (Ival) specifies the number of seconds between each event of the task. So Gps=1800 will take a fix every 30 minutes. Gps=3 is every 3 seconds (smallest value; Gps=1 or 2 does the same as 3).

☝ ***Attention:***
Gps=0 means Gps is –OFF-: no measurements in this block. Be careful with this setting.

The internal clock of the device runs in units of 16 seconds. So the tasks interval is recalculated to this unit. However a special mechanism is made for the Gps task so that it can run in second units.

For the Acc task a third parameter is in place; the number of samples it records at each event. When the task "fires", the accelero data is recorded at a rate of 20Hz (20 samples per second). So if the user adjusts the number of samples to 20, one complete second of accelero data is recorded. As the sensor is tri-axis, the amount of data grows fast. 1-2 seconds (20-40 samples) is many cases enough. Be careful for higher numbers.

☺ The Acc task can be seen as recording a movie; one picture doesn't make a movie. But 50 pictures at 50Hz make a movie of one second. With 1-2 seconds of an "accelero movie", bird behaviors can be determined. Soaring, gliding, walking, flapping…. Even the wing-beat can be calculated.

Please note that there are three ways of recording the accelero sensor data.

1. As an independent task with an interval and no. samples (as explained above)
2. Recorded with each Gps fix (explained later)
3. Synchronized 1 & 2 (explained later)

Option 2 is mostly (and often only) used. In that case the Acc-Ival is set 0 (is off).
Please note that the Samples field is a shared field for the other way of accelero data recording.

The Setting Summarize frame summarizes all the settings that are made with the different tabs. It gives the user some overview to prevent mistakes.

5.3.2 Fence Activity

This tab is only visible if "Use GPS Fence" option in /Gps-Device/FW Version 2/Settings/Gps Fence/ has been checked. This activity has no time blocks, thus when valid (see below), these setting are active the whole time.

5.3.3 Settings

5.3.3.1 Gps-Fence

In this tab the user can specify a Gps-fence. This is a rectangular area created by two (decimal) Geo locations; Upper left (A) and Lower right (B). To prevent errors, the calculated sizes are shown.

☝ ***Attention:***
The Gps-fence can't yet cross the ±180 longitude and ±90 boundaries.

When the fence has been created the user can choose which activity should be active for inside or outside the fence. This is done because the features in Main and Fence activity are not yet the same.

With a Gps-fence in place, the activity (main or fence) depends on where the bird is. But before the device knows where the bird is, it has to make a valid Gps-fix. Also it is possible that a Gps-fix could not be made for a long time.
To cope with these situations the fall-back-to main mechanisms is in place:

- When no valid Gps fix has yet been made, the main activity will be active
- After timeout minutes with no valid fix, main activity will be active

☝ ***Attention:***
Many schemes' can be created with the Gps-Fence features. Checks twice to be sure that they do what they're expect to do.

5.3.3.2 All Activity

Gps
Here, the user can activate the earlier mentioned 2nd way of recording accelero data.
In most cases, the user wants to record an "accelero movie" locked with a Gps fix.
To do this:

- Check the "Add above number…" checkbox.
- Select recording for Gps Ival<15 and/or Gps Ival>=16

The number of accelero samples taken is the number in the ("shared") samples field of the Acc task that is valid. So if the Fence activity is valid then this number will be taken. If main activity is valid then the number taken also depends on the time. This is a bit confusing and is one of the many things to change in FW version 3.

Gps navigation platform
This setting is a direct setting of the used GPS engine. Study more about this before changing.

Accelero
The 3rd way of recording accelero gives the user the possibility to record one or more accelero movies in a relatively long Gps-interval. The Acc-Ival will in this mode be synchronized with the Gps-Ival. As a limitation of this, the Acc-Ival needs to be smaller than the Gps-Ival.

- Example: Gps=1800, Acc=300/20, Synchronize is checked.
  When a Gps-fix has been made, -each- 5 minutes later an accelero movie will be recorded. Thus, between each Gps fix, there will be 6 movies equally spaced in time.
  If also a movie is wanted with the Gps-fix, the "Add above number.." need to be checked.
  We can assist you making the right settings for this use.

The other check box "Temporarily stop Acc…" is an option to save valuable memory space. If the user is only interested in Acc-movies added to a Gps-fix, it's an option to stop recording when the battery has become too low to do Gps measurement (winter days, dark forest etc).

Energy
The device is equipped with a rechargeable battery. This battery has a certain capacity chosen with respect to the allowed overall weight of the device. When the battery is full, charging will stop and available energy is not used. A mechanism has been created to use this surplus of energy. By adapting (dividing) the Gps-Ival the device will use more energy. The second parameter limits the minimum.
If this option is used, the program shows the actual Gps-Ival for this event in green behind the Gps-Ival in the Main or Fence Activity tab. The E+ postfix refers to energy surplus.

Memory saving
Also an option to save/control device memory. Often used when birds will go on migration.

5.4 Groundstation Network

This tab-page is a tool to manually test/check the Groundstation Network. When setting up the system in field for the first time, checks on this page can be used to test the connection to all or a specific relay. Also they the topology of the network is showed here.

Normal Operation Checks
The birdtracking program itself runs checks at certain intervals. But with the buttons in this frame, the user can force them to happen within a few seconds.

- *Base Reset*
  This action will shutdown the zigbee network first. Then repowers the base module and setup the zigbee network again. All relays will loose connection and it might take a while before the are connected again.
- *Network Check*
  Fires 3 network check commands. If they fail the base will be reset.
- *All Relay Check*.
  This sequence will check all relays present in the setup. If the relay doesn't receive this check in 30 minutes, it will reset itself. This is called a "watchdog" and prevent relay hangup.
  When running the check all kinds of communication can be seen in the communication windows. But the overall result is what counts. On the status bar each relay has a number and the result of each relay is shown here in the format: aa-bb% / ss
  - aa is the average OK checks seen over the last 25 checks
  - bb is the average OK checks seen over the last 5 checks
  - ss is the status of the last check.

  It's perfectly normal that the relay check sometimes return an error. But to judge the radio link, these averages have been created.
  The all relay check is the check that also refreshens the network topology.
  Right after a Base Reset, the relays need the re-join the network. It might take some minutes. In some cases, the relay won't reconnect until it's watchdog has reset it. Then it thus can take 30 minutes.

Other Checks
- *Base Interface Box Check*
  This check can be used to see if the cabled communication to the base is working properly. It fires a command which return a lot of data which should end with OK.

Groundstation Network Setup Check
This is the tool to check an individual relay. When setting up the system in the field, you can focus the test to the relay you are setting up, or aiming right now.

All relay in the system are listed with "relay-lights". Click on the light to select the relay you want to test. Next you can choose between the two buttons for a single test or 10 tests in a row.

This test does not use the status bar to show the result. The user must look to the communication history and watch for OK of ERROR. If an error occurs, the check also briefly discribes the error. Good reception is all OK. “No link” means no connection so alter the direction of the antenna.

Current Network Topology
This frame shows the current network topology. Thus how all the relay Id is use connect to each other and to the base. Some extra information.

5.5 Gps-device Data storage

All the up-, and downloaded data is saved in daily log files. Each device ID has its specific log file for that day. That is, if it has connected that day. If a device does not connect in a given day no log file is made.
The data can be found in the birdtracking program directory (C:\Gps_logFiles). The format of the files is:

Log_<Id>_<Date>_<Postfix>.txt

where Id is a four digit number and date is dd-mm-yy

Besides this file, all the data that passes the Communication History window is saved in:

Log_com_<Id>_<Date>_<Postfix>.txt

For engineering and debugging purposes the program has lots of error traps inside. These errors are logged in the Log_error_<date>_<Postfix>.txt

The logfiles need to entered in the special database service for the birdtracking system. This service will process the data. The user can query this database and it will return post-process data in various formats.

Information how to do this can be found in a special document.

5.6 Program operation 24/7

The principle of operation is to let the program run 24/7 to get the data out whenever the Gps-device connects. The netbook is carefully adjusted that this operation is not abrupted. So automatic windows update etc. has been disabled. To keep the machine working without problems, please keep it a dedicated birdtracking machine and don’t install other software.

5.7 Remote Computer Acces

If the base station is at a remote (uninhabited) location, it is handy to use remote desktop to transfer data and arm new measurement schemes. The netbook is pre-installed with LogMeIn and is capable to do so.
First the netbook needs to get internet access. This can be done with the use of a Usb-internet dongle or better 3G-router. How this is done is beyond the scope of this manual.

☝ ***Attention:***
The system uses frequency and channels that are widely used for Wi-Fi and other consumer electronics. These signals can possibly disturb our communication. So when creating internet connectivity please don’t use Wi-Fi unless absolutely no other option is available.

LogMeIn can be used very easily and works in most cases. The name of your LogMeIn account, and the password will be supplied by us.

To remote access the netbook:
1. On another machine browse to LogMeIn.com
2. Login: bts_<your account>@hotmail.com, psw: <xxxx>
3. Connect to the computer listed (by clicking the button)
4. Account: birdtracking, psw: <xxxx>

LogMeIn might need to install an add-on to the browser. Yes, indeed twice the same password is used.

6 How to do and examples

6.1 Upload new device settings

First make all necessary settings in the FW Version 2 tab of the Birdtracking program. Then switch to the Main Control tab and fill in the ID-numbers of the devices that need to get those settings. Separate then with comma's no spaces. Now you can wait for the next communication event, or directly trigger an communication event by using the magnet as described in previous chapter.

6.2 Storage settings

When not using the device it's good practice to give them storage settings. These settings are
TimeBlock 1 all 08:00, TimeBlock 2 all 19:00
Gps=0 (off), Com=60000 (once a day), Acc=0 (off)
All other settings unchecked (No Gps fence none in "all activity")
Now upload these settings as described above.

☝ ***Attention:***
Prevent in all case that a device with these setting gets put on a bird. With one communication event a day it might be very difficult to upload the right settings.

6.3 Fully charge the device (with artificial light)

Before mounting the device on a bird or putting the device in storage for a long period, it is advised to charge the device. If sunlight is available then that is preferred. If not a construction halogen lamp (400Watt) will also do, only slower. Keep about 25cm distance between lamp and devices. Use a table ventilator to force cooling for the devices. Artificial charging is faster when the device has storage settings (or moderate activity settings).

☝ ***Attention:***
400 Watt halogen light at 25cm will heat up device severe. You <u>need</u> to aim a (table) ventilator on it.

Below the Communication History you can see the last received S0 data line. The number behind DATA is the ID number of the device. The 8th number of the S0 line shows the battery voltage in mV. The battery is full if it reads > 4000mV.

Intermezzo

Oystercatcher

7 General Don’ts

7.1 Base station connected, computer or program off.

The base station is still powered by USB when you shutdown the computer in the normal way or exit the program. This will leaves the network existing and devices can connect. However they won’t be “served”. They will timeout after 30 seconds, but this is still energy consuming for the Gps-devices.

So if you want/need to shutdown the system then disconnect the USB cable of the base-module.

If the base-module is powered down, the relays will keep on “searching” for the network. This takes more energy than normal operation. So in case of shutdown of the system, please disconnect the battery pack in the battery box of the relay(s).

7.2 Magnet reset

The magnet should only be used shortly to reset the device. Do –not- store our device as Argos devices! No magnets near devices when stores. It will deplete the battery in a couple of days.

8 Troubleshoot

8.1 Communication port does not exist

Several causes can display this message.

1. Check the whole USB chain from computer to base-module.
2. The base module is USB powered. Do you use a passive USB-hub? If so then take it out the chain. Try again.
3. The USB driver hangs; please restart your computer.

If points above do not solve the problem then check the next steps:

- In windows open the device manager’s Ports (com&lpt) listing
  My Computer – properties – hardware – device manager – Ports (Com & LPT).

There should be at least one USB Serial Port (COM x) present.

- Write down the number. If there are more numbers, detach all other USB connections except of course the base-module.
- Go to the birdtracking program folder (C:\Program Files\Birdtracking)
- Double click on Birdtracking.ini
- At the top of the file, change the number “1.Port = x” to the number you’ve written down.

If the problem still remains, then email baaij@science.uva.nl

8.2 Device near base does not connect

Most likely, the device’s power is too low. Under battery voltage of 3.3 volt, the communication is skipped to save the battery. Please charge the device with (artificial) sunlight as explained above.
If you’re sure that the battery is not low, you can also Reset the Base. The button can be found on the Groundstation Network tab, frame Normal Operation Checks.
If the problem still remains, then email baaij@science.uva.nl

8.3 Base Reset errors

To resolve try following steps:

1. Exit the program.
2. Disconnect the USB cable. Wait for windows to acknowledge with the well know “bling-blong” sound. Then reconnect the USB cable. Again “blong-bling” wait a few seconds and restart the program.
3. If the problem still remains, then reboot the whole computer and restart the program.
4. If the problem still remains, then email baaij@science.uva.nl

8.4 Relay Check Errors

If your system has been equipped with one or more relays then they will be checked with an interval. It’s a known issue that sometimes a relay does not respond. A build in feature, so called watchdog, will reset the relay, and probably resolve the problem in one hour. If “No respond” remains, then the following items may be of help:

- Is it just one relay? If not it might be the base-module. Then close the program, Disconnect the Usb cable, wait 10 seconds, reconnect and restart birdtracking. See if this has helped (it might take waiting for ~30 minutes)
- If just one relay; are the batteries empty? Check the logfile of the specific relay
- Is the weather very bad? Very foggy, rainy? See first if the weather is the cause.

- If the problem persists you need to take it out of the field to the base-station and try to connect in close proximity. Call/mail for support.

9 Appendices

9.1 Birdtracking ini-file format

to be added