Buyer's Guide for Field PDAs:
What you need to know to buy the best PDA + GPS unit for your field work

Do you need a PDA for your fieldwork?
It can be a big decision (and often expensive) to go from a simple handheld GPS unit to a more advanced system like a PDA for your fieldwork. There are things to consider when deciding if you need a PDA:

Use a handheld GPS if you…
- □ Only need GPS coordinates and prefer to use paper/note book to record field data,
- □ Want a simple and light-weight device,
- □ Are concerned with price.

See the "Handheld GPS Buyer's Guide" for more info.

Use a PDA if you…
- □ Want to collect field data electronically,
- □ Need a keyboard or pen stylus for extensive data recording that is both fast and easy,
- □ Want to use custom programs, e.g. ArcPad
- □ Want to use custom digital forms to enter data,
- □ Want to use more and better maps and GIS data as back drop to your GPS data in the field.

If you decide to purchase a PDA system for fieldwork, there are a few things you need:
- ✓ PDA
- ✓ GPS receiver (if you want GPS positioning)
- ✓ Software

PDAs
What's important for <u>fieldwork</u>?

Ruggedness & weather resistance
Rugged units are more expensive than lighter-weight ones, but the investment is worth it if your fieldwork includes moderate to extreme rugged terrain and environments. PDAs designed primarily for business or navigation applications (i.e. HP iPaq, Dell Axim) are not very water resistant, something to consider when you're in environments where it might rain or your water bottle/CamelBak might leak onto the unit in your field pack. It is also a good idea to buy a protective, water-proof case like the one pictured *above* made by DryPak (GPS works through the plastic!). The Trimble Recon (*below*) is rugged enough to work in freezing, muddy, and wet environments.

Operating system (OS)
The programs you want to run on your device will have a huge impact on the operating system (OS) you choose. Common OSs include: Windows Mobile (also known as Windows Mobile for Pocket PC or Pocket PC, etc.), Palm OS, and the new Mac OS X for iPhone. ESRI's ArcPad only runs on Windows Mobile operating systems. Since each PDA device runs only one OS, this will narrow down your choices for which device to buy.

Processor
The faster processor, the faster and smoother programs like ArcPad will run. With a faster processor, larger datasets like background imagery will also work more smoothly in ArcPad. Try to buy a processor with 300 MHz or greater. ArcPad requires ARM-based processors, including Intel (StrongARM, XScale), Samsung, Texas Instruments (OMAP), and Atmel processors. Since each PDA device contains a different type of processor, this will narrow down your choices for which device to buy. If you won't use ArcPad, processor type is not as important as processor speed (MHz).

Memory
The more memory ("RAM"), the faster and smoother the programs, like ArcPad will run. To run ArcPad, you need a minimum of 64 MB of RAM, although more than this (128 MB or more) is optimal. Memory upgrades are possible for an additional $100-300.

GPS receiver: Integrated or external?
A big decision is whether to buy a PDA with an integrated GPS (like the Garmin iQue M5, *left*, or the Mio 168RS, *right*), or without – in which case you'll need to buy a separate external GPS (or use a GPS handheld you already have). Integrated GPS allows the expansion slot to remain free so you can add a memory card containing maps and data. Depending on the device, integrated GPS can be simpler and seamless, but it does not necessarily produce a seamless and trouble-free GPS connection. External GPS receivers come as either Compact Flash (CF) attachment or bluetooth receiver. See the description of external GPS receivers below.

Telephone capabilities

As Smartphones (PDA and telephone combined), like the Palm Treo 700 with Windows Mobile OS pictured *left*, become more popular, the desire to telecommunicate from the field will increase. Consider if you (now or in the future) want to connect to your email or the Internet from the field, or upload field data (including digital photos) from the field directly to your database back in the office. Telephone and web connectivity translate to high costs, both in the choice of your Smartphone and in subscriptions costs for having web connectivity on your phone.

Expansion

Depending on what you plan to connect to your PDA device, you will want to get appropriate devices. It is possible to connect a handheld GPS unit via a serial or USB port, provided the ports exist on your PDA device. Getting a device that is bluetooth-ready will allow you to connect with other bluetooth-enabled devices like GPS receivers while keeping the expansion slots and other ports open for other accessories.

Keyboard & pen stylus

If you will need to record a lot of text, you might prefer a PDA with a keypad, like the HP iPaq 6515 pictured *right*. Most PDAs come with a pen stylus, which is easy to use, but is often time-consuming to enter long field notes. However, most devices today have handwriting and character recognition to aid the process.

Screen & display

The larger the screen size and the higher the resolution, the better. Also, you'll definitely want a device that has a transreflective screen, which is an anti-glare display that provides optimal viewing in both low light and bright sunlight. If a transreflective screen isn't possible, you may purchase an anti-reflective cover to clip onto the device or a screen protector which also reduces glare (*above-right*). If a larger screen is needed, consider a rugged tablet PC, such as the Xplore Tablet PC (*left*).

Battery power

The longer the battery life, the better. Rugged devices which are designed for fieldwork have longer battery lives and can last for up to 10 active hours. However, no matter what unit you have, you should buy a backup battery just in case. Also, it helps if your device can take regular batteries if you're in a pinch.

Size & weight

While lighter and smaller devices are easier to carry in the field, they also tend not to be very rugged. It is a good idea to handle the device before you buy it, to get an idea of how it will feel when you're out in the field.

Price

Price will impact your decision of what to buy, including PDA device, GPS receiver (if it is not integrated in the PDA device), software (if desired), subscriptions to things like web connectivity (if you have a compatible device like a Smartphone), and any training that you made need to use all the technology.

Some Recommended PDA Devices:

PDA Device	ArcPad Compatibility?	Rugged?	Integrated GPS?	Cell Phone?	Price
Trimble GeoXH	x	x	x		$6K-8K
Trimble Recon	x	x			$2K-3K
Trimble Recon w/ ProXR receiver	x	x	x		$3K-5K
Magellan MobileMapper Pro	x	x	x		$1K-3K
Magellan MobileMapper CE	x	x	x		$2K-4K
HP iPaq	x				$300-900
Mio 168 w/ built-in GPS	x		x		~$600
Garmin iQue M3, M4, and M5	x		x		~$700
Palm Treo 700w/wx Smartphone	x			x	*
Verizon Wireless XV6700	x			x	*
Samsung SCH-i730	x			x	*
Cingular 8525	x			x	*
Cingular 8125 Pocket PC	x			x	*
Dell Axim	x			x	*
Casio Cassiopeia	x			x	*

* PDA phones are much less expensive when purchased with a wireless service plan. See carrier's website for more details, as well as many more phone models that may be compatible with ArcPad.

Reviews:

Rugged PDAs: http://www.wirelessdevnet.com/channels/pda/ruggedpda/
Hardware-specific information: http://www.gpsinformation.org/dale/PocketPC/cehardware.htm
Windows Mobile GPS & Navigation Software: http://www.gpsinformation.org/dale/PocketPC/wince.htm
CNET Reviews for GPS PDAs: http://reviews.cnet.com/Handhelds/2001-3127_7-0.html?tag=cnetfd.dir
MiTAC Mio 168 review: http://www.pocketpcmag.com/_archives/jul04/mio168.asp

GPS Receivers

A GPS receiver is not absolutely necessary for using ArcPad because you can always visually estimate your position in the field. However, having GPS does produce more accurate locations of your field data.

You must choose between a PDA with integrated GPS or without – in which case you'll need to buy a separate external GPS (or use a GPS handheld you already have). Integrated GPS allows the expansion slot to remain free so you can add a memory card containing maps and data. Depending on the device, integrated GPS can be simpler and seamless, but it does not necessarily produce a seamless and trouble-free GPS connection. External GPS receivers come as either Compact Flash (CF) receiver or bluetooth receiver.

Some **CF receivers** have an easier time connecting than do bluetooth receivers, and bluetooth receivers require that your PDA device has bluetooth capability. However, **bluetooth receivers** can be attached to your hat, clothing, or backpack providing non-stop satellite reception (that way, if you put your PDA in your pocket and then take it out to use it again, you don't have to wait to get a satellite fix again; you only have to quickly re-connect your PDA and receiver.)

When choosing a GPS receiver, be sure to compare:

1) Overall accuracy
How accurate do you want your GPS locations to be? Trimble units like the GeoXH are mapping-grade GPS units which have receivers that provide sub-meter horizontal accuracy under the best conditions (e.g., clear open sky, flat terrain, good satellite position). If you need sub-foot accuracy, you will need to use additional antennas or receivers specially designed to differentially correct the data, or post-process your GPS data correction back at your office using data downloaded from the Internet. GPS receivers that are WAAS-enabled and/or have the new SiRF chipsets are capable of higher accuracies that others. Usually, the more accurate receivers are substantially more expensive. Trimble units and MobileMapper devices allow for DGPS either post-processed or real-time (with added equipment). Other devices allow for post-processing only with added software like GPS Correct for ArcPad (see the Software for Fieldwork section).

2) Time to first fix (TTFF)
Time to first fix is how quickly your receiver connects with satellite signals, giving you a GPS location. This should not be considered lightly, because a lot of time can be wasted waiting for your GPS receiver to get its first satellite fix. After the first fix, the receiver has an easier time keep tracking of satellites in the sky, but the first fix always takes a while. Some have found the bluetooth receivers to have a faster TTFF than CF cards.

3) Battery life
Bluetooth receivers don't drain your PDA batteries as much as CF cards do. Bluetooth receivers have their own battery source, whereas CF cards use the PDA's batteries. Many receivers, such as those made by TeleType and GlobalSat, have battery life up to 16 hours.
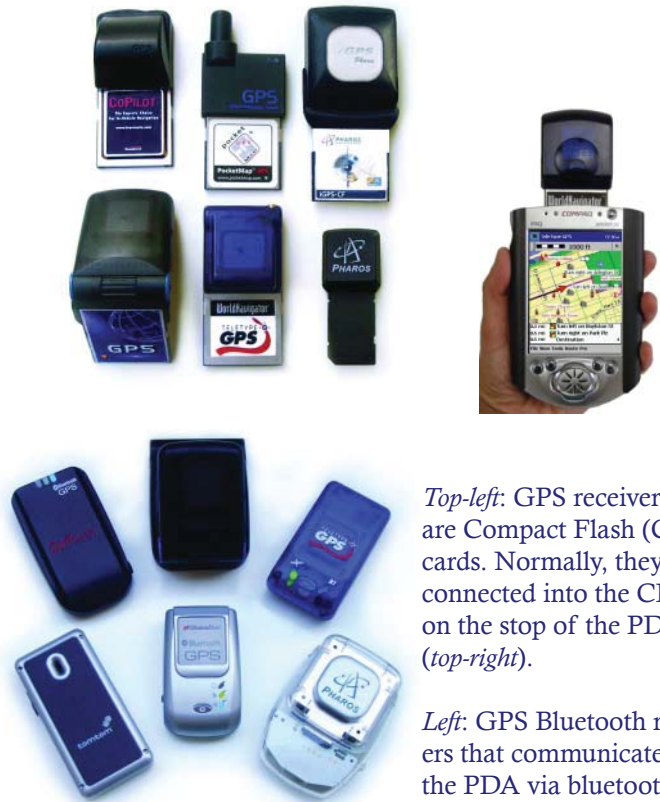
Top-left: GPS receivers that are Compact Flash (CF) cards. Normally, they are connected into the CF slot on the stop of the PDA (*top-right*).

Left: GPS Bluetooth receivers that communicate with the PDA via bluetooth.

Several brands of GPS receivers in the September 2005 issue of Smartphone & Pocket PC Magazine: http://www.pocketpcmag.com/_archives/sep05/gpssolutions.aspx. In addition, some of the information here was taken from this article.

What GPS receiver should I use?
If you're planning on using ArcPad, it is important to know that ArcPad supports the following protocols for communicating with GPS receivers. Most GPS receivers on the market are one of the these, but double-check just to make sure!
- National Marine Electronics Association. (NMEA) 0183, ver. 2.0
- Trimble Standard Interface Protocol (TSIP)
- Rockwell PLGR Protocol
- Delorme Earthmate

Recommended GPS receivers:
- Holux GPSlim236: http://www.holux.com/product/
- GlobalSat: http://www.usglobalsat.com/category.asp?catid=4
- Garmin (works with both Palm OS and Window Mobile OS): http://www.garmin.com/products/garminmobile10/
- TeleType GPS World Navigator:
  http://www.pocketpcmag.com/_archives/Jul03/gps_teletype.asp
- TeleType's PC Card GPS Receiver:
  http://www.pocketpcmag.com/_archives/mar01/GPSReceiver.asp
  http://www.pocketpc mag.com/_archives/sep05/gpssolutions.aspx
- TeleType's GPS Bluetooth Receiver:
  http://reviews.cnet.com/TeleType_GPS_Bluetooth_Receiver/4505-3490_7-30880954.html?tag=uolst
- HP iPaq Navigation system:
  http://reviews.cnet.com/HP_iPaq_Navigation_system/4505-3490_7-30600552.html?tag=pdtl-list

Reviews:
http://pocketpcmag.com/_archives/oct06/gpssolutions.aspx
http://www.pocketpcmag.com/_archives/sep05/gpssolutions.aspx

Software for Fieldwork
Below is a description of software you should know about:

What is ArcPad?
ArcPad is software that is installed on a PDA or other mobile devices. ArcPad requires that the device have Windows Mobile operating system, which means that no Palm devices may be used with ArcPad. With ArcPad, you can:
- Create, edit, and display GIS data
- Attribute data collection using customized forms
- Add data from the Internet (if Internet connection is available)
- Integrate with GPS or DGPS to collect points, lines, or polygons
- Integrate rangefinders for hard-to-reach areas, with measurements of distance, bearing, and inclination.
- Integrate digital camera

Trimble units like the GeoXH (*above*) can run both Trimble's Terrasync and ESRI's ArcPad software.

What is Terrasync?
Terrasync is software created by Trimble to be used on Trimble GPS units. If you have Terrasync and you like it, it is probably unnecessary to buy ArcPad, as it does all the same things as ArcPad does, except it generally does not have streamlined integration with geospatial data.

What is GPS Correct Extension for ArcPad?
The GPS Correct extension for ArcPad was created by Trimble for use non-Trimble units with ArcPad installed. GPS Correct does nothing to your data at the time of data collection. What it does is this: during data collection, GPS correct collects a file of raw GPS observable data in the background and stores it one your PDA. Then later, back at your office computer, you can use this file to post-process your GPS data. To perform the post-processing, you can use either Trimble's GPS Analyst extension for ESRI ArcGIS software or Trimble's GPS Pathfinder Office software. GPS Correct can improve your GPS accuracy to sub-meter, depending on conditions and your GPS receiver. Buy GPS Correct only if you want sub-meter accuracy, and you don't have a Trimble unit; and instead have a PDA like an iPaq.

What is GPS Analyst?
GPS Analyst was created by Trimble as an extension to ESRI ArcGIS software (version 8.3 or later). It is the only software that allows you to differentially post-process within ArcGIS software. If you buy GPS Analyst, then you don't need to buy Pathfinder Office. If you buy GPS Analyst, you will have to buy ArcPad and GPS Correct as GPS Analyst is designed for these programs and is useless without it.

What is Pathfinder Office?
Pathfinder Office is Trimble's software for handling all data creation, manipulation, display, and transfer between your PC and your Trimble device (e.g. GeoXH, Recon, etc.). If you buy Pathfinder Office, then you don't need to buy GPS Analyst.

What is Microsoft ActiveSync?
Microsoft ActiveSync is the required software necessary for transferring data from your PDA with Windows Mobile OS, e.g. iPaq, Trimble Recon, to your PC. When you first open your PDA, you'll want to visit http://www.microsoft.com/windowsmobile/activesync/ to download the most current version (v. 4.2 for Windows XP or earlier, at the time of writing this guide). ArcPad needs v. 3.8 or higher.

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ArcPad Specifics:
Will ArcPad work on your PDA?

1. The first thing to look for is a PDA or mobile device that runs Windows Mobile Operating System (OS). The current version is Windows Mobile 5.0, but ArcPad also works with Windows Mobile 2003 (including Second Edition), also known as Pocket PC 2003, and Windows CE 4.2 and 5.0, which run on portable computers. A list of devices that use Windows Mobile can be found at: http://www.micro-soft.com/windowsmobile/devices/default.mspx.

2. The second thing to look for is the correct processor. ArcPad only runs on ARM-based processors, including Intel (StrongARM, XScale), Samsung, Texas Instruments (OMAP), and Atmel.

3. The third thing to look for is if the PDA or mobile device has enough memory. While ArcPad requires a minimum of 64 MB for installation, it is recommended that you buy a device with as much memory as you can afford.

4. The last thing is whether or not the PDA or mobile device as anti-glare technology. If not, you might be able to add an anti-reflective cover as an accessory.

Minimum system requirements to run ArcPad on your PDA, according to ESRI (http://www.esri.com/software/arcgis/arcpad/index.html)

Operating System	• Windows Mobile 2003, 2003 Second Edition, 5.0 • Windows CE 4.2, 5.0
Processor	ARM-based processors, including the following • Intel (StrongARM, XScale) • Samsung • Texas Instruments (OMAP) • Atmel
Memory	• 64 MB RAM
Free storage space	• Approx. 9 MB to install ArcPad • Approx. 512 MB or less for optional additional components
Desktop syncronization software	• Microsoft ActiveSync 3.8 (or higher)

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