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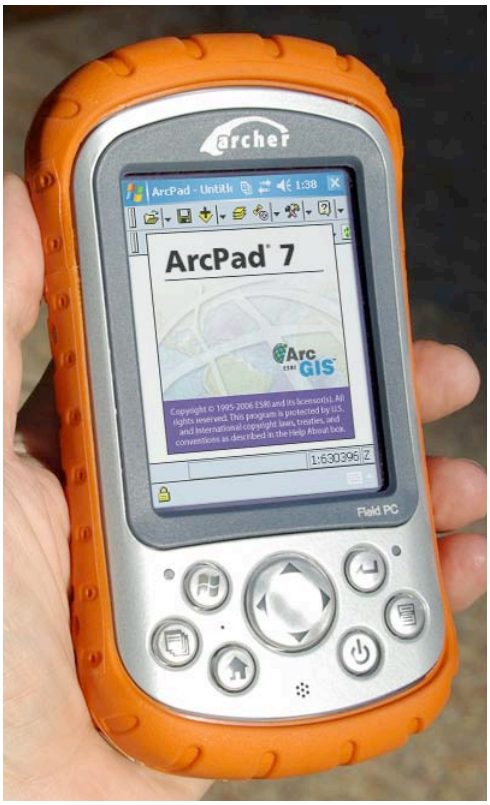
JUNIPER ARCHER FIELD PC

BRILLIANTLY DESIGNED ULTRA-RUGGED PDA

By Conrad H. Blickenstorfer, Ph.D., July 2007

If you're in need of an ultra-rugged Windows CE-based PDA, Juniper Systems of Logan, Utah, offers the Archer Field PC for applications in numerous vertical markets from agriculture to forestry to meter reading/data collection to wildlife resources and more. The Archer provides standard Windows CE functionality and excellent connectivity in a device so tough that it can be used in the most extreme working conditions.

Juniper, which was founded in 1993, is a subsidiary of Campbell Scientific which makes data acquisition and control products. Juniper Systems used to be named HarvestMaster and changed its name when the company grew beyond its traditional agricultural markets. HarvestMaster agricultural data collection tools continue as a brand of Juniper Systems. In addition to its rugged hardware lineup, Juniper also offers a wide variety of specific vertical market software optimized for Juniper hardware.



Ultra-rugged

I like the folks at Juniper Systems. They have a great sense of humor. On their website there is a picture of the Archer Ultra-Rugged PDA with a warning label next to it. The label says:

"*Warning. The Archer ultra-rugged Field PC is designed to withstand much more demanding circumstances than the average human body: lengthy drops onto concrete, heroic temperatures, prolonged submersion in liquid, extremely long work days, and occasional confrontations with wild animals. Take care of yourself.*"

That's funny but it's also true. The Archer is one tough handheld. Here are the specs that matter:

■ If push comes to shove, you can operate the Archer in temperatures as low as -22 degrees Fahrenheit and as

high as 122 degrees. Bluetooth conks out at about -4 degrees, but the rest of the Archer works just fine in bone-chilling temperatures. And 122 degrees is about as hot as it gets in places where humans can work and survive.

■ As far as the ever-popular drop testing goes, the Archer survives multiple drops from five feet onto concrete. And not just in nice lab conditions. It'll survive those drops throughout its operating temperature range.

■ For ingress protection, the Archer rates a stellar IP67. The first number stands for protection against solids. 6 is as high as it gets, and it means the unit is totally protected against the finest dust. The second number is for the degree of protection from liquids. That scale goes from 0 (no protection) to 8 (totally immune to water, even indefinite immersion). A 7 means the device is protected against the effects of immersion into water, up to a certain extent. For the Archer, that means it can survive half an hour or so under a meter, 3.3 feet, of water.

■ A special version of the Archer has been certified as “non-incendive” for use in Class I Div 2 areas as well. That doesn't make it intrinsically safe but means it won't arc or spark and doesn't have hot surfaces, all of which can make a device a hazard in certain applications.

■ The Archer has also been tested according to the MIL-STD-810F procedures regarding water, humidity, sand and dust, vibration, altitude, shock, high temperature, low temperature, temperature shock and so on. Juniper Systems can supply details.

Protection through intelligent engineering

How did Juniper Systems achieve such

Connectors are sealed with thick plugs

stellar ruggedness specs? By adding a whole lot more clever engineering than meets the eye. Don't let the friendly "high visibility" orange pumpkin exterior of the Archer fool you (the orange version is for maximum visibility; a gray one is available also). It's just very well integrated padding and protection. Remove the plas-

tic/rubber elastomer overmold by simply undoing a grand total of six screws and you find underneath an entirely more serious looking piece of equipment.

Below are the pieces of the Archer Field PC laid out: You can see the orange elastomer parts that provide protection, the backside of the magnesium core, the battery that seals tightly against the contacts, and the rubber plug/handstrap assembly.

Above you can see the bare core of the Archer. It's a rock-solid, brilliantly engineered magnesium case that seems milled from a solid block of metal. How does the Archer manage a IP67 rating when it has all those ports and expansion slots? From what we can tell, by separating things into different compartments. The vulnerable interior with all the electronics is housed inside the magnesium case. The ports at the bottom of the device are mounted in a plastic block screwed onto the magnesium housing. The ports are protected, but not totally sealed, by thick rubber plugs. Even underwater, while a bit of water may get into the connectors, it won't get inside the case because the interface between the connector block and the magnesium housing is sealed.

The situation is different on top of the unit where the two expansion slots are. There are electronics in there and they need to stay dry. Sealing is provided by the elastomer top cap. An o-ring approach (o-ring in principle; Juniper is actually using sealing plates) is used to keep water out, so make sure the top cap is securely screwed down after you've taken it off to insert a card. And make sure nothing is clinging to the sealing surface as that would allow water to penetrate.

The battery compartment is not sealed, so how is water kept from reaching the contacts? Once again, Juniper's engineers used the o-ring approach. The contacts have a rubber seal around them that presses against a flat surface on the battery, keeping water out.

This is a very intelligent approach to solving ingress protection challenges: instead of simply enclosing the entire device, which would make access to ports very difficult, the various areas that require contact between inside and outside are sealed separately, with different methods, and according to the degree of protection required.

Another smart aspect of this approach is that should the outer padding get cut or ripped, it can be replaced easily and inexpensively. The same goes for the rubber flap with the four individual protective plugs.

The secret to the Archer's ruggedness: a sealed, armored core

Technology

The technology used in the Archer is solid, proven Pocket PC grade rather than leading edge. The device is powered by the 520MHxz version of the Marvell PXA270 processor. This is still a good solution although the PXA270 is no longer Marvell's flagship mobile chip. That position has now been taken over by the PXA3xx, and specifically the speedy 800MHz PXA320.

There is 64MB of RAM and 256 to 512MB of Flash. The larger flash disk is much appreciated; earlier versions of the Archer were limited to 64 or 128MB of Flash.

The transflective display measures 3.5 inches diagonally and uses the ubiquitous 240 x 320 pixel resolution. The display is just bright enough and is outdoor-viewable, though there is more glare than we like. However, a device often used for mapping and navigation might benefit from a full VGA (480 x 640 pixels) display.

On the software side, Juniper chose Windows Mobile 5.0. This is a stable, time-tested operating platform with numerous software development tools and a large library of applications.

Interfaces and expansion

The Archer has both a Compact Flash Type I/II card slot as well as a SDIO slot. Both are user-accessible after undoing two Philips head screws and removing the top elastomer cap.

On the interface side, there is a standard 9-pin RS232 port, and two USB ports. One of them is a USB host, using a Mini-A jack, to control other devices. The other is a USB client, using a Mini-B jack, for synchronization with desktop or notebook PCs. The power jack is located next to the USB client. All ports have individual protective rubber plugs.

Wireless communication

The Archer can be ordered with integrated Bluetooth Class II. Wireless communication (WiFi or wireless cellular modems) and GPS via SD or CF cards. Any standard cards will fit. Juniper Systems offers GPS receivers from Trimble, GlobalSat or Holux; the Enfora GSM/GPRS modem; and Socket WiFi and Bar Code scan cards.

Extended caps

Juniper uses an "extended cap" system that can accommodate GPS, barcode readers, cellular modems, RFID readers, a digital camera, and other extended/oversized cards.

Currently available are a Communication Cap designed for use with CF and SDIO wireless cards; a Universal Cap with a clear, hard-coated window for use with large peripherals such as GPS receivers, digital cameras and RFID; an Optical Cap with a scratch-resistant scan window designed for use with a bar code scanner; and a Data Acquisition Cap specifically designed for use with the National Instrument CF-6004 data acquisition card.

Our review system came both with the standard and with the Universal Cap. One might expect that the use of an extended cap might reduce the Archer's stellar IP67 sealing, but that is not the case. The extended caps are meticulously designed and engineered and they have internal o-ring seal adapter plates to keep dust and water out as effectively as the standard cap. That is quite remarkable. Below you can see the unit with the Universal Cap installed.

Controls and navigation

The Archer has a sealed resistive touch screen, a 4-way navigation disc, and six hardware buttons. The hardware button, three each on either side of the navigation disc, are backlit and labeled, but they can be reassigned. As is, the buttons bring up the Windows Start menu, the Applications Manager, the Today screen and context menus. There is also an enter button, and a slightly recessed one that turns the device on and off. The touch screen can be operated either with the supplied 4.6-inch long stylus

Juniper Archer

Type: Ultra-rugged PDA

Chassis: Magnesium case with elastomer overmold (orange or tactical gray)

Processor: Marvell PXA270/520MHz

OS: Windows Mobile 5.0

Memory: 64MB RAM and 256-512MB of Flash

Display: 3.5" backlit transflective TFT with 240 x 320 pixel resolution

Digitizer/Pens: resistive touch screen/1

Keyboard: on-screen

Expansion slots: 1 CF Card Type II/II and 1 SDIO

Size: 3.5" x 6.5" x 1.7"

Sealing: IP67

Drop: Multiple drops from 5 feet to concrete

Operating temperature: -22 to 122 F

Sealing: IP67

HazLoc: FM approved non-incendive Class I Div 2 per FM 3611 available

Power: 14 WHr Lithium-Ion ("more than 20 hours")

Communication: Bluetooth Class II; optional WiFi and cellular wireless modems via cards

Interface: USB mini-A and mini-B, COM1; optional extended custom caps can include GPS, scanners, camera

Price: depends on configuration

Contact:
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that stows away into a garage on the upper left side of the computer, or with any other stylus or even finger. There are no additional hardware controls.

Size and ergonomics

Being an ultra-rugged device, the Archer Field PC is larger and heavier than a consumer-grade Pocket PC. It is 3.5 inches wide, 6.5 inches tall, and about 1.7 inches thick. The computer weighs just over a pound, light enough to carry for hours.

Except for users with very small hands, ergonomics are excellent. The Archer fits perfectly into a hand and the elastomer protective cladding provides a good grip. An elastic handstrap mounted on the back of the device provides extra security against dropping. The hardware controls require a firm push and provide tactile feedback. Their backlight is adjustable.

The protective rubber plugs at the bottom can be a bit obstreperous. They need to be guided and require a firm push to be seated firmly into place.

Drop and underwater test

We put Juniper Systems' ruggedness claims to the test, and the Archer Field PC passed with flying colors. We dropped it from four feet onto rough driveway pavement several times. Not only did it survive, there wasn't as much as a single scratch.

We also dumped it into water to a depth of about a foot and a half and let it sit there for a few minutes, with applications running. The Archer didn't leak and kept on running.

A word of caution, though: if your Archer ever falls in the water, keep in mind that while the core is sealed, water does get into the interface block and the battery housing. The contacts are sealed and no water gets where it shouldn't be, but you definitely must take the protective cladding off, remove the strap and battery, and dry everything off before re-assembly. If you keep that in mind, immersion is simply not a problem.

Video of review

With YouTube-style videos becoming ever more important, we recorded a description of the Archer on video. The 8-minute movie shows how the Archer, is constructed and how it performed under water and during drop tests. you can view the video at: www.youtube.com/watch?v=7hCEUQIrp0s

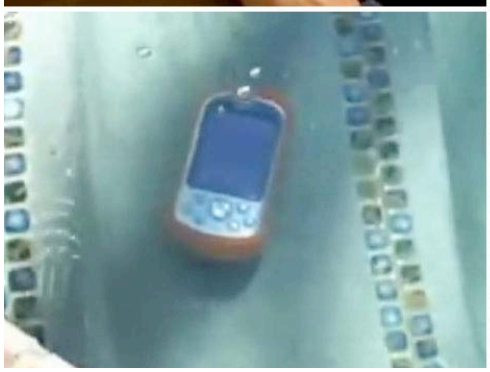
Bottom Line

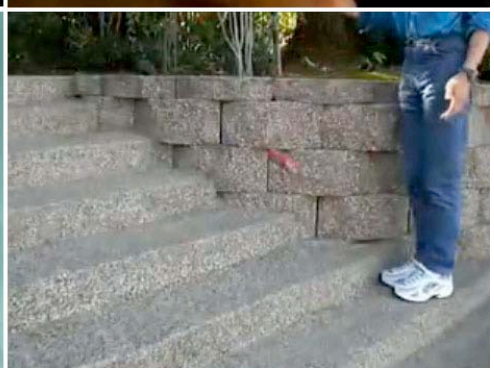
The Juniper Systems Archer Field PC may look friendly with its pumpkin-orange cladding (gray is available) and big round buttons, but it is an entirely serious machine that's as tough and rugged as they come.

A very intelligent design combines a rock-solid magnesium core with easily-replaceable exterior elastomer protection, making for both superior durability and above-average connectivity and onboard expansion. The Archer is ergonomically designed, too, and its strong battery easily lasts a full shift or even two. Electronics and software are tried and field-proven, though not state-of-the-art. The transmissive 240 x 320 pixel display offers only average brightness and has too much glare; we'd like to see a full VGA display with more anti-reflective coating.

Overall, the Archer Field PC is a superbly designed, ultra-rugged handheld computer. It's tough enough to handle virtually any abuse, yet small enough to be carried anywhere. This and its powerful battery make the Archer a convincing choice for any number of demanding field applications.

– Conrad H. Blickenstorfer





To the left you can see scenes from the video we took during the Archer review. Dismantling of the unit revealed a brilliantly conceived design that is key to the unit's toughness and sealing. We dropped the Archer into water nd let it sit, then bounced it around. It survived intact and without a single scratch.