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GENERAL DYNAMICS ITRONIX GD6000

VERSATILE, POWERFUL VEHICLE-RUGGED NOTEBOOK WITH SUNLIGHT-VIEWABLE DISPLAY

by Conrad H. Blickenstorfer

The General Dynamics Itronix GD6000 is an advanced vehicle-rugged notebook computer with excellent performance and a number of features the competition will find hard to match. Based on the tried-and-true VR-2 platform, it is a third-generation product that builds on the inherent quality and reliability of its predecessor, but offers state-of-the-art performance with a 2.53GHz Intel Core 2 Duo processor. The machine is primarily intended for vehicle use, but has application in a wide variety of industries that require strong processing and wireless performance in a machine that is rugged enough for most jobs.

The "GoBook" name is gone, passing up on brand equity earned over years with generations of rugged GoBook computers. What hasn't changed is the 13.3-inch touchscreen display that offers excellent outdoor viewability thanks to the patent-pending DynaVue technology. The difference DynaVue makes compared to a standard transmissive display, or even one with anti-reflection coating, is amazing and greatly adds to the utility of this machine.

Wireless performance is strong due to an integrated quadra-helix antenna system for fast and accurate fixes, and specially designed wireless modules. There is good onboard connectivity, as well as expansion potential via externally accessible card slots and a media bay.

Existing customers will appreciate the new model's full compatibility with all prior VR-Series docks and peripherals, and the class-leading performance of the GD6000 is a strong upgrade and expansion incentive. New customers will find in the GD6000 a machine that provides consumer notebook performance and features, but industrial grade toughness and reliability for vehicle operation.

The GD6000 was released in January, 2009. It is a technology update to the company's GoBook VR-2, and also the first General Dynamics Itronix machine to drop the venerable GoBook name. Unchanged is the strong resolve to expand the market by offering a state-of-the-art machine that is compact enough for the mobile workforce as well as tough and durable enough to be deployed in vehicles. This requires careful balancing of size, weight, performance, cost and ruggedness. Target customer profiles dictated design and features, and this latest update keeps the computer ahead of the curve.

The primary target markets of the GD6000 are vehicle applications in field service, military, other government areas, public safety, and utilities. With its large and bright display, full complement of features, and full notebook power, the machine can handle all sorts of maintenance, logistics, GIS, and general operational applications.

GD6000: updated technology, more speed

Designed for versatility and class-leading performance, the "vehicle rugged" GD6000 is powered by a 2.53GHz Intel Core 2 Duo T9400 processor with a 1066MHz Front Side Bus and 6MB of L2 cache. Many experts feel that L2 cache is the most important performance factor on an x86-based Intel processor, and this processor's 6MB L2 cache is state-of-the-art. The chip is manufactured using Intel's 45nm hafnium-based technology that allows for smaller processors, yet more power without additional heat. It also supports Intel's Trusted Execution Technology, a new Intel initiative aimed at preventing software-based sensitive information theft. Standard memory is 1GB of fast DDR3 SDRAM, upgradeable to 4GB. The standard hard disk is a 160GB unit that operates at 5,400 rpm and includes al heater for operation in very low temperatures. The multimedia pocket comes with a DVD-RW/CD-RW drive that fills most users' needs.

Speed and performance are moving targets for computers. Processors get faster, but operating systems, applications and websites also grow larger and more complex, soaking up the new power. General Dynamics Itronix has always prided itself

in providing superior performance, in the process winning several Editor's Choice awards in *Pen Computing Magazine*'s High Performance Rugged Notebook category. The GD6000 carries on that tradition with a processor that is faster than those used by most of the competition.

In order to objectively measure the GD6000's performance we installed and ran Passmark Software's PerformanceTest 6.1. This benchmark suite runs about 30 tests covering CPU, 2D graphics, 3D graphics, memory, and disk and then computes scores for each category and an overall PassMark score. The results are in the table below. For comparison we added the benchmark numbers of a first generation version of the GD-Itronix semi-rugged notebook series, and two competing notebooks using Intel Core 2 Duo T7200 and T7500 processors.

When perusing the results, note that the processors used in these machines were designed for high performance notebook computers. Their 27 to 35 watt TDP (Thermal Design Power) is far higher than that of low and ultra-low voltage chips, or the Intel Atom processors that get by with as little as two watts. These machines were built for speed and performance, and rely on smart power management and big batteries to still get decent battery life.

That said, the GD6000 is a strong performer. It is almost three times as fast overall as the first generation semi-rugged GoBook VR-1 (we tested the Hummer version). That is a massive improvement. The GD6000 is also significantly faster than the GoBook VR-2 it replaces. Speed is a moving target, but as of now, in terms of raw speed and overall performance, the GD6000 beats the competition.

Superb outdoor viewability with DynaVue

While speed makes the GD6000 responsive and efficient at crunching numbers, it's the computer's display that makes it a pleasure to use. The GD6000 uses the patent-pending General Dynamics Itronix DynaVue display technology that combines a number of optical properties to minimize reflection while preserving contrast. Add to that a powerful 500-nits backlight and the result is exceptional viewability under almost all lighting conditions. We spent a lot of time using the GD6000 outdoors and came away impressed with its screen and overall display quality.

With DynaVue, users can work outdoors and even in the brightest sunshine and direct sunlight. The display takes on a bit of a greenish tint, but you can easily see the screen and you can use it for work. In the past, working outdoors with a notebook computer meant hunting for a shady spot in the hopes of being able to see the screen well enough. That is just not a problem with the

GD6000. You get full outdoor viewability and you can use the computer anywhere and anyplace.

The unretouched pictures below show a comparison between the 13.3-inch DynaVue GD6000 screen on the right and the standard 12.1-inch display used in the older GoBook VR-1. Both have touch-screens and both are bright and easy to read indoors, but outdoors the difference is dramatic.

The first picture compares the two displays in bright daylight, but in the shade. Both displays are readable, but the GD6000 with its powerful backlight and DynaVue is significantly brighter.

The second picture has the displays facing the sun, but the picture was taken from an angle so that the sun would not directly reflect into the camera. The older display's matte surface diffuses the light so much that the screen becomes unreadable. The

DynaVue display, on the other hand, is near perfect.

The display technology used in the GD6000 is as good as it currently gets. In bright sunlight it is still not like reading a book or a magazine, the display is not paper-white, and at times you have to position the screen to avoid reflections. That's a small price to pay for this remarkable outdoor viewability.

If there is one thing that can still be improved it is the LCD's viewing angle. We've become used to LCD viewing angles of almost 180-degree both vertically and horizontally and no longer expect anything less. The GD6000's viewing angle is wide horizontally, albeit with a change in colors (gray turns yellow), but quite narrow vertically.

Elegant design

Since the prior generation VR-2 was already an elegant, attractive and well executed machine, there wasn't any need for external changes when GD-Itronix designed the new GD6000. That's good news in terms of backward compatibility for existing customers. There is a large number of VR-1 and VR-2 computers on duty out there in the field, and the GD6000 will fit right into those deployments without needing different peripherals, docks, power supplies, carry handles and cases, and whatever else VR-1 and VR-2 customers might have purchased.

General Dynamics Itronix had to make a decision about staying with the old 4:3 display aspect ratio or switching to the 16:10 ratio display that has come to dominate the consumer notebook market the same way wide-format TVs have replaced the old 4:3 format sets. Unlike HDTV with its wide-format programming, there seems no compelling reason for computers to switch to a wide-format screen other than watching DVDs. For now GD-Itronix has resisted that trend, which means the new machine is compatible with its predecessors, but it's interesting how perceptions change and the standard 4:3 format now looks tall and narrow.

The GD6000's magnesium alloy housing and chassis feel very solid and have a high quality feel. There is a strong brand identity with clean lines and a sure eye for colors and materials. The machine is dark gray except for an elegant matte-silver powder-coated insert on top of the computer that prominently features the "General Dynamics" brand name. There is a bulge on top of the computer that houses the WWAN and GPS antennae. GD-Itronix also offers a volume order Corporate Branding Program with custom logos, labels and colors.

The GD6000 has a resistive touchscreen that you can operate with your finger, a stylus, or just about any stylus-like object. There is a double-ended stylus that snaps onto a specially designed indent in the center on top of the LCD. This way you certainly know where it is, but I'd order a few extras just in case the small pen gets lost, which it very well may.

The full-size keyboard has 84 black keys with large white letters, symbols and numbers. A function key accesses extra functions assigned to various keys, and those labels are blue. A numeric keypad is integrated into the keyboard, and those

PERFORMANCE	GD-Itronix GD6000	GD-Itronix VR-1 Hummer	Averatec Voya 6400	GETAC P470
Processor	Core 2 Duo T9400	Pentium M750	Core 2 Duo T7500	Core 2 Duo T7200
Clock speed	2.53 GHz	1.86 GHz	2.2 GHz	2.0 GHz
Thermal Design Power	35 watts	27 watts	35 watts	34 watts
CPU Mark	1538.8	300.4	1263.5	893.9
2D Graphics Mark	294.8	253.3	305.5	158.5
Memory Mark	696.8	336.2	522.8	400.0
Disk Mark	378.0	213.0	266.1	343.3
3D Graphics Mark	180.7	115.4	101.9	138.3
Overall PassMark	679.5	233.6	543.4	420.8

functions are labeled orange. Like most modern corporate and industrial notebooks, the GD6000 can be ordered with an integrated fingerprint reader to the right of the touchpad. The GD6000 also has two small keyboard illumination task lights mounted below the screen hinge. Light intensity can be adjusted via keyboard in six steps from off to full power.

Ports, expansion and connectivity

The GD6000 has good onboard connectivity and expansion capabilities. The picture below shows all four sides of the computer. The front is nice and clean, and free of any controls. Most jacks and interfaces are in the back. All are individually sealed and protected with easily replaceable rubber plugs. From left to right, there are the power jack, a Gigabit RJ45 jack, two USB 2.0 ports, a modem port, a legacy serial port, and a standard 15-pin VGA-out port.

On the left side, the GD6000 has separate mini-jacks for headphones and microphones, a Kensington lock slot, and the grille for the system's fan-driven heat exchanger. There is also a front handle mounting point. Access to the removable hard disk is below the audio ports.

The right side shows the CD-RW/DVD-RW Multi Drive and next to it a Type II PC Card slot and an Express Card slot. The optional Smart-Card reader was not installed on our unit. It would take the space of the Express Card slot, so it's either/or. On top of the Multimedia Pocket is the CRMA Express radio bay. CRMA stands for Common Radio Module Architecture, and "Express" means the CRMA modules used in the GD6000 are of the new and smaller form factor variety. Modules simply slide in, then lock in place with a positive connection.

Versatile vehicle dock

Many GD6000s will be deployed in a variety of cars, trucks, and military vehicles and will require a good docking solution. The US$499 GD-Itronix vehicle dock is designed specifically for the GD6000 and its predecessors. It has a front key lock with a three-point locking system for security, and a front release mechanism for easy docking and undocking. A standard VESA mounting plate dampens vibration, and the all-steel dock is safety-tested to meet SAE J1455 traffic safety requirements. There are external RF antenna connections for WWAN and WLAN radios that allow for automatic antenna switching between the GD6000 and the cradle.

The vehicle dock has two USB 2.0 ports in the front and two more in the back, IEE1394, an external monitor port, RJ45 LAN, speaker and microphone, as well as legacy ports (two PS/2, two serial, one parallel). Input voltage is 11 to 16 VDC with a max power draw of ten amps. This being a relatively light and handy notebook, many customers will want to use it in an office, while traveling, or at home. For that, General Dynamics Itronix offers an Office Dock that the GD6000 snaps onto. The dock passes through all of the onboard ports, but also provides two additional USB ports, two PS/2 ports, FireWire, S-video and a parallel port.

Power

Finding the proper balance between performance and battery life is a big challenge for notebook designers. With the GD6000 the task was perhaps a bit easier as many machines will be used in vehicles where there is onboard power. As a result, the standard battery is a relatively modest 10.8 Volt, 4,400 mAH 6-cell

General Dynamics Itronix
GD6000

Type: Vehicle-rugged notebook computer

Chassis: Magnesium alloy

Processor: 2.53GHz Intel Core 2 Duo T9400

OS: Windows XP Professional or Windows Vista

Memory: 1 to 4 GB DDR3

Display: 13.3" XGA 1024 x 768 pixel DynaVue TFT with 500 nits backlight (meets DOD-STD-3009 military standard for cockpit displays for viewability and ambient light ratio)

Digitizer/Pens: Integrated touchscreen with DynaVue

Keyboard: 84-key 100%-scale with dual illuminator front lights

Storage: 160 GB shock-mounted 5400 rpm hard disk with heater for low temperature operation; MultiDrive CD-RW/DVD-RW

Size: 12.0" x 10.25" x 2.25"

Ruggedness: ANSI/IEC 529 IP5x dust ingress protection; spill-resistant keyboard and palm rest; -4 to 140 degree Fahrenheit operating temperature; Vibration: ASTM 4169-99 truck assurance level II, schedule E

Weight: 7.1 pounds as tested

Power: 10.8V/4,400mAH (47.5 watt-hour) Li-Ion battery; optional 71.2 watt-hour battery

Communication: 802.1a/g/n, Intel WiFi Link 5100AGN; Bluetooth 2.0 + EDR, GPS, HSDPA, EVDO Rev A

Interface: 2 USB 2.0, port replicator, fingerprint reader, audio in/out, RJ45 gigabit LAN, RJ11 V.92 modem, VGA, serial

Price: starting at US$3,500

Contact: General Dynamics Itronix www.gd-itronix.com

(47.5 watt-hour) Li-Ion pack that snaps into the front of the machine. An extended 9-cell battery is optionally available. We ran BatteryMon benchmarks to determine battery life away from vehicle power. The idle discharge rate of 14.5 watts translates into a battery life of about 3.3 hours.

Integrated wireless

GD-Itronix was an early supporter and provider of state-of-the-art integrated wireless with optimal performance and signal reception. I saw their most impressive radio testing laboratory in a tour of the company's facilities a couple of years ago. They leave nothing to chance.

Since radio technologies and standards change so quickly that the life expectancy of any integrated radio module is less than half that of the computer itself, GD-Itronix equips its computers with CRMA modules that are immune to vibration and drops and can be replaced if a carrier launches a new radio service. Card-based radios can also be used as they may be the only available solution for a particular wireless service, but their connectors are less reliable and their internal antennae often highly directional.

Vehicle-mounted and other field-deployed units are often operating at the fringe of radio signal coverage, and that makes superior antenna performance mandatory. GD-Itronix equips the GD6000 with a protected Quadra-helix antenna for fast and accurate fixes and a symmetric antenna pattern. This means greater range and a superior coverage area. GPS-equipped units use high-sensitivity SiRF III firmware for a quick initial signal lock and reliable signal maintenance. The GD6000 also has two small external antenna plugs. They come in handy for in-vehicle operation where external antennae can eliminate the signal loss caused by enclosures. Currently available wireless-wide-area network radio solutions include EVDO Rev A, a fast wireless data transmission service offered by Sprint and Verizon; and HSDPA/UMTS, offered by AT&T. The GD6000 also includes Bluetooth Class 2 and 802.11a/b/g/n WiFi. Since the GD6000 may be used in military and other applications that require radio silence, all radios can be turned off instantly by pressing Fn-Caps Lock.

Ruggedness

General Dynamics Itronix refers to the GD6000 as vehicle-rugged. The company states that the GD6000 actually meets or exceeds the "fully rugged" requirements in ten of 13 commonly applied ruggedness criteria. Meeting the remaining three would have resulted in higher cost or weight without providing tangible benefits to the GD6000's intended use. So, the GD6000 is built to a drop from 30 inches on each face as opposed to the 26 drops from 36 inches that fully-rugged machines must pass; although the machine has a spill-resistant keyboard and touchpad and most ports are sealed with individual rubber plugs, it doesn't have a water ingress protection rating; and there is no HazLoc certification.

The GD6000 machine was designed and optimized for vehicle-deployed workforces and must therefore be able to handle the shock, vibration, temperatures, humidity and general protection required for in-vehicle operation. The lower drop spec is of little real world significance. With regard to water protection, most water damage done to notebooks stems from users spilling beverages onto keyboards. The GD6000 is immune to that, but, say, an IP54 rating would still be nice.
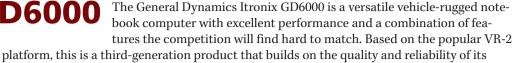
Security

The GD6000 offers a variety of physical and software security measures. The machine has a swipe style solid-state fingerprint reader located to the right of the touchpad. Biometric fingerprint scanning is very effective and can be used to complement, reduce or eliminate multiple passwords. There is a Kensington lock slot on the left side. The TPM 1.2 micro controller with cryptographic functionality allows the creation and management of computer-generated digital certificates. Combined with software, these can be used to send and received secure email; set up the browser for client identification; sign Word macros; encrypt individual files or entire folders; and create secure network connections. You can also individually disable hardware that could be used to transfer data, such as PC Cards, the optical drive, LAN, wireless radios, and com/USB ports. A special Stealth Mode turns off anything that could be heard or seen in situations where such precautions are required for safe operation. There is also a BIOS pre-boot password without which the GD6000 won't start to boot. Add to that the three-point locking system of the vehicle dock, and it's clear that the GD6000 offers a great deal of physical and software security.

Service

A big difference between a machine like the GD6000 and standard consumers notebooks is service. Most GD-Itronix customers cannot afford downtime and therefore rely on a level of service that is unheard of with consumer notebooks. Service contracts can be extensive, but they can be customized and there is almost nothing the GD-Itronix service organization cannot do. I've seen them in action.

Summary: GD6000

The General Dynamics Itronix GD6000 is a versatile vehicle-rugged notebook computer with excellent performance and a combination of features the competition will find hard to match. Based on the popular VR-2 platform, this is a third-generation product that builds on the quality and reliability of its predecessor but offers state-of-the-art performance with a 2.53GHz Intel Core 2 Duo T9400 processor. The machine is primarily intended for vehicle use, but has application in a wide variety of industries that require strong processing and wireless performance in a machine that is tough and rugged enough for most jobs.

The venerable "GoBook" family name has been dropped in favor of a more corporate nomenclature. What hasn't changed is the commitment to class-leading performance and to superior display technology that makes use of the computer in direct sunlight possible. The difference DynaVue makes compared to a standard transmissive display, or even one with anti-reflection coating, is amazing and greatly adds to the utility of this machine.

Wireless performance is strong due to an integrated quadra-helix antenna system for fast and accurate fixes, and specially designed wireless modules. There is good onboard connectivity, as well as expansion potential via externally accessible card slots and a media bay.

Existing customers will appreciate the new model's full compatibility with all prior VR-Series docks and peripherals, and the class-leading performance of the GD6000 is a strong upgrade and expansion incentive. New customers will find in the GD6000 a machine that provides consumer notebook performance and features, but industrial grade toughness and reliability for vehicle operation.

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