GENERAL DYNAMICS TADPOLE TOPAZ

HIGH-END PERFORMANCE AND BLAZING 3D GRAPHICS ON A HIGH-RES 15-INCH DISPLAY IN A COMMERCIAL-OFF-THE-SHELF NOTEBOOK

by Conrad H. Blickenstorfer, photography by Carol Cotton

In April of 2010, General Dynamics Itronix introduced the rugged Tadpole Topaz notebook computer. The machine is geared towards military power users, first responders, and federal agents who require workstation-class applications with mobile server performance. That's a tall order and, given that the Topaz was designed primarily for military applications, presumably a costly one to fill. Interestingly, while the Topaz certainly is not inexpensive, that's not the case. Based entirely on commercial-off-the-shelf technology, the Topaz is a veritable bargain compared to some of the truly dedicated military iron.

What does commercial-of-the-shelf, or COTS, mean? Essentially that components used are standard commercially available products as opposed to gear specially developed for or by the military. COTS means lower cost and a much wider selection of parts, and often also parts that are years or decades more advanced than what's available within the military. There are drawbacks to COTS—such as less control over specs and sources—but the payoff comes in equipment that often can do the job for less.

So what is the Tadpole Topaz and what does it have to offer? That would be a tough, rugged notebook computer with a large 15.1-inch 1400 x 1050 pixel sunlight-viewable display and enough performance to power through very demanding applications, delivering stunning graphics performance in the process. While the Topaz is compact and lightweight by military standards, that still means a 12-pound piece of equipment measuring 15 x 12.4 x 2.4 inches. Size and weight are relative.

Those familiar with the General Dynamics Itronix GD6000 and GD8000 rugged notebook computers may view the Tadpole Topaz as a larger and even more performance-oriented machine that combines the sleek, high-tech General Dynamics notebook look with a design that is more directly geared towards military needs and requirements. As David Miles, marketing manager for General Dynamics' Tadpole products, says, "*Warfighters responsible for battlespace air traffic control need the computing horsepower to support airspace management programs with a workstation display that supports 3D imagery and mapping without scrolling around to see the entire picture.*" That about says it all.

So how did Cupertino-based Tadpole—a group that once got started back in the early 1990s by beefing up rugged Telxon tablet computers and getting them to run the industrial strength SUN Solaris OS—do it? Now a part of General Dynamics Itronix, Tadpole offers mobile servers, mobile workstations, and ultra-thin clients, all available with various operating systems, and all catering to the special needs of the military, though they also have clients in other branches of the government as well as in education,

healthcare and industry. Tadpole clearly know what those types of customers need, how to deal with GSA contracts and such, and how to comply with the various security and support requirements and regulations. From what we can tell, the Topaz is the first Tadpole product that goes beyond their traditional SUN Solaris niche and into offering a COTS rugged computing platform that's equally suitable for Windows, Linux or Solaris applications.

Ports, expansion and connectivity

On top of the next pages you can see the Tadpole Topaz from all sides. For a big, rugged machine it is amazingly sleek and elegant, with exemplary attention to detail. Note how every single port and opening has its own separate protective metal door. The color scheme is General Dynamics' mono-chromatic light-gray and dark-gray and silver, with various types of matte and metallic finishes, all combining for an elegant, high-tech look.

The top picture shows the front of the Topaz, with two speakers to the left, a DVD writer in the

center (also protected with an outer hinged door), 3.5mm audio, and a Smart Card reader to the right. There is also the recessed power button

The bottom picture shows the backside of the unit. There you find the centrally located power connector (which pulls off a bit too easily), next to it a standard DB-9 serial port and a VGA port, and on the left side a grounding contact. Also shown is the nicely designed lightweight carry handle that snaps onto the unit with a springloaded carabiner hook.

The two pictures below show the left (top) and right (bottom) side of the unit. From left to right you can see the vent of the heat exchanger, a DB-25 connector that provides both a synchronous and an asynchronous RS232 port, three RJ45 jacks, and the removable hard disk bay. Note that having three independent gigabit Ethernet ports is one of the things that separates a military-spec machine, where the ability to connect to different networks matters, from a consumer machine, where it doesn't.

On the right side are, again from left to right, the 34/54mm ExpressCard slot, four USB 2.0 ports, an

machine, the doors seem to primarily provide physical and electromagnetic protection; there are no O-rings or rubber seals. Second, there should be a way to at least lock the battery and hard drive compartments better. As is, it's too easy to accidentally pull one out (or have it stolen). In a follow-up conversation with Tadpole we learned that the ability to quickly and easily remove the drive is actually a feature: in military settings drives are removed and locked away when the machine is not in use, and in battlefield situations it must be possible to very quickly remove the drive should the need arise.

Keyboard

While I'd be careful with water around the many access doors of the Topaz, no such precautions are necessary for the full-scale 86-key keyboard. It's a fully sealed membrane affair with small rectangular keys. The keys are black with white symbols (blue for secondary function symbols), and there is backlighting that goes from off to full bright in four steps. There is also an integrated track pad with three mouse buttons. Why three buttons? Because SUN Solaris and many Linux apps uses three instead of just two mouse buttons, with the middle button generally used to adjust selections.

As is the case with all membrane keyboards, this one requires a bit of getting used to, and it likely won't be anyone's choice to write the next great American novel on. The keyboard is very functional, though, and also very clean and easy to read. The trackpad is very responsive and a pleasure to use.

Performance

In general, mobile computing is all about compromise. Designers need to balance size, weight, battery life and performance in order to find an optimal solution for a particular mobile computing problem. That goes for the Topaz as well, but since this is a machine for mission-critical computing, performance definitely takes precedence. As a result, the Topaz is powered by a 2.53GHz Intel Core 2 Duo T9400 processor with a 1066MHz Front Side Bus and 6MB of L2 cache. L2 cache is one of 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 supports Intel's Trusted Execution Technology, an Intel initiative aimed at preventing software-based sensitive information theft.

With specifications like that, where does the compromise come in? Well, as powerful as the T9400 is, with a thermal design power of 35 watts, it is still considered a mobile processor and thus not in the same league as high performance desktop chips. Also, Tadpole decided to pass on Intel's new Core i5 and i7 processors that can provide higher perform-

opening for the dual PC Card Type II slots (or one of the thicker Type III variety), and then the battery. Since the USB ports are fairly deeply recessed, USB keys may need an adapter cable to connect.

If you notice a lot of metal, that's because each port has a special "filter" that guards against electromagentic interference and protects against electro-

magnetic pulses (at least that's our guess). Each door has at least two replaceable metal hinges, and a spring-loaded latch to lock the doors in place. The latches seemed a little loose, but shipping versions will have a tighter tolerance and better fit.

Two things surprise. First, while some of the openings provide direct access to the inside of the

PERFORMANCE	GD-Itronix Tadpole Topaz	GD-Itronix GD8000	GD-Itronix GD6000	GD-Itronix Duo-Touch II	GD-Itronix MR-1
Processor	Core 2 Duo T9400	Core 2 Duo SL9400	Core 2 Duo T9400	Core Duo U2500	Core Solo U1400
CPU Speed	2.53GHz	1.86GHz	2.53GHz	1.2GHz	1.2GHz
Thermal Design Power (TDP)	35.0 watts	17.0 watts	35.0 watts	10.0 watts	5.5 watts
CPU Mark	1636.4	1185.5	1538.8	631.1	328.0
2D Graphics Mark	447.6	102.1	294.8	164.4	180.6
Memory Mark	668.9	559.0	696.8	240.6	231.7
Disk Mark	615.8	372.6	378.0	318.8	183.2
3D Graphics Mark	238.8	52.7	180.7	101.4	88.3
Overall PassMark	776.7	518.8	679.5	312.6	202.8

ance and some of Intel's new technologies.

The T9400, however, is by no means obsolete. It's the same chip that does duty in General Dynamics' highly acclaimed GD6000. In addition, since the Topaz has a separate high-performance graphics subsystem, there is no need for the Arrandale chips' integrated graphics and the T9400's 6MB cache trumps the smaller 3MB or 4MB caches of the new Arrandales.

To see what kind of performance the big Topaz can deliver, we ran our standard benchmark suite, Passmark Software's Performance Test 6.1, that 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. For comparison, we included the benchmarks of the other members of the General Dynamics Itronix lineup.

The results are pretty much as expected and show the general overall performance level for each of these rugged machines. The most interesting comparison is that between the Topaz and the GD6000, both of which use the Core 2 Duo T9400 processor. There is, however, a difference insofar as the GD6000 was designed as a standard vehicle-rugged laptop computer whereas the the high-end Topaz includes far more powerful graphics and storage subsystems. As a result, the discrete graphics and high-performance solid state disk in the Topaz yield superior performance. In fact, its overall PassMark score of 776 is the highest we have ever tested in any rugged mobile system. How did Tadpole do that?

Superior OGL performance
One of the reasons is the video subsystem in the Topaz. While most rugged notebooks make do with integrated graphics, the Topaz adds discrete graphics for exemplary video performance. This is done via a high performance NVIDIA GeForce 8600M GPU GT (Graphics Processing Unit) with 32 stream processors, 512MB of dedicated video memory, a 128-bit memory interface and Microsoft DirectX 10 shader models and high dynamic range lighting. There is, of course, also support for high definition video via H.264, VC-1, MPEG2 and WMV9 decode acceleration for playback that far surpasses what is available with integrated graphics. What it boils down to is that the Topaz can deliver excellent graphics performance for tasks such as 3D wireframe models, complex PDF documents, nuanced shading and massive GIS applications that make standard notebooks choke.

We investigated graphics performance a bit more and found that in another benchmark suite (CrystalMark 2004R2) that better breaks down graphics perormance, the Topaz achieved OGL (OpenGL) scores that were clear off the chart! OGL is a cross-platform API widely used for 2D and 3D computer graphics in CAD, flight simulation, virtualization and so on. We did a direct side-by-side benchmark comparison between the Topaz and an older General Dynamics Itronix VR1 (the Hummer version). The benchmark starts with simple 3D tasks that become progressively more complex, increasing the load until the frame rate drops below a threshold, at which time the test is complete. We did video that dramatically shows the performance difference. In terms of numbers, the VR1, a powerful machine just four or five years ago, scored 1,733. The Topaz? 22,955.

How amazing is this result? Well, the second -best machine we ever benchmarked, and we have benchmarked hundreds, scored 2,773 (a Getac P470). The reason, of course, is that the Topaz's NVIDIA discrete graphics are optimized for OpenGL 2.1. So if OpenGL performance matters, the Topaz offers absolutely superior performance in this class of machines.

High-end Solid State Disk
The second benchmark area where the Topaz excels is in its DiskMark score, which is also the best we ever measured in a rugged machine (including those with SSDs). That's because the Tadpole group again went all out and equipped the Topaz with a MemoRight MR25.2-064S SSD with a SATA interface. This is not your ordinary solid state drive, but a high-end component usually chosen by designers who know that overall system performance depends on the speed and performance of the primary drive more than on anything else. SSDs, of course, also have a number of advantages over rotating media—there are no motors and moving parts, and none of the fragility, noise and heat generated by them.

The high-end MemoRight MR25.2-064S SSD used in our review unit can do sustained read and write transfers of over 120 Mbytes/second (test results we've seen seem to confirm this), i.e. about three times faster than most hard disks. It has an idle power consumption of just one watt, and sustained read and write power

General Dynamics Itronix
Tadpole Topaz

Type: Military rugged notebook

Chassis: Die-cast magnesium chassis; magnesium alloy case/high impact resin

Processor: Intel Core 2 Duo T9400 2.56GHz, 1066MHz FSB, 6MB L2 cache

Graphics: Intel GMA 4500MHD with 1024MB shared memory + ICH9M; nVidia GeForce 8600M GT discrete graphics with with 512MB VRAM

OS: Windows XP Pro, Vista Business/Ultimate, 7 Pro/Ultimate, Redhat Enterprise Linux 5 (32/64-bit versions), SUN Solaris 10

Memory: Up to 8GB 1066MHz CL7 DDR3 SDRAM

Storage: Test unit: MemoRight MR25.2-064S 64GB SATA (150 Mbytes/sec) SSD; also available 250 or 500GB shock-mounted removable 7,200 rpm HD

Optical: 8X DVD Read-Write / 24X CD-Read-Write

Slots: 2 PC Card Type II or 1 Type III, 1 34/54mm ExpressCard, 1 SmartCard reader (compliant with DoD Common Access Card (CAC) reader specification and ISO 7816 Personal Computer Smart Cards)

Display: Outdoor-viewable 15.1" XGA (1400 x 1050) TFT with DynaVue with touchscreen, exceeds minimum contrast ratio as required for bright light by DOD-STD-3009 military standard for cockpit displays for viewability and ambient light; standard display heater

Digitizer: Resistive Touch (option)

Keyboard: Rugged 86-key sealed 100%-scale, backlit rubber membrane

Size: 15.0" x 12.4" x 2.4"

Ruggedness: 0 to 125 degree Fahrenheit (operating); Enclosure Class IP54; Withstand dust (0.3 +/- 0.2g/ft3) blowing at 3.5mph, for 20 minutes; operates in conditions of blown precipitation and spillage; ESD IEEE STD C62.38-1994 and ANSI C63.16-1993, or IEC 801-2; EMI MIL-STD-461E; (3) drops on each face from 3 ft. in transit case; humidity 10 24-hour cycles operational

Weight: 11.7 pounds as tested, with standard battery and optical drive

Power: 9-cell 11.1V/7,200mAH (78 watt-hour) Inspired Energy NI2020XE Li-Ion battery

Communication: Optional 802.1a/g/n Intel WiFi Link 4965AGN

Interface: 4 USB 2.0 Standard-A, 1 asynchronous serial RS232/422/485 DB-9, 1 asynchronous serial RS232 plus 1 synchronous serial RS232 via DB-25 connector, VGA video, 3.5mm audio jacks for mic and headphone, 3 x RJ45

Price: starting at US$6,000

Contact: General Dynamics Itronix
www.gdc4s.com/Tadpole
DoD inquiries: toll free 1-888-237-6536
Commercial inquiries: toll free 1-800-734-5483

consumption of 2.5 watts. It can handle 200G shocks (2 msec) while operating, altitudes up to 40,000 feet, and, in its military version, an operating temperature range of -40 to 85 degrees Celsius.

The MemoRight SSD is a 2.5-inch format device that uses the hard disk form factor with a steel enclosure, weighs 3.5 ounces, has data retention of over ten years, and mean time before failure is over 1.1 million hours. What this means is that the Topaz boots quicker than most systems, there is no disk noise, and overall performance is excellent.

I should mention that the MemoRight SSD is optional. Standard equipment is a 250GB or 500GB shock-mounted 7200 rpm hard disk.

Power and battery life

Finding the proper balance between performance and battery life is another never-ending challenge for notebook designers, and especially so for machines which will see duty far away from power outlets. That's the reason why the vehicle-rugged GD6000 that shares the Topaz processor, but will usually be able to rely on onboard power, has a relatively small battery whereas the more mobile GD8000 has a much larger one.
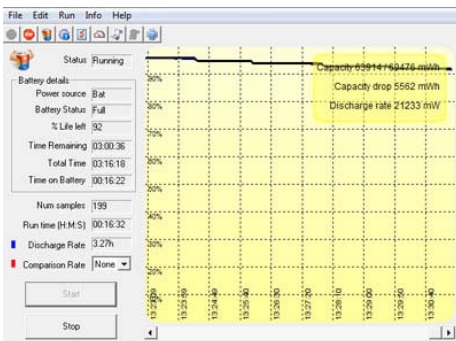
The Topaz, too, has a big battery, and that's because the machine needs it. Power consumption never dropped below 20 watts (the GD6000 used as little as 14.5 watts), and that's with WiFi off, the screen fairly dark, and the machine idling. At that rate, the battery would theoretically last about 3.5 hours. In real life continuous use, it's probably less.

As far as specs go, the Topaz uses a large Lithium-Ion pack 10.8 Volt, 7,200 mAH (78 watt-hour) NI2020XE smart battery from Inspired Energy. It has a push button to see current charge (25/50/75/100%), conforms to smart battery specifications, complies with CE & FCC immunity & emissions standards and is UN/DOT/IATA Transportation tested and compliant. This supplier, again, is high end—the company was once part of Eveready's rechargeable OEM division, was purchased by Moltech Corporation, and then saw an employee buyout of the smart battery business. Their sole corporate purpose is to design and manufacture intelligent rechargeable batteries.

The battery sits in a compartment in the right side of the computer. It can easily be removed and exchanged for a fresh one (there is no battery hot-swapping without AC power, though). The bottom-line here is that the Tadpole Topaz is a big machine that uses quite a bit of power. However, the battery is large enough to last for a couple of hours away from an outlet, and for a machine like the Topaz, which will often be used in command centers or vehicle where there is power, that is usually enough.

DynaVue display technology

With its large display, high resolution and superior graphics performance, the Topaz is perfect for graphics-intensive applications in the field. However, a display must also be easily viewable under various lighting conditions in order to be truly useful, and this is another area where the Topaz shines. Like all General Dynamics Itronix computers, the Tadpole Topaz uses the DynaVue display technology that combines a number of optical properties to minimize reflection while preserving contrast and facilitating exceptional viewability under almost all lighting conditions. With DynaVue, personnel can work outdoors and even in the brightest sunshine and direct sunlight. The display takes on a greenish tint in sunlight, but you can easily see the screen and you can use it for work. In the past, working outdoors with a notebook computer often meant searching for a shady spot so that the screen would become readable enough for actual use. That is not necessary with the Tadpole Topaz. It provides full outdoor viewability and that means you can use this computer anywhere and anyplace.

How is this possible? Primarily because DynaVue makes intelligent use of optics and physics that affect the way light is reflected or absorbed. I remember how I first saw DynaVue demonstrated on a GD-Itronix VR2 a few years ago and was blown away by how well it worked. In the meantime, out-

door viewability has become more common in the rugged computing field, but DynaVue technology remains impressive and unsurpassed.

The unretouched picture on the next page shows the Topaz and the VR2 facing the sun on a bright California morning. The screen does not wash out and remains clearly visible, with good contrast. Digital cameras still often have problems duplicating what the human eye sees when it comes to polarized and optically treated displays, and they tend to over-emphasize blue; in reality the Topaz screen looked even better to the eye than what the camera captured. It was also very sharp and rendered colors better than in the picture.

One thing I wish is that DynaVue were more immune to fingerprints. They are barely visible indoors, but can become distractive in outdoor light, and probably especially so in units equipped with the optional touch screen (which ours did not have).

Comparison: Conventional vs DynaVue

The pictures below are side-by-side comparisons between the 15.1-inch Tadpole Topaz screen on the right and the standard non-DynaVue 12.1-inch display used in the Hummer version of an older GD-Itronix GoBook VR-1 on the left. Both screens work very well indoors, but outdoors you can clearly see the difference DynaVue makes. Again, the Topaz screen actually looks better, more vibrant, and much

less blueish than what the camera captured, but the images accurately depict the difference in glare, reflection and contrast between the older model's display and the Topaz DynaVue screen.

The first picture below compares the two displays in bright early afternoon daylight, mid-April, in a shaded location. The Topaz display with DynaVue is perfectly readable without any reflections on its semi-gloss DynaVue surface. The older non-DynaVue display's anti-glare coating also shows no reflections, but the anti-glare coating diffuses the light and turns the display milky.

In the next picture, the two machines are viewed from an angle so that the sun would not directly reflect into the camera. The Topaz DynaVue display remains totally readable with good color and decent contrast. The older display's matte surface treatment diffuses the light so much that the screen becomes virtually unreadable.

The final picture has each display facing directly into the morning sun. The older anti-glare screen does an excellent job diffusing the light but it also renders the display completely unviewable. The Topaz DynaVue screen reflects the sun in sort of a controlled way, and most of the screen remains readable. That can make all the difference in the world in a real deployment.

Four years after its 2006 introduction, the General Dynamics Itronix DynaVue technology remains about as good as it currently gets. DynaVue is no longer alone in facilitating sunlight-viewable displays, but we haven't seen anything better either. There is room for improvement as in bright sunlight even DynaVue is still not close to looking like a magazine or book page, and at times you need to move or tilt the display to avoid distracting reflections. Overall, the DynaVue technology's outdoor viewability is remarkable.

While DynaVue impresses, the LCD's horizontal and vertical viewing angles are fairly narrow and unexceptional. As you vary the viewing angle, you get substantial chromatic shifts that by now should be a thing of the past. By comparison, Hydis AFFS+ technology offers perfect 180 degree viewing angle, but, unfortunately, not in larger displays.

Wireless

When it comes to wireless, while consumer and commercial computing equipment usually cannot have enough integrated wireless connectivity of all kinds, equipment geared primarily towards military is different. That's because while military C3 (Command, Control and Communications) systems can definitely benefit from the very rapid pace of commercial wireless advances, those networks are not reliable and secure enough for military use.

As a result, dedicated military equipment uses technologies such as the Secure Communications Interoperability Protocol (SCIP) for secure voice and the High Assurance Internet Protocol Encryptor Interoperability Specification (HAIPE IS) for secure high-speed packet data like email and web apps. And the use of commercial wireless devices, services and technologies is strictly regulated in documents such as DoD Directive 8100.2. As a result, while the military certainly takes advantage of commercial networks with their speed and features whenever possible and advisable, for tactical deployment the military uses its own dedicated networks which, by definition, are not commercial off the shelf.

For backup, however, and for situations where the use of COTS wireless technology is permissible, commercial high performance wireless technology is appreciated, and the Topaz can provide it via an optional PCIe-based WiFi card.

Our review unit came with the Intel Wireless WiFi Link 4965AGN. This is a module that operates both on the 2.4 and 5.0GHz spectrum and supports the new wireless N standard protocol with its much faster receive data rates of up to 300Mbps (802.11a/b/g is only good for up to 54Mbps). In addition to the potential 5X bandwidth and two to three times the range of 802.11a/g protocols, the power-efficient WiFi Link 4965AGN module is optimized for better wireless reception at longer distances thanks to three antennae and MIMO (multiple input, multiple output) technology, and the module is half the size of the old one. In essence, MIMO technology leverages multipath behavior (where transmitted information bounces off walls, ceilings,

and other objects, reaching the receiving antenna multiple times via different angles and at slightly different times) by using multiple, "smart" transmitters and receivers with an added "spatial"

dimension to dramatically increase performance and range.

The N standard also employs double-wide channels that are facilitated by combining a pair of 20MHz wireless communication channels into a 40MHz channel. This channel bonding increases the data rate because data rate is directly proportional to channel band-width. The three antenna connectors support a 2 transmit/2 receive antenna configuration, with a third auxilliary antenna.

Since the Topaz has both PC Card and ExpressCard slots, additional wireless functionality can easily be added.

Under the hood(s)

Like many field-serviceable units, the Topaz provides easy access to several user-replaceable modules. The image to the right shows the computer with its three backside covers open. All of the doors are made of thin metal and have high quality hinges. The doors are secured via rotating locks that can be operated with your hands. All doors have foam-rubber seals with a silver mesh coating. They look like they keep occasional moisture out, but they are not traditional O-ring seals.

In the picture below, on the top left is a small compartment that provides access to the unit's Mini PCI Express slot, here populated with the optional Intel 4965AGN WiFi Link card

The larger opening below provides access to the computer's two memory module slots. The Topaz uses standard 1066MHz DDR3 modules, and our unit came with two 4GB modules for a total of 8GB of onboard RAM. I wouldn't mind to have the memory in my computer a bit more securely tucked away.

The small door to the right provides access to something you don't usually find in a notebook computer (or a desktop, for that matter). It's a standard 10-watt fuse, the kind that you find underneath the dashboard of your car. Here it provides extra protection to the delicate circuitry of a mobile computer.

That's about it for access via the bottom of the unit. There are two other things facing down, though. First is what looks like a small speaker protected by a piece of foam rubber. Second, there's the machine's fan and heat exchanger. The fan is a very substantial unit and you definitely hear it when it comes on (which is often). There's a lot of heat to be removed from what is, after all, a remarkably com-

pact enclosure. Six rubber blocks serve as feet to create some air space underneath the unit. If it's sitting on carpeting or any other surface that obstructs proper airflow, you can instantly hear that in the pitch of the fan.

The holes around the perimeter and elsewhere house the almost three dozen screws that hold the top and bottom of the Topaz togther. We usually find it hard to resist taking a machine apart to see what things look like inside, but given the complexity of the task and the risk of possibly damaging a valuable early production machine kept us from doing it.

As is, while almost all notebook computers these days are made in Taiwan or China, Tadpole's Miles says the Topaz is made right here in the United States, and the label on it says, "Assembled in the USA from domestic and foreign components."

Ruggedness and protection

As far as ruggedness goes, any machine in this class must pass certain standards and be able to hold up to the conditions and abuse likely to be encountered in the targeted operating environments. As a result, the Topaz is a machine that's infinitely tougher than your average consumer notebook. Whereas many of those are flimsy and downright fragile, to the extent where they hardly seem like mobile equipment anymore, the Topaz is substantial. Its all-metal construction feels solid and trust-inspiring, the triple hinges are of bank vault quality, the LCD case locks very securely against the main body of the computer, and the gray rubber cladding that goes around the entire machine, top and bottom, is both purposeful and elegant. Tadpole did a bang-up job in designing a machine that both looks and feels terrific.

How does all of that translate into measurable ruggedness specs and testing?

In terms of operating temperature, the range is zero to 125 degrees Fahrenheit, which should cover most (though not all) places where the military may likely take computers to. The machine has also been tested for thermal shock, like going from 0 to 70

degrees Fahrenhiet in ten minutes, or down from 125 to 70 degrees. It can be operated in non-pressurized altitudes up to 15,000 feet, and it passed the requisite ten 24-hour humidity cycles.

Tadpole says the Topaz fulfills a requirement that we don't often come across, that of remaining fully functional following a "near strike lightning" as specified in DoD MIL-STD-464 Paragraph 5.4. MIL-STD-464 covers the electromagnetic environmental effects requirements for systems, and from what we can tell, the standard describes both the magnetic and the electric field rates of change at a distance of 33 feet. Tadpole further claims adherence to the requirements of MIL-STD-461E, which is the DoD standard for the control of electromagnetic interference characteristics of subsystems and equipment. MILD-STD-461E generally covers the control of electromagnetic interference of electronic enclosures and electrical connections.

As of this writing, while the Topaz product sheet states the device was "tested in accordance with MIL-STD-810F requirements," we have not yet seen detailed test results.

Sealing is at the IP54 level, where the "5" means the system is protected against dust (though limited, non-harmful ingress is permitted), and the "4" means it's protected against water sprayed from all directions, again with limited ingress permitted. What that basically means is that the Topaz can handle a good deal of rain and dust, and the general construction with its individually sealed connectors and other openings and the totally sealed keyboard would support that.

The stated drop spec ("(3) drops on each face from 3 ft. in transit case") is less than we would expect and requires additional explanation, as does the simple "transportation and operation in wheeled and tracked vehicles" comment under vibration resistance. GD-Itronix is usually meticulate about ruggedness testing and methods, and so we'll add full ruggedness information as it becomes available.

Security

At a time where we entrust more and more information, including mission-critical data, to computers, security is an ever more important issue. To that extent, the Topaz offers several physical and software security measures. There is no fingerprint scanner, but a Smart Card reader can be used as a very effective way to complement, reduce or eliminate multiple passwords.

The Security Menu in the BIOS lets you set and change both supervisor and user passwords. You can also write-protect the disk's boot sector to guard against viral attacks.

The BIOS also lets you enable or disable the Topaz's TPM (Trusted Platform Module) support. 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.

In order to use TPM, you must configure the system with your choice of security software.

The Topaz also offers an unusually extensive set of customization options on top of what you usually get in the BIOS. There is a UserStealth mode that lets you boot the system with the LED lights, fan, audio, system beeps, and radios individually turned on or off, and with the backlight initially off. 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.

DoD inquiries: toll free 1-888-237-6536
Commercial inquiries: toll free 1-800-734-5483

Summary: GD-Itronix Tadpole Topaz
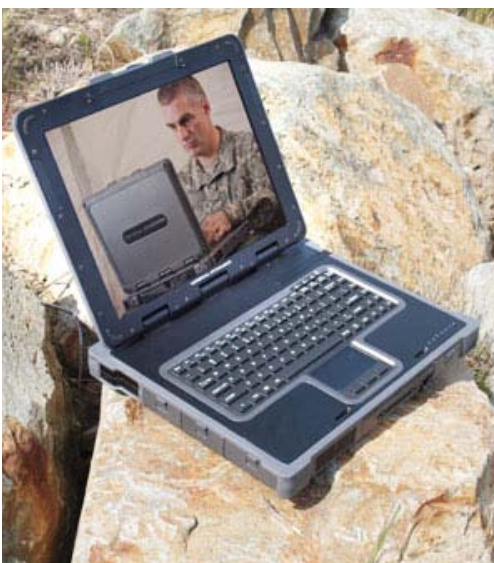
The Tadpole Topaz by General Dynamics is a rugged 12-pound notebook computer designed to provide functionality and performance that exceeds what is commonly available in the mobile computing space. Yet, its approach of using COTS ("commercial-of-the-shelf") technology and components results in a high-performance device that's substantially more affordable than what hardware specifically designed within military projects would cost.

To accommodate the type of complex, compute-intensive and graphics-oriented applications common in many mission-critical field deployments, the Topaz has the computing power (2.53GHz Intel T9400), memory (up to 8GB of DDR3 SDRAM), storage (super-fast SSD), screen size and resolution (15.1-inch, 1400 x 1050 pixel) and discrete graphics (nVidia GeForce 8600M GT) to get the job done. As of May 2010, it is overall the fastest rugged machine we have ever tested at RuggedPCReview.com, and its 3D/OGL performance is phenomenal.

Thanks to the General Dynamics DynaVue technology, the large display also offers excellent outdoor viewability under all lighting conditions. DynaVue makes it possible to use the Topaz even in direct sunlight.

There is good onboard connectivity (including three legacy serial ports) as well as expansion potential via externally accessible card slots (PC Card and Express Card). The Topaz also includes a DVD writer, a Smart Card reader and no fewer than three independent Gigabit Ethernet ports.

As a machine designed for the special needs of military and government markets, the Topaz runs either Windows, SUN Solaris or Linux, and offers EMI (Electromagnetic Interference) protection exceeding that of most commercially available equipment.