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Assessing The Broad Business Case For Rugged Computing

This paper outlines the key demand drivers for reliable computing while describing the elements for different levels of "ruggedness." It reports on the spectrum of mission-critical mobile users who have different levels of needs for rugged computing. It provides guidelines for "certification" and testing to accurately assess vendor claims and appropriately map the correct rugged form factor to the required functionality.

**Assessing the Broad Business Case for
Rugged Mobile Computing Devices**

While the concept of rugged computing has been pioneered by users working in extreme environmental conditions, there is growing evidence that a broader business market is developing for this category of mobile computers. The new trend is driven by three factors:

- The number of mobile workers as a percentage of the overall workforce is growing;

- New broadband wireless technologies (EVDO[1] and HSDPA[2] and Gobi in particular) increase the opportunities to connect to key information resources from more places and at any time; and

- Increased usage of mobile computers in a greater variety of environments exposes these devices to greater risk of physical harm.

According to analysts at Boonton, NJ-based Insight Research, employers are now actively promoting the expansion of their mobile workforce, especially as new technology developments enable continuous communication with employees outside of the office. This observation is further supported by a study from the Washington, DC-based Telework Coalition, which found that:

- 89 of the top 100 US companies offer telecommuting;

- 58 percent of companies consider themselves a virtual workplace;

- Only nine percent of employees worked at headquarters; and

- 67 percent of all workers used mobile and wireless computing.

Workers, in short, are on the move. They are increasingly doing mission-critical work when they are away from the office. While it may have been feasible in the early days of mobility to use dial-up facilities— and later find Wi-Fi hotspots in coffee houses or hotel lobbies— the mainstreaming of mobility creates a new requirement for anytime access.

This helps to explain why demand for wireless broadband services is expected to grow at a compounded rate of more than 60 percent through the rest of the decade, while wireline services will grow at only 10 percent over the same forecast horizon, according to Insight analysts. Business users— and a growing number of consumers— find that they cannot afford to wait when they need to connect with colleagues, customers and suppliers.

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[1] Evolution, Data Only or Evolution, Data Optimized
[2] High-Speed Downlink Packet Access

"Anytime" connectivity implies an "anywhere" requirement. As people access their network resources more often, they are also doing it from more places; some of those places are not always computer friendly. That is why, in a separate survey conducted by Harris Interactive, 70 percent of U.S. adult laptop users (in a sample of 2,300 respondents) strongly agreed that they would not feel comfortable storing their laptop in an overhead bin while traveling on an airplane because of fear that it might become damaged. The survey further found that:

- Among adults who regularly use a laptop computer, 47percent use their laptop outside of a typical office environment on a daily basis;

- 25 percent regularly (i.e. 3 days a week or more) use a laptop while traveling or somewhere else outside their home or work;

- Among laptop users, 68 percent report their laptop is most at risk when traveling as a result of being dropped and knocked against a hard surface or getting crushed under the weight of other objects; and

- 39 percent reported experiencing some form of mishap (drop, knock, and spill) with their laptop.

These findings are in line with research conducted in 2005 by Framingham, MA-based IDC, which showed that dropping while carrying was the "number one" cause of accidental notebook damage. Liquid spills and falls from a table or desk rounded out the top three mishaps leading to accidental damage.

…Understanding the True Total Cost of PC Ownership

Many buyers have focused on purchase price alone when procuring notebooks. A closer look at the numbers— and the quality of the end-user experience— is turning this conventional wisdom into seriously outdated thinking.

According to a recent market research report authored by analyst David Krebs at Natick, MA-based Venture Development Corporation, nearly 50% of the total cost of operating an enterprise mobile computing device is caused by lost worker productivity when the device fails.

He concludes that the upfront cost of hardware adoption accounts for only 16% of mobile computer total cost of ownership (TCO). This implies substantial savings with the purchase of rugged equipment, because operating costs will be much lower over the long-term than with non-rugged mobile platforms.

This could explain why a study conducted by ABI Research in December of 2006 forecast that a new durable notebook category (also known as business-rugged) will grow at a compound annual rate of over 16% between 2006 and 2011.

"The combination of rugged features in more consumer-grade mobile devices is at the very core of product differentiation and the growing need to cater for field force enablement. Fully ruggedized products in traditional vertical markets such as oil and gas, mining, and the military will continue to be strong...[but] there will be growth for these products in not so traditional markets." — **Stuart Carlaw, Analyst, ABI Research**

The die, it seems, has been cast, and ruggedness is no longer just for environmentally extreme industrial and military users anymore. It is moving into the mainstream of the global 2000 and beyond. As a result, a broad spectrum of mission-critical mobile users is emerging with different levels of rugged requirements.

Projections like these and others have caused a flurry of activity as non-rugged consumer and commercial-grade PC manufacturers rush in to tap this high-growth market opportunity. In so doing, claims are being made that can be confusing to executives seeking to field a mobile work force with cost-effective and highly reliable computing resources.

What they are learning, as they deploy new more rugged mobile computing equipment, is that one size does not fit all, even within an organization. It is therefore important to have an understanding of the key elements that determine the level of ruggedness that is needed by users, and that is available from the vendor community.

…Overview of Rugged Computing

Rugged computing has traditionally sought to bring the promise of information technology to harsh environments, including:

- Outdoors in the elements, with extreme temperatures, humidity, and precipitation;

- In the presence of large quantities of airborne liquids or particulates such as in industrial, construction, or desert environments; and/or

- In vehicles (including aircraft, on- and off-road land vehicles, and marine installations), which are characterized by high vibration, mechanical shocks, and violent altitude and attitude changes.

The recent surge of interest in rugged mobile platforms has prompted new entrants into the field who claim a wide array of capabilities as "certifiably" rugged. In truth, manufacturer's claims of ruggedness are subjective and not uniformly understood. Currently, there is neither a single industry standard, nor an independent testing authority, for rugged computing products.

Some private equipment testing agencies have tested and assessed durable computing products for manufacturers and their customers. The results of these tests, however, are often not released to the public in their entirety – if at all. Thus, manufacturers define their own standards for rugged computing, and additionally, have introduced variations on the concept of rugged.

Most manufacturers who claim to build rugged computers have gravitated to a variation of a standards scheme set forth by a leading user of rugged computing technology: the U.S. Armed Services. The MIL-STD-810F standards specify a variety of environmental tests that manufacturers can use to prove that equipment will survive in the field. Of these variables, those that are most relevant to rugged computing include:

- Humidity
- Contamination by Fluids*
- Salt Fog
- Sand and Dust*
- Icing/Freezing Rain
- Explosive Atmosphere (arcing/sparks)
- Leakage

- High Temperature
- Low Temperature
- Temperature Shock
- Solar Radiation (Sunshine)
- Low Pressure (Altitude)
- Shock (transport, dropping)
- Vibration
- Rain*

(*On the topic of Ingress Protection, or IP rating, it should be noted that a specific standard has been developed by the International Electrotechnical Commission to classify the degree of protection provided by the enclosures of electrical equipment.)

Currently, the Armed Services do not conduct actual tests or certify that rugged devices meet MIL-STD-810F standards. Instead, the Armed Services expect their suppliers of rugged computing equipment to assure or guarantee adherence to the standards. As a result, many rugged computing manufacturers are able to tout their devices as "MIL-STD-810F-compliant" when they meet only one or two of the testing criteria, and even if the device is never offered to or purchased by the Armed Services.

Manufacturers often claim partial- or near-compliance with a particular MIL-STD-810F testing standard, or otherwise overstate their device's rugged characteristics. This is why it is critical that claims be tested and proven.

From a practical end-user standpoint, enterprise notebooks can be broken down into three basic categories:

…Rugged (also known as Fully-Rugged) Laptop Computers

These are computers that must withstand the harshest environmental conditions, including dust, sand, lots of shock and vibration (such as in vehicle- mounted applications), as well as situations that can lead to a device falling to the deck or ground. The most dramatic examples of this environment are the front-lines of a combat situation or in public safety applications. Other examples include construction sites, oil rigs, field service applications and other conditions that expose the device to outdoor elements and harsh treatment.

…Semi- and Business-Rugged (also known as Durable) Laptop Computers

This tier applies to a wide array of conditions that may expose a mission-critical device (that contains applications and data that are crucial to maintaining business operations and employee productivity) to damage or failure. From a market development perspective, this is the high-growth segment of the rugged market. Examples of people in need of business-rugged capabilities include (but are not limited to):

- Consultants and other business executives who carry their entire "office" with them during engagements. These engagements often call for extended visits with clients at their location. Even during extensive periods of travel they must continue to manage their day-to-day business operations as they deliver value to their clients.
- Outside sales people who travel often to meet with clients to present proposals and presentations as well as access data and keep track of transactions that must be synchronized with back office systems at headquarters.
- Field engineers or architects who work at client or job sites and carry schematics and technical specifications to solve problems or upgrade systems for clients that are geographically dispersed.
- Healthcare professionals who carry patient and clinical information. This includes doctors, therapists, nurses and physician assistants providing routine care in hospitals, clinics and homecare situations. (Emergency medical and operating room scenarios will find more appropriate solutions in the "rugged computing" category.)

…Non-Rugged (also known as commercial or consumer) Laptop Computers

These are for applications that require the lowest level of ruggedness. This solution works for organizations that have made a decision to replace all desk-top computers with laptops or notebooks, for users, including administrative personnel, who are not likely to travel or expose their devices to harsh conditions, as their laptops rarely leave the office environment.

It is important, however, that buyers and users carefully evaluate all vendor claims around ruggedness.

…Rugged User Community Expanding Beyond Traditional Scope

Rugged computing users have typically tended to work in specialized environments in government and a few specific industrial or commercial business sectors.

Within government, the Armed Services stand out as the principal users of rugged computing products, where rugged devices can be found from the front lines of combat operations to rear-area support tasks such as training, equipment maintenance, and logistics support.

Other federal government users involved with incident-response, such as elements of the Federal Emergency Management Agency (FEMA), also use rugged computing products in field operations. Field operatives in the Departments of the Interior and of Agriculture also use rugged computers.

Public safety users at the federal, state, and local level— law enforcement, firefighters, and emergency medical technicians— make up a significant and important user base for rugged computing products, especially with vehicle-mounted computing installations.

In private industry, rugged computing is used especially in the medical, petrochemical, utilities and telecommunications industries, where field service personnel are required to use computers in their work, often in extreme conditions. Rugged computing has also caught on in natural resource management and manufacturing, and modern day mountaineers, explorers and field scientists have integrated rugged computing into their activities.

However, the rugged computing market is changing to include more than just traditional military, public safety, and field services users. As industry and commerce continue to incorporate information technology and communications into business processes, more enterprises are realizing that mobile computing adds efficiency and value to on- and off-premise operations.

Enterprises also see that the reliability and robustness of rugged computing technology can make traditional mobile computing more efficient and effective by improving availability and eliminating costly downtime and outages.

…Ruggedness Elevates Reliability and Accessibility

There is a growing realization among enterprises that they can get more out of their mobile workforces by equipping their employees with computers that can withstand the worst physical and environmental abuse and minimize outages.

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According to estimates by IT analyst firm, Gartner, Inc., annual failure rates for conventional commercial laptops range from 15 to 23 percent. Since 2003, notebook PC damage rates have risen 22.5 percent, with an average damage incident cost of $2,900.

Currently, most major US suppliers of conventional consumer- and commercial-grade portable computers outsource assembly to a group of China-based contractors who assemble the machines from a variety of supplied parts on low margins. As a result, quality control of individual components and assembly is diminished.

Notebooks that meet the more rigorous standards of ruggedness, in contrast, fail at an overall rate of less than five percent annually, with some offerings reporting failure rates in a range less than 2 percent. These are sometimes built by the same companies whose names are found on the PC itself, helping to explain their higher quality.

These lower failure rates translate directly into savings in capital outlays and lost productivity. For instance, in the health care industry, research from Venture Development Corporation shows the savings that can be achieved with rugged computing as a result of:

- Fewer repair expenses and less downtime when assisting customers. On average, the total cost of ownership for rugged computers over three years is 15 percent lower than that of non-rugged notebooks, translating to savings of hundreds of dollars per unit.

- Rugged mobile PCs can have longer warranty periods and longer replacement cycles versus commercial-grade notebooks.

- With a four-year replacement cycle for rugged notebooks versus a three year replacement cycle for commercial-grade notebooks, rugged notebooks are 11.6 percent less expensive on a per-annum basis.

- Failure of commercial-grade notebooks results in an average of 30-60 minutes of lost productivity per day for a care giver. With reliable, rugged mobile computing solutions, healthcare professionals can maximize productivity and uptime.

No matter the industry, solution or application, it is critical to find the right device, with the right level of ruggedness, for the tasks at hand.

…Gearing up for Fully Rugged Solutions

Organizations with "fully rugged" requirements should look for computing platforms that have been independently tested and found to comply with the MIL-

STD-810F test procedures that most closely reflect the challenges targeted users will face in the field. These tests include drop-, shock-, moisture-, dust- and vibration-resistance, exposure to extremely low and high temperatures, and other stressors. Third party certification is critical. But it is also important for buyers to understand which elements of the MIL-STD-810F were in fact tested.

At a minimum, fully rugged notebooks should be suited for highly demanding portable and vehicle-based assignments in harsh field and industrial environments. Buyers should look for metallic cases (such as magnesium alloy) that have been shown to be 20 times stronger than plastic.

LCD screens should be fully sealed and internally dampened to provide extra protection against moisture, dust, and shock. Screen brightness should be 500 NITS or higher to support outdoor readability.

Sealed cases and fanless designs, as well as spill-resistant keyboards and touchpads should also be included to provide protection from the weather, spills, and splashes that are an inevitable reality in mobile computing environments. At a minimum, organizations that have this requirement should know how to use the IEC's IP standard to determine how much dust and water the product can withstand and still operate.

Hard and optical disk drives should be mounted in damping materials and equipped with various other shock insulation features, including flexible connections between boards and components to protect mission-critical data from the dangers of shocks, bumps and drops.

Finally, reinforced, integrated broadband wireless communication equipment and antenna should be built into the machine to protect it against damage while maximizing the ability to access information from any place at any time.

…Fully Rugged in Commercial Environment

Del Taco, the Lake Forest, California-based restaurant chain, uses fully rugged computers to improve production line efficiency and cut information technology maintenance costs. For instance, to improve drive-through customer experience, Del Taco deployed a wireless, network-enabled rugged thin client mobile computing system. Employees can now walk out into the weather, into the drive-through line to take orders. The system streamlined service during busy breakfast and lunch rush periods.

Del Taco relies on rugged computers to monitor vendor sites and maintain equipment. They allow Del Taco's technical support team to immediately evaluate and remediate problematic restaurant workstation equipment. This has reduced the need for outside technical support, which helped Del Taco cut $700,000 in third-party IT service calls in the first year of using rugged PCs.

…Gearing up for Semi- or Business-Rugged Solutions

While semi- and business-rugged devices cannot withstand the same levels of stress as fully rugged solutions, they are often a higher-performing alternative from a processing capacity perspective. The reason: fully rugged computers are completely sealed to protect against dust and liquid exposure. As a result, they cannot use fans to cool the system down. To accommodate this requirement, components that emit lower levels of heat are used in fully rugged solutions. Of course, that said, rugged computing leaders like Panasonic have worked hard to innovate to bridge the divide between high performance and rugged reliability.

Semi- and business-rugged solutions offer a user experience and computing capacity that is comparable to conventional non-rugged laptops at a level of reliability and robustness comparable to rugged devices. They are an appropriate solution for heavy mobile use where reliability and availability are top priorities but vehicle mounting and weather are not a factor.

Business-rugged devices should share many of the internal features of fully rugged devices, such as shock-absorbing flexible connectors and specially engineered shock-resistant hard- and optical-drive components.

…Semi- and Business-Rugged in Military Environment

Even the military is finding applications for semi- and business-rugged portable computing, illustrating the point that one size does not fit all within an organization. Semi- rugged solutions are appearing in intense— but non-combat— environments, such as Tactical Operations Centers, intelligence and logistics operations.

One Army program that uses semi-rugged computers is the Medical Communications for Combat Casualty Care (MC4). MC4 is a medical information management system that supports Army field medical forces, enables comprehensive lifelong electronic medical record access for soldiers, and enhances medical situational awareness for Army commanders.

The MC4 system consists of mobile computers, networking and peripheral equipment to interface with medical command and control. The mobile medic computer system must be portable and durable since it supports field medics deployed in combat conditions while ensuring soldiers have the care they need on the battlefield.

…Business-Rugged Computing in the Healthcare Environment

Gwinnett Hospital System, based in Gwinnett, Georgia, has deployed business-rugged systems to support its 4,000 employees and 750 physicians. When Gwinnett opened a new hospital in October 2006, one of its main goals was to

enable medical staff to access information from anywhere in the facility. Another objective was to be able to reach physicians and nurses in the facility without using the overhead paging system.

Rick Allen, Director of IT Operations for Gwinnett, used a simple test to determine the type of business-rugged notebook computer he wanted to standardize on.

"I knocked it off my desk, let it bounce around a little, picked it up and used it. We have not had to send any units out for repair," he says.

Gwinnett's physicians and nurses use business-rugged notebooks to view medical records, order lab tests, get test results, view X-rays, request medications, view alternative treatment options, obtain contact information and communicate via instant messaging. More business-rugged notebooks are being deployed to support a fully electronic record-keeping initiative.

…Conclusion: Rugged Reliability is a New Mobile Computing Imperative

Demand for various levels of rugged computing is rising across both traditional and non-traditional markets. The demand is driven by the growth in numbers of mobile workers, new wireless broadband capabilities and the fact that more frequent use of devices in different locations exposes computers to higher levels of environmental risk.

Growth in demand for rugged computing is occurring despite the fact that unit prices of these computers are higher than traditional commercial offerings. Organizations are able to cost-justify investments in rugged computers because they are less likely to be broken during the normal course of events in a mobile environment and cost less to own over their useful life. Growing evidence suggests that the long-term total cost of ownership (TCO) is significantly reduced because of the reliability and longevity of the platforms.

The ability to use the various levels of rugged computers to meet the specific needs of different classes of users, while providing access to network resources, allows organizations to secure additional productivity gains from employees. As a result, more organizations in a greater number of industries and applications are finding a solid business case for fully, semi- or business-rugged notebook computers in their operations.

For more information on rugged computer technology in action...visit
http://www.panasonic.com/business/toughbook/products.asp