

# Rugged IT

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# You Can't Fulfill the Promise of Netcentricity if You Crack an Egg

If you take a raw egg, put it in a steel box and drop it from shoulder height, what's going to happen to that egg? The answer is, of course, a cracked egg. But for the rugged computing industry that was the way it went about its business for many years. It would take a commercial product, wrap it in armor and then call it rugged. The result, in many cases, was scrambled eggs.

That mindset has changed dramatically in recent times as the military, law enforcement, first responders and medical markets are demanding rugged systems that can be dropped repeatedly and from greater heights, that are sealed against finer grains of sand and also moisture, that have fewer or no moving parts, that have screens that can be viewed in sunlight out on the flight line and in the desert, and that can be easily operated while wearing gloves.

Manufacturers are attacking single points of failure like screens and hard drives with new technologies like solid state drives that have no moving parts, which means that they are less susceptible to shock and vibration, and don't need fans for cooling. Without fans, rugged laptops can be lighter and smaller—which is the constant mantra heard from users when asked what they want to see in next-generation rugged IT products.

And in the age of the Apple iPhone, rugged computing devices can no longer do just one function. Many rugged computing devices today must have the ability to do everything from accessing the Internet and email, to providing Global Positioning Systems coordinates, to taking digital images.

And they must do them in a package that costs less than ever before. That's become possible for manufacturers to accomplish primarily because ruggedized devices have essentially become commodity products that can be purchased off the shelf, just like non-ruggedized computers from companies like Panasonic and Dell.

"Not that many years ago, rugged computer systems were built to military specifications for individual Army program offices and systems," said Micki LaForgia, project director for U.S. Army CHES (Computer Hardware, Enterprise

Software and Solutions), which is the clearinghouse through which all Army personnel buy computing devices. "Now the Army is buying the products developed for the commercial market that meet the rigorous requirements, including EMI and Tempest, for the tactical warfighter. These developments are resulting in lower costs and shorter developmental transition of technology and integrated logistics supportability for rugged IT."

It was only a year ago that a rugged category was added to the Army's semi-annual Consolidated Buy (CB) of desktops and notebooks. Because of their affordability, greater functionality and widespread availability, CHES has seen a 100 percent increase in sales of the rugged notebooks from that first offering in 2009, according to LaForgia.

CHES has also seen an increase in demand for semi-rugged or "business ruggedized" products, which are a hybrid of commercial notebooks and ruggedized platforms. These products provide enhanced

survivability at a lower cost point than the fully ruggedized versions.

The military's emphasis on eTools (no, not the military standard shovel and pick, which is also called an E-Tool, with the "E" meaning "entrenching") is also driving its need for rugged IT. The Air Force, in particular, has modified its basic directives for aircraft and equipment maintenance to include the use of eTools to manage things like electronic maintenance manuals and technical orders at its three major maintenance depots at Hill Air Force Base (AFB) in Utah, Tinker AFB in Oklahoma and Robins AFB in Georgia.

"Perhaps the best sound bite I have ever heard is from a maintenance technician who said that these devices can save the Air Force millions of dollars," said Fed deGastine, business development manager for Panasonic Computer Solutions' federal business.

Today is truly the dawn of affordable rugged computing. Now if they could only figure out a way to fry an egg on the display screen. □



# One Laptop Per Child Develops Computing Devices for a Rugged World

Rugged computing devices are typically targeted at the military and first responders. However, one of the world's most unique rugged IT programs is aimed at children, specifically children in under-developed countries who would normally never have access to any computers at all, let alone ones designed to withstand rugged environments usually found in Third World countries.

Several years ago, the non-profit One Laptop Per Child (OLPC) Foundation set as its goal the development of a laptop computer that would use little power, be extremely low in cost, be ruggedized for both desert and jungle environments, and provide good computing performance.

For all intents and purposes, OLPC accomplished its goals with the development of the first-generation XO laptop. Since late 2007, the organization has shipped 1.25 million laptops worldwide (one-quarter of them going to Uruguay, which announced last November that every child between the ages of 6 and 12 now has an XO laptop).

OLPC took a lot of heat from media outlets like Wired magazine for not producing the laptop computers for \$100, as OLPC founder and MIT professor Nicholas Negroponte had promised at the time. Rather, they are sold for \$188. But as OLPC Foundation chief technology officer Ed McNierny told Government Computer News, "we wouldn't have gotten a \$188 laptop if we hadn't tried for \$100."

In the area of ruggedization, the first-generation XO has rounded edges, a sealed, rubber-membrane keyboard, and an integrated handle for carrying to and from school or home. To prevent failure of the hard drive and internal connectors, two areas that are susceptible to damage, the laptop employs flash memory instead of a hard drive, and there are only two internal cables.

The machine's plastic walls are 2mm thick, as opposed to the standard 1.3mm. Its wireless antennas double as external covers for the USB ports, which are protected internally as well. The estimated product lifespan is at least five years.

McNierny explained some of the XO's unique ruggedization features.

"Essentially, all of the electronics are in the upper housing. On a conventional laptop, what's in the upper housing is just the screen, and the motherboard and hard drive are underneath the keyboard. In our case, there is nothing underneath the keyboard. The motherboard is actually behind the screen. You can bang on the bottom part of the laptop with a

hammer because there is nothing in there but a steel plate for stiffening.

"From a mechanical perspective, putting everything in one place lets us focus on the mechanical spacing and crush zones around the display area. The screen and the motherboard also provide a degree of mutual reinforcement. Each is rigid in itself, and if you bolt them together you have a mutually reinforcing mechanical structure that is then placed in an envelope that gives you a crush and buffer zone for protection."



The ability to repair the XO in the field is also a key attribute of the unit. A #1 Phillips screwdriver is the only tool needed to disassemble the laptop and replace any component, according to McNierny. And because hardware stores are few and far between in many of the environments where the laptop is being used, the handle contains a complete set of spare screws.

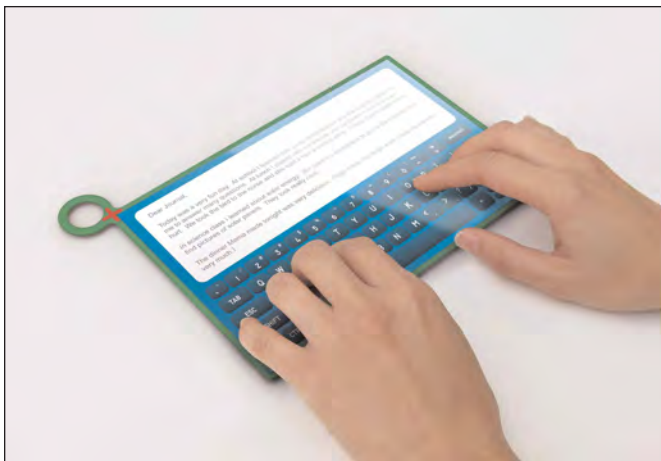
## From a Rugged Laptop to a Rugged Tablet

Recently, OLPC refreshed the internals of the XO by replacing the AMD processor with a VIA processor that provides twice the speed, and four times the DRAM memory and flash memory. It runs both Linux and Windows operating systems. No significant changes were made in the area of ruggedization to what is now called the XO 1.5.

About a year from now, the foundation plans to introduce the XO 1.75, which will be essentially the same industrial design but with improved impact resistance from a rubber bumper around the unit. The screen will be replaced with

an 8.9-inch touch-sensitive display. The XO 1.75 will be based on an ARM processor from Marvell that will enable twice speed at one-quarter the power, and is targeted at \$150 or less.

The big news for OLPC, though, was the announcement earlier this year that development is now underway to design



and manufacture a ruggedized tablet computer to be called the XO 3. To be available in 2012, the foundation is targeting a price below \$100. It will feature a single sheet of flexible plastic, and be designed to be unbreakable and without holes or ports anywhere on the unit.

Moving to a tablet design instead of a laptop offers a number of ruggedization benefits, including no mechanical keyboard to be a single point of failure (the user will be able to type directly onto tablet's touch-sensitive screen), and even better sealing against dirt and water.

"The benefit we get out of a full, soft keyboard is that there is no mechanical keyboard of any sort and one less point of failure and one less opportunity for infiltration around the keyboard," said McNierney. "The other major ruggedization benefit of the tablet design is going to an entirely plastic substrate where we have a plastic display and a plastic housing integrated together in a single, plastic sandwich, if you will.

"We're doing a lot of prototyping to find the right type of stiffness and feel. Some of those technologies are great if all you want is an e-book reader, but we need to be both a book reader and a general-purpose computer.

"If you had something that was very soft then you could probably treat it very roughly and it would probably do quite well, but it would be impossible to hold in your hand and

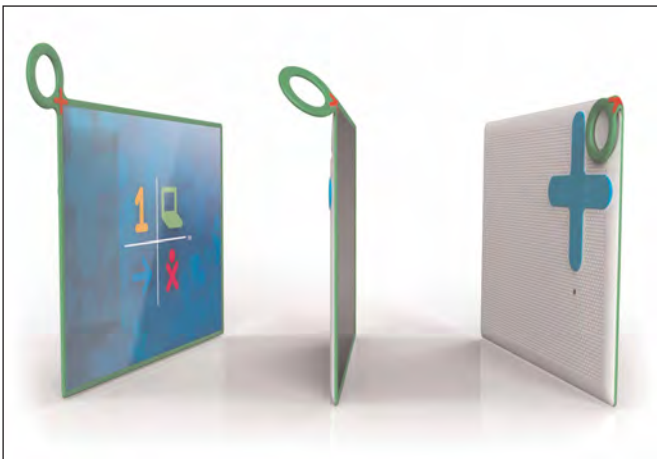
write on. Rigidity is important for usability because we're going to places where a suggestion as simple as 'put it on the table' doesn't work because you haven't got a table. You have to be able to sit and put it in your lap and have it still be usable."

Another challenge still to be figured out with the tablet is how to repair a sealed unit when the housing cannot be unscrewed like OLPC's XO laptop.

"One of the things we need to deal with is field repairability, which is slightly incompatible with a tablet," said McNierney. "Something that is tightly integrated plastic, ultrasonically welded and with a battery that can't be removed really helps with dust, water and all-around ruggedness. But you have a problem if something breaks.

"We go to places where there isn't a warranty center. You've got to be able to fix it in the field, and that's a difficult tradeoff. The biggest challenge today and going forward in terms of ruggedness is meeting that balance between ruggedness and field repairability."

OLPC has its work cut out for it in developing an all-plastic substrate, which is something that no other computer



manufacturer in the world has successfully introduced to the market. But taking on such a challenge fits nicely with what McNierney says is the overarching question that drives the foundation's development work.

And that is: "Are we doing something that the commercial industry is already doing? If the answer is yes then we should just stop doing it. We're a non-profit, we don't make money selling laptops. There is no benefit to us in duplicating something that somebody else has already done." □

# On the Record With Ashok Jain

**A**shok Jain is product director of Common Hardware Systems (CHS) for the U.S. Army's Program Executive Office Command, Control and Communications-Tactical (PEO C3T). CHS provides the hardware for all Army tactical computing and networking systems. It also provides lifecycle support for the hardware, including the operation of regional repair and support centers located at strategic locations like Camp Liberty in Iraq and Bagram Airfield in Afghanistan. He spoke with Barry Rosenberg for this special report on rugged IT for 1105 Government Information Group Custom Media.



## *1105 Government Information Group Custom Media: Laptops are clearly not the whole story in rugged computing. How does CHS view it?*

**ASHOK JAIN:** Here is our take on it. Over the last couple years, several manufacturers have entered the market with what we call rugged computing devices. That has introduced good competition and brought the prices down. It has improved performance, it has improved battery life on some of these small notebooks and tablets, and it has improved survivability for the military in the rugged environment. Recently, there has been an introduction of solid state hard disc drives with no moving parts, and that has improved the application of these small computing devices. So I wouldn't say just laptops, but small computing devices and our ability to use them for operations on the move.

We're able to integrate these small computing devices into operational transit cases. In other words, in places where we don't need a platform like a tank or a Stryker vehicle or a Humvee, you just integrate these into operational carrying cases where you take them into a field, open them up and connect them as you move.

## *1105: What are the enabling technologies for these small but rugged computing devices?*

**JAIN:** The new products are better shielded against EMI and provide better performance in terms of RAM. Five years ago we had only 5GB RAM notebooks, now we have 8GB

RAM notebooks. So we are able to use these devices for multiple purposes, not only as clients but as sometimes as servers. We've also been able to develop network virtualized systems of dumb clients and servers to provide us with reach back capability. With virtualization we don't have to worry about the underlying operating system, and can use multiple operating systems without any issues.

## *1105: Is there a connection to between virtualization and ruggedization? Does that mean the computing units can be smaller since the software doesn't reside on the device?*

**JAIN:** In some cases that is correct. From the military perspective, it all depends on where it is deployed, what the function is and what the application needs to be. Based on that we determine what the right solution is. We don't look at it as just one system at a time, but rather as a holistic system of systems approach.

It is not just a computer. A computer is just one tool. Is it network ready? Can it run out there without EMI interference when operating in connection with SINCGARS and other radios in the field? Those are all the things you look at.

The other question is—depending on what computing solution you're looking at and what your budget constraints are—what elements of your system of systems approach can make it possible delete an installation in a vehicle. Putting a solid state drive inside a computer means we can install it in a platform like a STRYKER or Humvee and not have any vibration issues.

## *1105: Has the price of solid state drives gotten to the point where the Army can afford to buy them in quantity?*

**JAIN:** Two three years ago, a 2GB solid state hard drive cost \$1,000. Now, I can buy a 250GB solid state drive for just a few hundred dollars. Also, they now come in 1.5 inch or 2.5 inch form factors, where they used to be 3.5 form factors.

## *1105: Without endorsing any particular manufacturer, are there any rugged devices that have caught your eye?*

**JAIN:** There are several from an Army point of view. VT Miltope has come up with a rugged computing solution. Then there is the Dell XFR rugged notebook and the General Dynamics Itronix GD8000. There is another rugged solution that we have been experimenting with from a small niche company called DTECH Labs. The product's name is the M3C4G (Mobile, Modular, Man-Carry C4 Gateway), which is like a commander's flyaway kit. It fits into a suitcase and allows you to do SIPR and NIPR over radios

and satellites. So you can take this suitcase and connect to the network through a BGAN satellite terminal. Such a mobile solution has seen interest from the folks at the National Guards, Homeland Security and the Army.

**1105: How do you view the ruggedization of controls on these devices?**

**JAIN:** Controls are important. We have to bring a lot of cables, so the important thing is the location of CD drives and USB connections. Location of those interfaces and connectors is important because you want to make sure you can install and integrate these systems into a military vehicle without cluttering the space. Size, weight and power are important so you're not creating a lot of heat. Cooling of these systems is important, as is where the fans are located.

Another aspect of controls is the keyboard. More and more these systems are being used outside in tents and other places where moisture, rain and other conditions can cause issues. You want to make sure you have an ability to operate these things in MOPP (Mission Oriented Protected Posture) gear when it gets extremely cold and soldiers have to wear gloves. When it gets cold, soldiers need to be able to operate

these devices with just one finger and with their gloves on. There are some big improvements that have taken place on some of the computing devices.

**1105: Which systems are most susceptible to failure in rugged IT systems, and how are you addressing the problem?**

**JAIN:** The displays. What we are looking at is flexible display technologies. We've been working with industry at Arizona State University on flexible displays, which are plastic displays that are non-breakable and consume less power. They could have very many applications such as laptops, wrist displays and soldier head-mounted display.

**1105: What other problem areas do you see?**

**JAIN:** The other one is the cost of a solid state hard drives. If they would become more affordable, you would see more in the commercial world. Right now, the whole laptop costs \$500 and the solid state disc drive costs \$500 just by itself. But I think the prices will fall further as more and more players come into the field and the capacity increases. Those two key factors, the displays and the hard drives, will improve survivability. □



# Rugged IT Manufacturers Addressing the Need for More Performance at Lower Cost

It's not just the Army that is engaged in war. Local police and fire departments, as well as emergency medical technicians and other first responders are engaged in a war of a sort. That would be a war on cost, and a war on point solutions that can handle only one function.

"The military is part one, but if you look at other parts of safety like police, fire and EMTs you see that their budgets are going down," said Steve Gilbert, global business development manager for Dell Rugged Computing Solutions. "I also see a lot more people trying to do more things with these boxes. I see people having to go outside more to do their jobs, be remote, and trying to take on new applications."

The emergence of GPS positioning data on rugged computing devices is a good example. Just like a driver in an automobile has a GPS display on his dash to offer driving directions, users of rugged IT devices can have access to GPS data for positioning data in work environments and on the battlefield.

So if part one is cost, then part two is performance. A repairman for a power company working in a bucket truck during an ice storm doesn't want to watch the hourglass icon on his screen when he needs important wiring information to restore power to a neighborhood.

"We are the first to put full-voltage Intel Core 2 processors in these units," said Patrick Seidensticker, product marketing manager of rugged products for Augmentix, which is Dell's manufacturing partner for some rugged computers. "If you're trying to stream video from an Apache helicopter into a Humvee, you can't have a 30-second lag. Just like your weapon, that unit has to be state of the art."

## The Rugged Tablet

State of the art capabilities for laptops are now also finding their way into rugged tablets. These devices have been around for a number of years, particularly as convertible tablets that are basically notebooks that can transition to a

tablet. Portable but limited in their ability to perform multiple functions, susceptible to shock and with limited battery life the earlier generations of tablet computers left something to be desired.

Even tablet manufacturers like Panasonic would admit that tablets designed for one industry like medical aren't necessarily optimized for other industries like aircraft maintenance. Looking to address that gap, Panasonic has introduced a new tablet called H1 Field, which combines some of the attributes of its H1 Health tablet such as light weight, with the attributes of its U1 unit, which has sunlight readability and meets the latest military rugged standard MIL-STD-801G.



"H1 Field is designed for users who need light weight, extremely long battery life, hot swappable batteries, a big screen with sunlight readability and extreme ruggedness in a portable machine," said Kyp Walls, director of product management for Panasonic Computer Solutions.

The H1 Field is rated for a six-foot drop, which exceeds MIL-STD-810G, according to Walls. The unit employs a magnesium alloy chassis to protect the components inside, which is then wrapped in a polycarbonate case. The internal solid-state hard drive is also reinforced. The machine is completely sealed and has an IP rating of 65, which means it has the highest level of protection against dust and dirt (6 on a scale of 0-6), and provides protection against low-pressure water jets from all directions (5 on a scale of 0-8).

"It is a good solution for aircraft maintenance depots," said Walls. "Because the batteries are hot swappable and there is wireless built in, it is a nice solution especially for guys working on the flight line or on an airframe where it is not convenient to plug in the machine or go get another battery. With spare battery packs, which are the size of two packs of gum, they can work for 8-9 hours at a clip without having to find AC power."

Panasonic began to ship the H1 Field in mid-March. □

# Rugged Computing on the Aircraft Flight Line

With aircraft maintenance technicians regularly working dozens of feet in the air on aircraft fuselages and on scaffolding-like docks, computing devices used for digital manuals and technical orders must be light weight, rugged, have wireless Internet capability and long lasting batteries. The reason is obvious: a technician needing a new battery, for example, could waste as much as an hour unhooking his safety harness, climbing down from the dock, getting a battery from the store room, and then climbing back onto the aircraft to continue work.

“At the depot we measure productivity in minutes,” said Richard Goodwin, computers and communications manager for the 309th Aircraft Maintenance Group at Hill Air Force Base in Utah. The Ogden Air Logistics Center at Hill is responsible for maintaining F-16 fighters, A-10 attack aircraft and C-130 transports for the Air Force. “With the amount of manpower we have out here, the time it takes to walk to an aircraft or to a computer terminal and back again, could equate to a million dollars in a year’s time.

“We can save so much money just by allowing that maintainer to stay on the aircraft. It puts the supervisors out there and frees them up from their desks. They can be out there with the workers. The maintainers and the supervisors can be comparing the same thing on their devices. It’s phenomenal.”

Goodwin said that aircraft maintainers at Hill are particularly interested in multi-functional devices, particularly in lighter tablet form.

“Multi-functional devices offer us a broader range of what we can do with the device than you could do a few years ago, including bar code scanner, RFID reader and a camera” he said. “We’re finally getting something that incorporates them all and doesn’t weigh more than five or six pounds.”

With Air Force regulations mandating the use of electronic tools, the primary function of the tablets will be used to replace paper technical orders (TO’s) with electronic TO’s that can be viewed on the screen.

“If you think of the cost associated with paper TO’s and how many times they have to be reviewed monthly, replaced and updated, we’re going to save the government tons of money when it can all be done on an electronic form factor,” said Goodwin.

As mentioned, one of the major advantages of the new rugged tablets have over the older rugged laptops is the variety of functions they can perform. For example, the

tablets used at Hill AFB include a built-in bar-code scanner so that work control documents can be scanned while the maintenance technicians are still on the aircraft.

Added Goodwin, “A lot of engineers want images, and these newer devices allow us to capture those images and send them with, along with the work control document, right from the spot. This will save time. The longer we can keep the mechanic on the aircraft, the more production we can get out of him.”

The maintainers at Hill AFB were initially concerned that the screens on the rugged tablets that they’re using would be too small at 10 inches to view wiring diagrams. In fact, the diagrams have been easier to view than originally expected.

“The maintainers can touch a wire on the screen, blow it up, trace it and follow it,” said Goodwin. “They say that identifying wires is clearer than it would be on a black and white piece of paper, which is sometimes hard to do. That has turned out to be a pleasant surprise.”

On the negative side, the computers tend to sometimes drop their Internet connection for no apparent reason—which is an issue that regularly occurs with wireless computing in general.

“Maintenance technicians need to have the ability to do wireless networking with their rugged IT products,” said Dave Fralish, chief of the CIO Support Branch at Tinker AFB. “These wireless capabilities must be able to be encrypted with, at a minimum, DoD medium grade security and this communication must be reliable and sustainable.”

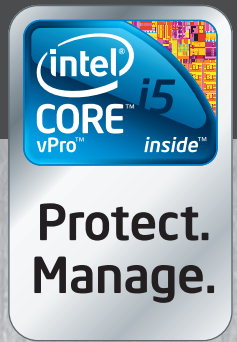
Inconsistent wireless connectivity is one of the reasons that military services stopped using pen tablets a few years back.

“This failure was largely attributed to the fact the pen tablets wireless capability was fairly limited in range and reliability,” said Fralish. “When the technicians are inside of an aircraft their rugged IT products need to be able to communicate reliably across potentially long distances with multiple obstacles in the line of sight to the communications access point. Referring to the encryption capability, these devices must also be able to connect to networks using wireless VPN technologies.”

That type of connectivity will allow technicians to use official instant messaging for communications with their respective organizations and supervision, Internet for research, or connect to servers hosting additional technical data or supply chain systems for parts availability and procurement. □

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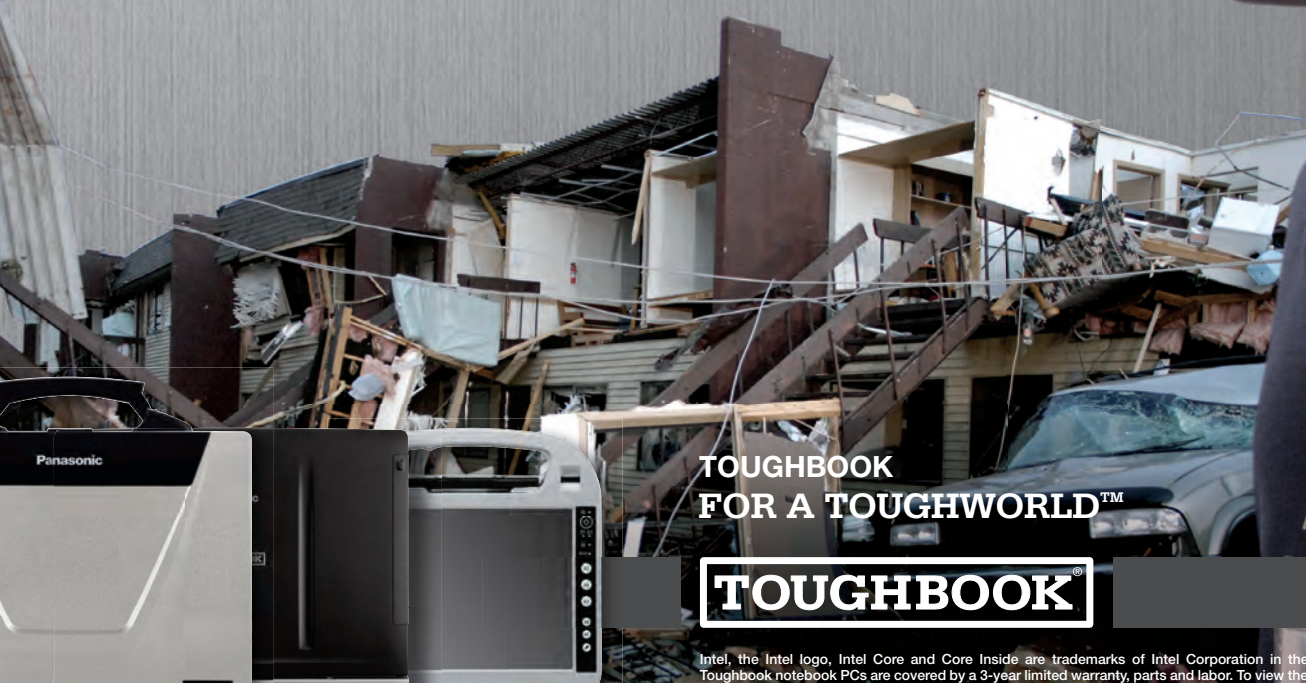


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