

White paper

Ruggedized Computers

sponsored by Dell Computers

How they have developed
and adapted to meet
the needs of the user and
his/her environment



REDCORP

Redcorp SA/NV. rue Emile Féronstraat 168, 1060 Brussels
Tel. +32 (0) 2 558 30 00. Monday to Friday from 9 to 18h.

www.redcorp.com

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History and development

The development of ruggedized, industrial grade mobile computers can be traced back to the 1980s and to manufacturers such as DVW (later Husky) Computers who even produced a machine actually called the Husky.

These early-ruggedized devices were produced for specific uses, situations and environments such as warehouses where the need for stock control barcode recognition was crucial or field environments (including military applications) where portability and durability were important features.



Source: Jon Westly - Husky Computers

Many of these first examples of what were described as industrial or external-grade computers were simply consumer products wrapped in a more robust casing and not genuine ruggedized machines with resistance to moisture, heat, heavy handling and other harsh conditions that might be encountered. They also didn't have a long battery life or large memories and data would be lost if the device ran out of charge before returning to base.

The components available at that time to produce industrial grade devices were limited therefore the devices themselves were imperfect in critical aspects. However there were obvious benefits and varied applications of genuine rugged computers held a great deal of commercial potential so the larger computer manufacturers soon started looking at the market seriously.

Some of the first efforts were pretty half-hearted and didn't address some of the major issues such as viewability and intrinsic robustness but soon purpose-designed and built machines (rather than adaptations of ordinary laptops) began to emerge. The original niche players soon found themselves competing with the big boys such as Dell and Panasonic for market share.



What are the differences between ordinary computers and rugged computers?

The principal differences between the mass-market versions of laptops, tablets and mobiles and their ruggedized counterparts concerns the construction standards and materials used: toughened casings, fully sealed keyboards, scratch-and shatter-resistant screens and components able to withstand temperature extremes and exposure to shock and vibration have become more common.

Other key features have not been overlooked however, like the ability to read the screen in bright sunlight, portability and flexibility while still retaining high performance and security. Equally, the absence of elements like hinged covers, which might weaken or compromise the strength and usability of the device can also be an important aspect of design and construction.

In terms of practicality, rugged computers will often incorporate a strap for ease of carrying, as these machines are made to be moved frequently and this often over relatively large distances while still needing to be accessible and convenient.



Example of a MIL-STD-810 Certified, 2U Rugged Computer

Who uses ruggedized computers?

The original users of ruggedized computers used to come from two main areas – the military and warehousing. Both of these sectors had understood the need for durable, accessible devices that could be used on the move and provide the resilience and adaptability to meet the challenges likely to be presented in such environments. The practical tasks that the computers facilitated were actually quite similar in both areas as the military initially used them for inventory, maintenance and inspection data.

Today a wide number and range of industries make use of rugged laptops and handheld computers; these include – agriculture, construction, the water industry, mail and transport services, retail and distribution, sales, healthcare, service and maintenance, oil and gas, manufacturing and public safety. This non-exhaustive list merely gives an indication of the breadth and versatility of the devices currently available to the market.

Specific adaptations of handheld devices can also be used for orienteering, navigation and other recreational or personal functions. In fact, any external activity that requires computation or recording facilities and access to data while out and about, can be accommodated by a rugged computer of some description.



How are they used?

The original rugged versions were simply more resiliently cased laptops that had been adapted for more unforgiving, even hostile environments. Their main advantage was transportability and durability and these were the features that users originally valued and required.

Contemporary ruggedized computers are far more sophisticated and varied in their applications and attributes and different types of user will prioritise different aspects of the machine.

Military – obviously these users are often in extremely harsh environments in terms of moisture, temperature and general weather and ground conditions so toughness, damp resistance and heat resistance are especially important here. Battery life and memory capacity are also critical factors as units can often be away from base for long periods and need to be able to function as separate, self-sufficient entities where there might be no access to power. Equally, the nature of military operations will often require GPS as a service so having this built-in or the ability to add it via a serial port is an important consideration in many circumstances.



Warehousing, retail, distribution – for businesses that have large inventories of products or materials to manage, handheld devices provide a great many advantages in usage. Their portability and flexibility mean they can be easily moved around large warehouses and stores and their memory capacity means they can hold data on vast numbers of lines. Wireless technology now means they can also communicate with other systems and users providing an integrated record of stock movement and location. Single inputs can enable consignments or packages to be tracked around the world via barcoding and provide operatives – and often customers – with information and access.

Extraction industries – data on structural safety and the need to monitor production levels are two of the main drivers for mobile computer usage in extraction industries such as oil and gas. The environments these industries operate in can be extremely hostile and demanding so the ruggedized devices need to be able to withstand these conditions and give the users an easy, accessible experience. Battery life can also be an important feature with 6-8 hours being considered a minimum; some products now incorporate hot-swappable batteries meaning the battery can be replaced without powering down, a very useful adjunct to the normal provision. A safety critical aspect of ruggedized machines for this particular environment is that they are spark-free as workers can be in very combustible atmospheres. This would require UL 1604 certification, which verifies machines for use in these specific areas.

Health services – mobile computers offer healthcare professionals access to patient records at the point of care and in a hygienic environment, plus they give the ability to perform a variety of healthcare tasks while on the move. Ruggedized computers for this sector need to meet the functional and hygiene requirements specific to healthcare environments, for example by offering resistance to disinfectant and meeting critical safety standards. They also need to provide Data Protection and recovery services in this highly sensitive area of work.

Agriculture – while uses in this field might not be immediately obvious, two of the major areas of operation come from animal welfare and soil sampling. All livestock is tagged today and a mobile computer can provide access to a particular animal's record instantly – so the incorporation of a barcode scanner is an essential feature for these users. Soil sampling is often performed in poor weather so weather proofing is an essential aspect of their design. The operation also involves using a serial port for communication with a GPS receiver so this facility will be a valuable addition to the device.



Source: www.gps.gov/applications/agriculture/operator

Construction – laptops and other rugged devices are used in construction for tasks such as reading plans, consulting land data and onsite worker updating and consultation. The nature of the environment means durability and resistance to external agents is very important, as is clarity of image and ease of use. If a supervisor is consulting with an operative who is at the top of a high building he wants to be able to see and hear him easily and without distraction or physical awkwardness.



Different categories of device

There are three categories of device available for use in this context; ruggedized laptops, tablets and smartphones.

Ruggedized laptops

These are of similar size and construction to consumer laptops but with some – or all – of the critical ruggedized features built in. Many models also incorporate Intel Core i processors which enable them to provide high-level graphics and fast processing capability. These are principally used in sectors such as construction and in the military. It is the major computer manufacturers such as Dell, Hewlett Packard and Panasonic that operate in this marketplace.

Ruggedized tablets

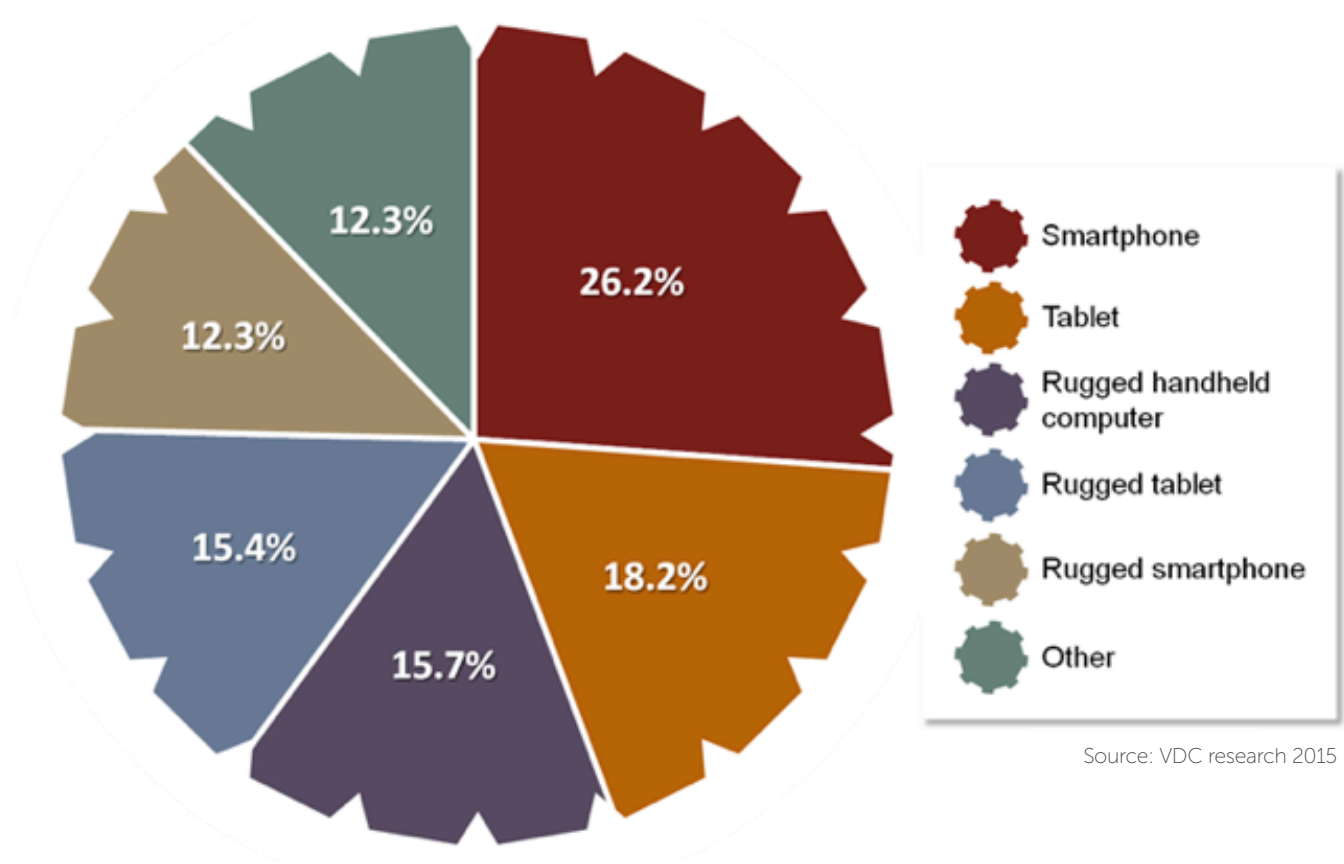
There are two grades of rugged tablet: semi-rugged and fully rugged. While the former has some of the essential features such as durability, resistance to moisture, dust etc. the fully rugged version is designed from the inside out to provide total durability and toughness. This is reflected through solid-state components and no moving parts. They also don't require fan cooling, further enhancing their integral, compact resilience. Features such as barcode scanning are often incorporated into these devices as they are commonly used in logistics and transportation.

Ruggedized smartphones

Rugged smartphones have highly durable and completely sealed casings rendering them resistant to punishing external conditions. They can survive extreme temperatures and total submersion in water as well as exposure to altitude and solar radiation. Their size and easy portability make them ideal mobile accessories and many are now equipped with features such as barcode readers, Push-To-Talk (PTT) walkie-talkie mode and NFC capability meaning it can talk to other devices in close proximity and exchange data, provide access to the internet etc.

These enhanced types of computer have already made considerable inroads into the generic workplace market as the chart below indicates. It illustrates the market share for business-related machines including non-external, in-office environments; so the perceived benefits of these devices – even to staff who are not in challenging surroundings or situations – are obviously beginning to be understood and appreciated.

This penetration is only likely to increase as non-business users begin to demand the same level of durability and the range of add-ons and services that have been developed for business users especially mobile and outdoor workers.



Source: VDC research 2015

Current developments in ruggedized computing

It is clear that the number of applications and sophistication of ruggedized computers has increased in recent years and this has seen refinements required for particular uses driving development. The use of Android as the standard operating system (OS) is now becoming accepted as is the need for facilities such as connectivity and voice recognition and command. With this in mind, technologies such as Bluetooth and Wi-Fi are often integrated into these ruggedized devices.

Reliability and durability are increasingly becoming the major issues for users as they struggle to manage and control IT costs in a competitive environment. Manufacturers, particularly Dell, have concentrated on improving the different aspects of the products meaning that although ruggedized computers are considerably more expensive than their normal counterparts they now provide improvements in productivity, accessibility and function that more than pay for themselves. Reduced maintenance costs and downtime plus instant information access and accuracy increase efficiency across the organization so the rugged computer's contribution becomes even more valuable.

For the military (and increasingly in other applications and areas) security and manageability are vitally important. This means devices having to comply with stringent component and software standards to provide the degree of assurance necessary. Faster processors, better functionality and improved ergonomic design are other benefits that are starting to be built-into ruggedized models.

Handheld ruggedized devices increasingly reflect the features of their consumer counterparts as the expectation that high quality picture recording (still and video), sound recording and fast, reliable internet access and hi-grade graphics become part of the mix.

Future of ruggedized computers

There are some who believe that the future of the mobile computer lies in the ruggedized approach. With workforces increasingly mobile and often operating from remote locations the way computers are used and viewed in the workplace is changing. With almost universal connectivity likely to become available the applications and usefulness of ruggedized mobile devices become even wider. Staff will be able to log on and connect with their offices from almost any location and receive and transmit data, read e-mails, perform online operations and generally interact in a way that wasn't possible before.

There is evidence that the use of ruggedized computers is expanding among blue and white-collar workers as well as those working outdoors or peripatetically. Lighter, smaller models that retain functionality, screen visibility and battery and data storage capacity while being easier to use and carry are being developed to meet the increasing demand for flexible, multi-purpose machines that can be used in a variety of situations and for personal as well as work functions.

Durability and longevity has always been an issue for IT purchasers and users, no matter whether it relates to laptops or the more portable types of computer. The mobile workforces of the future will only heighten this imperative, so it's clear that the age of the ruggedized computer looks likely to grow and expand for some time. Indeed, it is not too far-fetched to see rugged version of machines becoming pretty much the norm in the not-too-distant future when people's whole lives revolve around connectivity, accessibility and availability of information and reliable and quick communications channels.

Both Intel and Dell have made significant contributions to the growth and development of ruggedized computing: for example, when Intel processors were integrated into battlefield devices as early as 1991, it revolutionized 'theatre-of-war' technology; and Dell have been first to introduce a rugged multi-touch tablet PC - the XT2 XFR - offering functionality and flexibility in the harshest of environments.



What to look for in a ruggedized computer

When buying a ruggedized computer, customers should be looking for a totally engineered solution and a machine designed with rugged environments in mind from the inside to the outside.

1. **Solid-state internal components** will ensure a minimum of moving parts and more resistance to shock and damage.
2. **Coatings and sealants** will guarantee the unit is genuinely weather and environment proof. Look for the Ingress Protection (IP) rating; this measures the ability of equipment to withstand penetration from liquids and solids.
3. **Drop specification:** all ruggedized computers should be able to withstand being dropped or falling onto hard surfaces from a height of around 1m. This test is normally done using each and all of the edges.
4. **Ability to tolerate extremes of temperature:** in order to meet this requirement most machines will have some form of internal heater to keep the components warm and operative in freezing environments. Check that your device has these features and can operate in temperatures of -30°C. Specific hazardous environments have their own certification requirements and must carry an I-Safe rating and the name of the laboratory that tested it.
5. **Screen and image quality** that are both durable and scratchproof, but that also provides viewability in all conditions of sunlight.
6. **Wireless connectivity** is important in order to access and relay information and communications while on the move.
7. Ruggedized equipment should be both vibration- and shock-proof.

In conclusion, review all the specification and testing data on the machine in question and verify that the testing has been done independently and by accredited agencies. Make sure that the specific attributes you require for the purposes and environment in which the device will operate are to the standard you need.