Choosing a good PC for the marine environment

Many navigation applications are now available for PC systems which provide the user with a flexible, long term, upgradeable system. RADAR scanners may be directly connected to such PC's along with many other devices and sensors which will provide a comprehensive navigation solution. Also, WiFi access to the internet, entertainment and office applications are increasing required for on-board use. Many high street PC systems are now available such as laptops and smaller fixed systems, most would seem to provide a practical solution for these requirements. However there are many pitfalls in selecting a high street PC that would normally offer a cheap and practical solution for home use. PC installations at sea are exposed to a harsher environment with exposure to sea air and vibration/shock typically caused by engine operation &/or rough passage of a vessel through a seaway. Pelagic Systems has long experience in building systems that will stand the rigors of life at sea but why should you consider purchasing a marine PC when the high street offers so many seemingly ideal cheap solutions at first glance?

The issues

First we consider the environment a PC must cope on a vessel and how a professionally built marine PC overcomes the issues.

Ambient Air

Sea air contains many elements which is why is often smells so good but unfortunately it also includes small droplets of brine (salty water) which can rapidly corrode electronic components. The best marine PC designs preclude ingress of brine droplets into the chassis by avoiding the use of cooling fans and venting holes. It is worth noting that some so-called marine PC's have internal fans or vent holes, these usually have a non-marine pedigree &/or are built from "ad hoc" components, perfectly acceptable for home use but best avoided for use at sea. A marine PC should be installed in a protected position away from the elements (unless fully waterproof), providing this is done and there is no direct exposure to sea water there should be no problems with a properly designed marine PC.

A small form factor rugged case PC with shock & vibration mounting

Advanced thermodynamic fanless design keeps components cool without fans & vent holes for sea air internal circulation!

Shock and Vibration

This can be a real issue for high street PC's. As a vessel makes way through a seaway all equipment is exposed to shock and vibration and this includes an on-board PC. Whether it's a power boat making way through a sea or a yacht beating to windward, shock and vibration are operating on a PC and internal components. So it's important that a PC is securely fixed down, it's no good hoping gravity will restrain movement as with PC's at home. Most high street PC's don't provide mount lugs for bolting down units securely but even if they are well strapped down, they are still exposed to G forces & vibration not anticipated for home use. Disk, sub-assembly boards (small electronic boards plugged into main boards), connections and cables are the main cause of PC failure due to shock and vibration

A high level of board integration means less cabling and connectors offering a cleaner design with higher reliability

A solid state hard drive is faster, more efficient and more reliable with no moving parts

Power supplies

Most vessels have a standard marine 12v or 24v DC power supply supported by a battery and engine alternator. High street PC's are designed for 240v AC power supplies (110v in North America & some other regions), including laptops. Inverters can be used to convert 12/24v DC to AC but they are usually inefficient and present a shock hazard not present with 12/24v DC supplies and are best avoided.

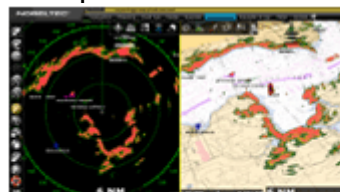**Battery duty cycle & operation**

During a battery charge and discharge cycle supplied terminal voltage normally varies between 11.5v and 15v DC but can be higher when charged by some smart battery chargers. Also during a power consumption spike the supply voltage can dip below 11.5v. "Noise" can also be present from other electrical equipment which can add voltage instability.

Battery service supply

With more and more electrical equipment and instruments fitted to boats power demands from batteries seems to always increase! While this may not be an issue for power vessels with large alternators it is an issue that sailing yacht owners in particular must consider. The best marine PC's use processors that provide maximum processing power with modest power consumption. And the lower power consumption, the less heat energy must be dissipated from the PC.

Choose a marine PC with processors powerful enough for your application and low energy consumption

A RADAR scanner can be connected directly into a PC LAN (Ethernet) port and displayed using PC navigation software

Beware of some smaller marine PC's which only just provide sufficient resources and are built down to a price. Our Voyager IIF has an Intel i7 processor with advanced HD4600 graphics which will easily run all marine applications with ease.

General installation considerations

Installation Position

Usually smaller is better for marine PC's! A smaller case is easier to site and is available because of a higher level of board integration. And the higher the level of board integration, the less internal connections and cable runs to fail. The installation should be in a ventilated location so that air temperature does not increase to an unacceptable level. If used in hotter locations (e.g. Mediterranean or Caribbean) consider normal maximum air temperatures, if necessary a fan can be installed for forced air circulation of enclosed spaces when required. In temperate climates normally a ventilation grill is sufficient to keep the temperature within normal limits. If you have an existing PC fitted with an internal cooling fan or vent holes, never cover up fan ducts or vent holes in an attempt to seal the unit, you will only cause over-heating and possible damage. Also when installing the PC consider maintenance, the PC should be sited so that it can be removed from an enclosed location without disconnecting cables. Also mark the cables at the plug, i.e. GPS, RADAR, NMEA, etc! A PC remote power feature is useful to power up the unit from a circuit breaker without having to touch the PC power switch. A remote front panel is also useful for access to a Blu-Ray/DVD/CD drive and ports for connection of other devices such as USB and Ethernet.

There are some so-called marine PC's which are actually quite large, this is typically because the PC's are manufactured on an "ad hoc" build process in a large chassis. The lower the level of board integration the more sub-assemblies, connections and cables are usually required which can lead to a higher failure rate and such machines are best avoided.

Connecting Instruments & Sensors

Most existing marine instruments and sensors use the NMEA 0183 connection standard or if using a proprietary standard (e.g. Seatalk) normally they can communicate to a PC either through a separate NMEA 0183 port or a suitable adapter. This serial connection may be connected directly to a PC RS422 serial port or to an RS232 through a NMEA 0183/RS232 adapter. It is therefore useful to have at least one RS232/422 "legacy" port available for such connections. NMEA 0183 serial cables can also be connected to a USB port using a NMEA/USB adapter. More recently NMEA 2000 has become available, this is a network connection standard and most modern instruments and sensors now support it. If you have a NMEA 2000

network installed or are contemplating installing one, these may simply be connected to a PC USB port using a NMEA 2000/USB PC adapter (Gateway). Use of adapters has the additional advantage of normally offering opto-isolation – this isolates the PC electrically from input sensors and helps to protect PC ports from any unwanted voltage spikes or earth loops.
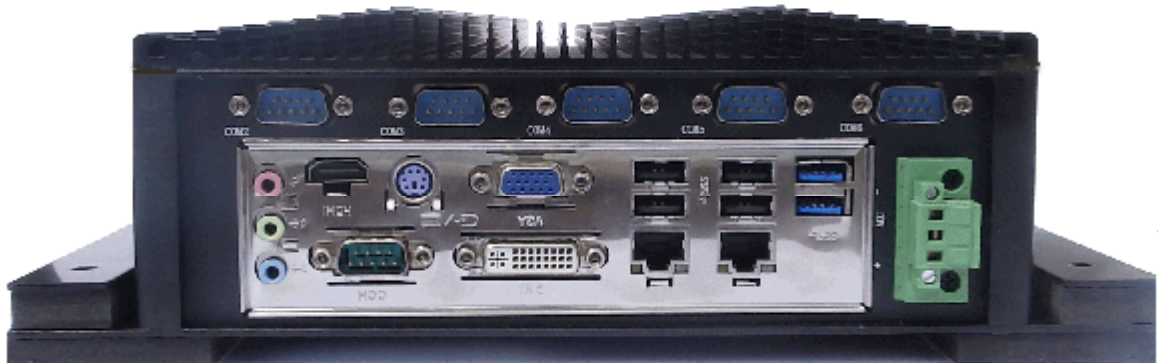
A NMEA 2000 to USB opto-isolated PC adapter

A NMEA 0183 to RS232 opto-isolated PC adapter

Some cheaper marine PC's suffer from a lack of I/O ports because of a non-marine pedigree. Make sure when choosing a PC that it has sufficient ports for your present and likely future requirements.

The Pelagic Systems Voyager IIF has all the I/O ports needed for marine applications.

Reliability

A PC navigation system must be as reliable as other electronic navigation systems, failure is not usually convenient and a marine PC must be resilient when conditions deteriorate. Sea air, shock and vibration are the biggest sources of failure with all electronic equipment and a marine PC should be designed and built to withstand these hazards.

Operating Systems

Windows XP is still popular, although no longer supported by Microsoft, we recommend Windows 7 for new PC's.

Check that a full set of device drivers are available for your intended operating system version.

Applications

Stability is key to successful use of a marine PC for navigation. Choose your applications carefully and avoid temporary application installations for short term use. The internet is a fascinating and highly useful service; cautious use of the internet is sometimes unavoidable and least risky on trusted sites but consider using a different computer for leisure browsing, an iPad or laptop for example. We recommend that navigation computers are not routinely connected to the internet.

Consider using a stand-alone Internet bridge to connect multiple on-board personal devices like our MWB-4G marine Wi-Fi & 4G system.

see: http://www.pelagicsystems.co.uk/products_accessories_mwb4g.html

In Summary

PC systems are now routinely used in all manner of applications including RADAR and Chartplotting at the bridge on very large vessels. Marine PC systems offer smaller vessel owners a flexible and upgradeable navigation system which is easily integrated with existing instruments and sensors to provide a comprehensive navigation system. RADAR scanners can also be easily added for separate PC RADAR plotting and chart overlays. Providing a suitable marine PC is selected, manufactured by a professional marine PC company such as Pelagic Systems, your investment will be protected for years to come.