



# Attention to details benefits primes outsourcing military avionics systems

By Frank Willis

*Vertically integrated government prime contractors can do it all, from boards right up to the entire airframe or vehicle. But should they?*

Avionics are among the last areas of military and aerospace systems to accept and adopt COTS-based technologies. Prime contractors, previously accustomed to designing the entire system from the ground up, can benefit by outsourcing to subcontractors with expertise in subsystems, boards, and all the way down to the component level. But attention to details makes all the difference in flight success.

As Commercial Off-the-Shelf (COTS) perpetuates throughout the military, major prime contractors have turned more and more to subsystem outsourcing. And even in the most mission- and life-critical applications out there, outsourcing embedded avionics systems has clearly become a widely accepted practice among prime government contractors. The potential benefits are many – speed to market, significant savings in capital outlays, best-of-breed, and reduced costs – to name a few.

There are many reasons for this trend, not the least of which are the speed with which suppliers can respond to the needs of the prime contractor, the savings in manpower and dollars, the pure convenience of delegating the whole subsystem, and the degree of integration the suppliers are able to provide. Market pressures mandate that the large prime contractors identify and continue to invest in their core competencies, and outsource other areas not considered core to their business, such as embedded COTS subsystems. Some of the key questions primes ask themselves are:

- What value-add do we bring to designing and assembling avionics subsystems?
- Why are we investing in a subsystem manufacturing facility when there are other options?
- Since we're concerned with the overall system integrity, must we delve all the way down to the component level?

## From system to subsystem

On this latter question alone, prime contractors need not delve into the details of subsystem, board- or component-level design and reliability issues. For example, an experienced subcontractor will have a deep understanding of how to manage heat flow through component mounting and placement, and component-to-case junctions. Outsource subcontractors are experts in dealing with these component-level issues using thermal vias, vacuum interfaces, heat sinks, gap pads, chassis design, and Printed Circuit Board (PCB) internal thermal layers.

Using multiple analysis tools, the subcontractor will predict factors such as thermal performance, or other environmental phenomena such as natural frequency and harmonics, or vibration and shock performance – all of which may not be part of the prime contractor's core expertise at the individual subsystem, board or component level.

During the design of rugged systems and boards, multiple factors must also be taken into consideration, such as materials, electromagnetic interference (EMI) protection, PCB construction, sealing, connectors, harnesses, human factors, fasteners, finishes and paints, manufacturability and maintainability, and many other materials and design constraints. For example, choosing anti-fungal, non-outgassing, and defense-acceptable materials is critical in reducing design and system qualification time.

## Rattle and roll

And in avionics systems – whether fixed wing, rotary, or even projectile – the unique demands of flying through the air put incredible shock and vibration forcing functions on subsystems and components. Primes acting as systems integrators may not be as comfortable dealing with details at the component level as are subcontractor experts. For instance, the most important part of the structural analysis/design is avoiding resonant coupling between the chassis and the circuit card assemblies. Resonant coupling occurs when the natural frequencies of two objects fastened together are close enough to cause unwanted vibration.

Here again, the component level can't be ignored. In an electronic system the items usually at highest risk are solder joints between components and printed circuit cards. To avoid resonant coupling, 3D CAD models should be fixed as they will be in operation so that natural frequency analysis can be performed on chassis and circuit card assemblies. Industry experience suggests a two octave separation between the circuit card assembly and the chassis in their first mode.

Prime contractors are familiar with all of these issues, for sure, but may not wish to be bothered with them down to the board- or component-level. In theory, the underlying factors that affect component, board, and system performance are well understood. In practice, however, designing, manufacturing, and certifying a functioning rugged system becomes far less certain.

For this reason, system integrators and prime contractors seldom undertake this arduous task. Instead, they customarily turn to subcontractors like SBS Technologies and others who have remained committed to offering in-house design, manufactur-

ing and testing capabilities for rugged systems. Outsourcing the system, in fact, has become standard industry practice. As a rugged system provider, SBS Technologies has built a reputation for being able to quickly understand customer specifications and then rapidly design, test, certify, and deliver exactly the rugged system our customer needs. These are exactly the qualifications required of a subcontractor providing COTS-based avionics to prime contractors. ⊕



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