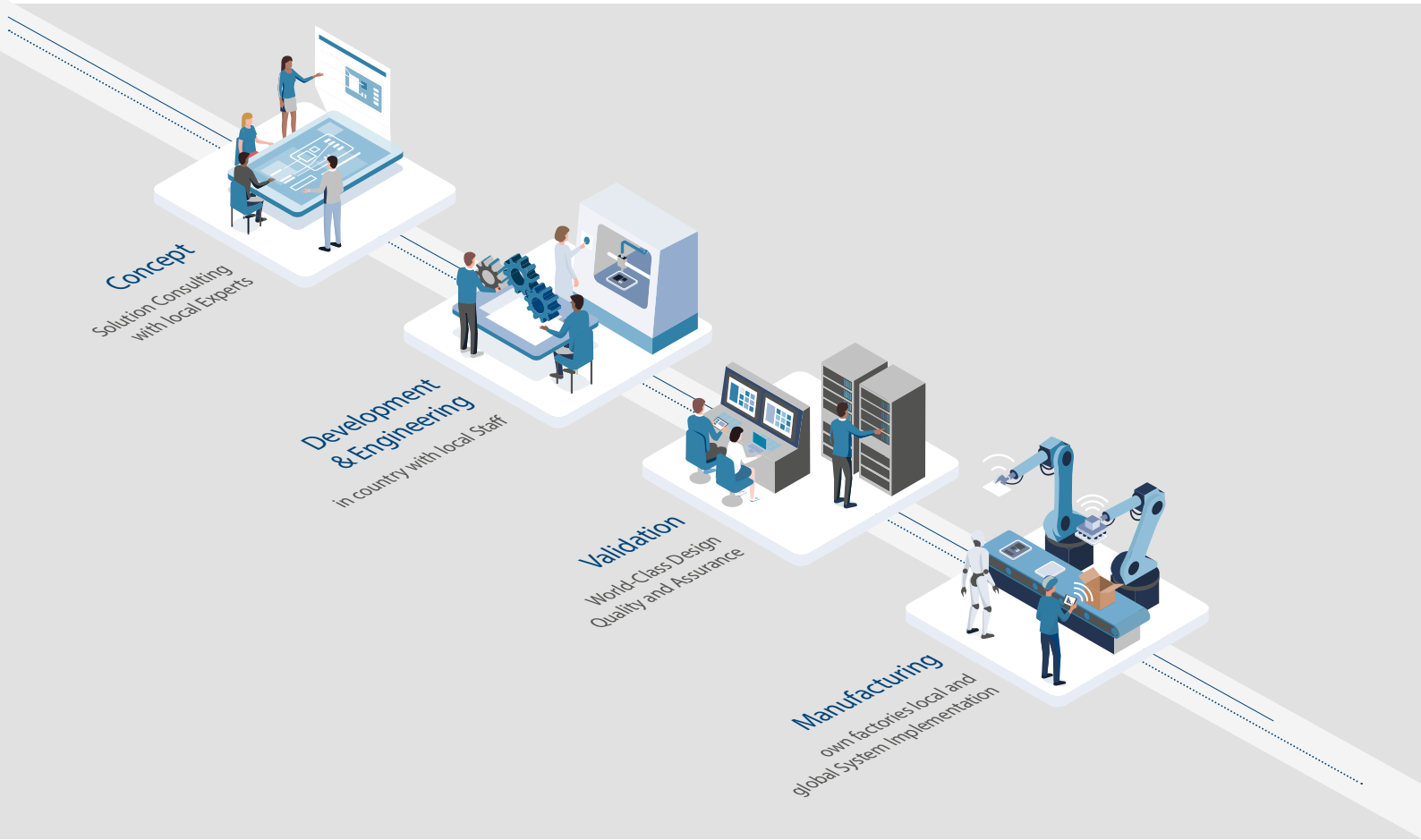
ADVANTECH

Enabling an Intelligent Planet

White Paper



Design and Manufacturing Services Solution Brief

Optimise your products and accelerate your development with custom Design & Manufacturing Services (DMS)

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Are you looking for the most suitable system solution for your application? Want to develop it all from scratch or want to save time, money and resources by re-using proven, ready-to-use and state of the art IP? Want to have access to a dedicated design team of specialized developers, who speak the same language, are located in the same time zone, and share the same cultural background? Want to save time and money on test and manufacturing? The local engineering and project teams from Advantech's Design & Manufacturing Services are here to support you on your next project, from concept to production and beyond.

Modern Times Need New Solutions for Design and Manufacturing

Today, equipment manufacturers and system integrators across sectors including industrial automation, healthcare, logistics and infotainment among others, have come to a point where it has become difficult, if not impossible, for them to understand every technology and building block of these systems in-house. The latest trends, such as the Internet of Things, Industry 4.0 and Artificial Intelligence, have opened up vast opportunities, but have also accelerated the increase in complexity for many equipment designs.

Project teams developing such systems must constantly refresh their expertise in technologies, components and standards, while maintaining extensive and deep knowledge of the application domain. Their businesses expect them to bring innovative products to market faster and faster while lowering development risks and staying within budget constraints. This is becoming increasingly difficult to achieve.

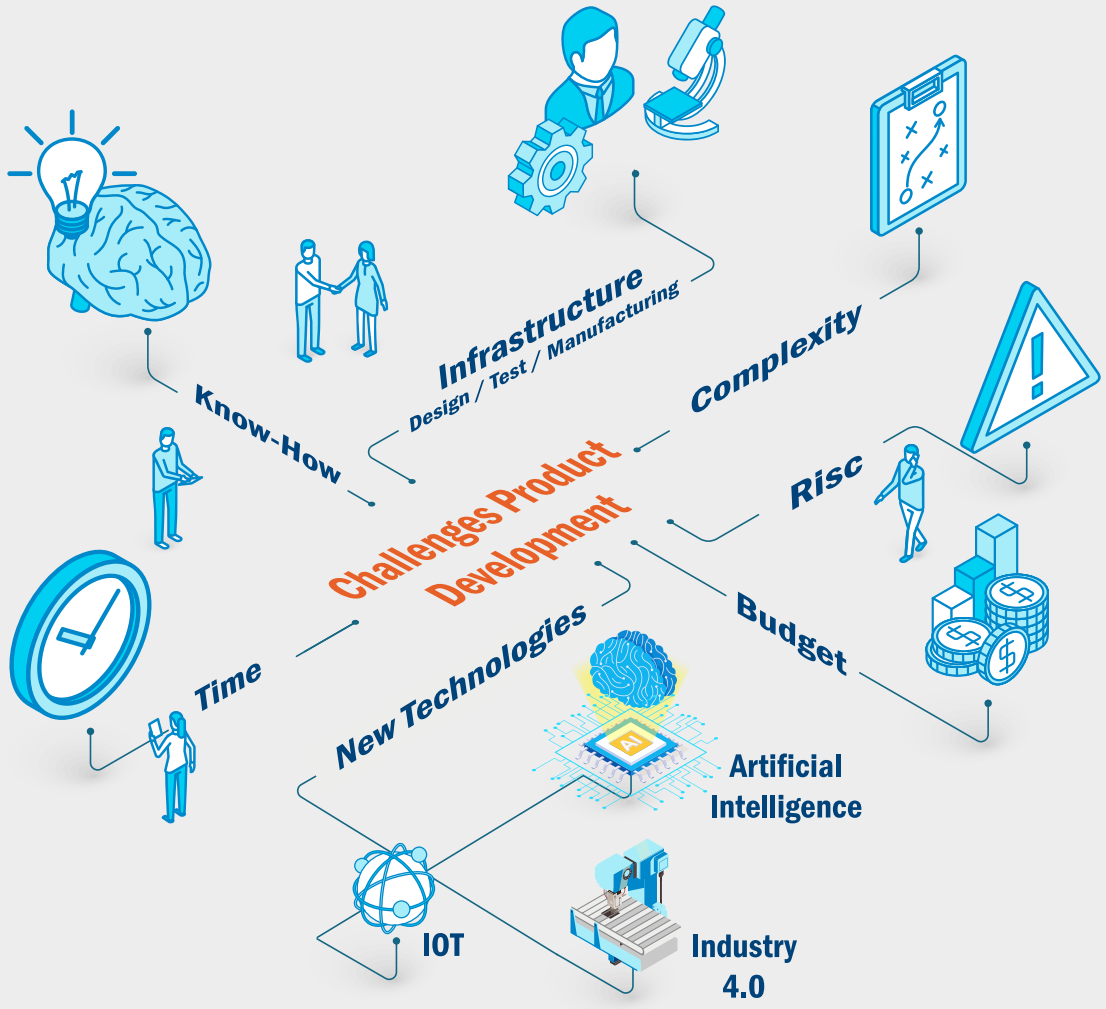
Outsourcing strategies for commodity components have helped equipment manufacturers to master this balancing act. In return, they can focus on their core competencies and avoid investment in design, test and manufacturing infrastructure for those items outside their domain focus. Why invest, if specialist outsourcing partners have the relevant technology at hand?

However, as complexity has continued to grow for OEMs, the challenges rattle down the chain. In many cases, outsourcing partners need to be able to master multiple technologies and then integrate them into a complex subunit. As trusted advisors, they are expected to contribute independent know-how and expertise to the OEM. The extended work-bench is transformed into the extended IP pool and think tank.

Why Not Just Use a Design Service?

Employing a custom design service has been a common approach for many years. However, this concept is only one half of the process as it separates the design phase from the manufacturing phase, and the corresponding accountability throughout the project. In the face of higher complexity, Design-for-Test and Design-For-Manufacturing have become more important than ever. State-of-the-art high-tech products need to be designed with the manufacturing technology and equipment in mind to avoid costly and unforeseen investments in new machinery when transitioning from R&D into mass production. A closed feedback loop between manufacturing and development teams is essential to establish and maintain the required know-how. This approach needs to encompass the full industrial life cycle management and must not stop with the launch of the product.

Aggregating design, manufacturing and life cycle management under one roof is a natural means to foster the establishment of such closed loop cycles, allowing policies, processes and investments from various functional departments to be aligned and integrated. Rather than engaging with separate design houses and contract manufacturers, an integrated design and manufacturing partner does not just establish a linkage between R&D and manufacturing upon the special request of an OEM. The linkage is a fundamental ingredient of such a partner's business model. Companies – like Advantech – offering full-blown design and manufacturing services, provide clear advantages here. Combining both services under one roof yields optimal product designs, while allowing risk mitigation and problem avoidance at the earliest stage. This means it is easier to keep complex projects on schedule, within budget and get them successfully launched into the market.



Why not skip the Design House?

Some contract manufacturers have tried to overcome this issue for their premium customers by establishing internal R&D resources for custom design projects. However, like design houses, these R&D teams do not develop new products and technologies independently, but only on customer request. New technologies and intellectual property may not be available when an OEM would like to apply it for a new product but may need to be built or acquired from scratch.

Advantages of Product-Driven Design and Manufacturing Services

To alleviate the innovation burden for the OEM, an ideal DMS partner maintains an independent portfolio of off-the-shelf products. The standard product roadmap ensures technology readiness including the required investments in design and manufacturing infrastructure.

The DMS team can then pick up the validated intellectual property as a starting point for customisation. This reduces development time and risks significantly and often offers solution approaches through a broad technological basis that were not even considered by the OEM.

A good partner will assign a dedicated team of specialists to the client's project instead of re-purposing the standard product team, avoiding conflict of interest between maintaining the standard product roadmap and focusing on the OEM client. This approach will deliver a sustainable technology platform in the long run.

An additional benefit of separating standard and custom product teams is that the processes and policies can be tailored to the nature of custom projects. While standard product development will follow default internal policies, DMS projects need the flexibility to adjust the processes to the OEM's specific needs. Taking this alignment between a DMS partner and the OEM another step further, added value can be created e.g. by sharing 3D models at the subassembly level during the concept phase for integration into the customer's system level design. Running thermal simulation at this stage also eliminates potential issues early on. Providing rapid prototyping and professional renderings enable assessments of the final design and facilitate a seamless integration into the customer's system.

In this way, product-driven DMS combines the readiness and maturity of off-the-shelf products with the flexibility and dedication of tailor-made designs.

Advantech is Your Ideal Partner, because …

… it has the largest technology and product portfolio in the embedded industry

… it offers comprehensive services for both design and manufacturing

… it has dedicated local resources for R&D and project management to support custom designs

… design and manufacturing are tightly integrated for optimum time-to-market and quality

… it covers the full industrial life cycle from concept to end-of-life

… standard product and custom design resources are not mixed for a full focus on the customization project

… it has a world-class technology ecosystem of the leading silicon, firmware, and software partners

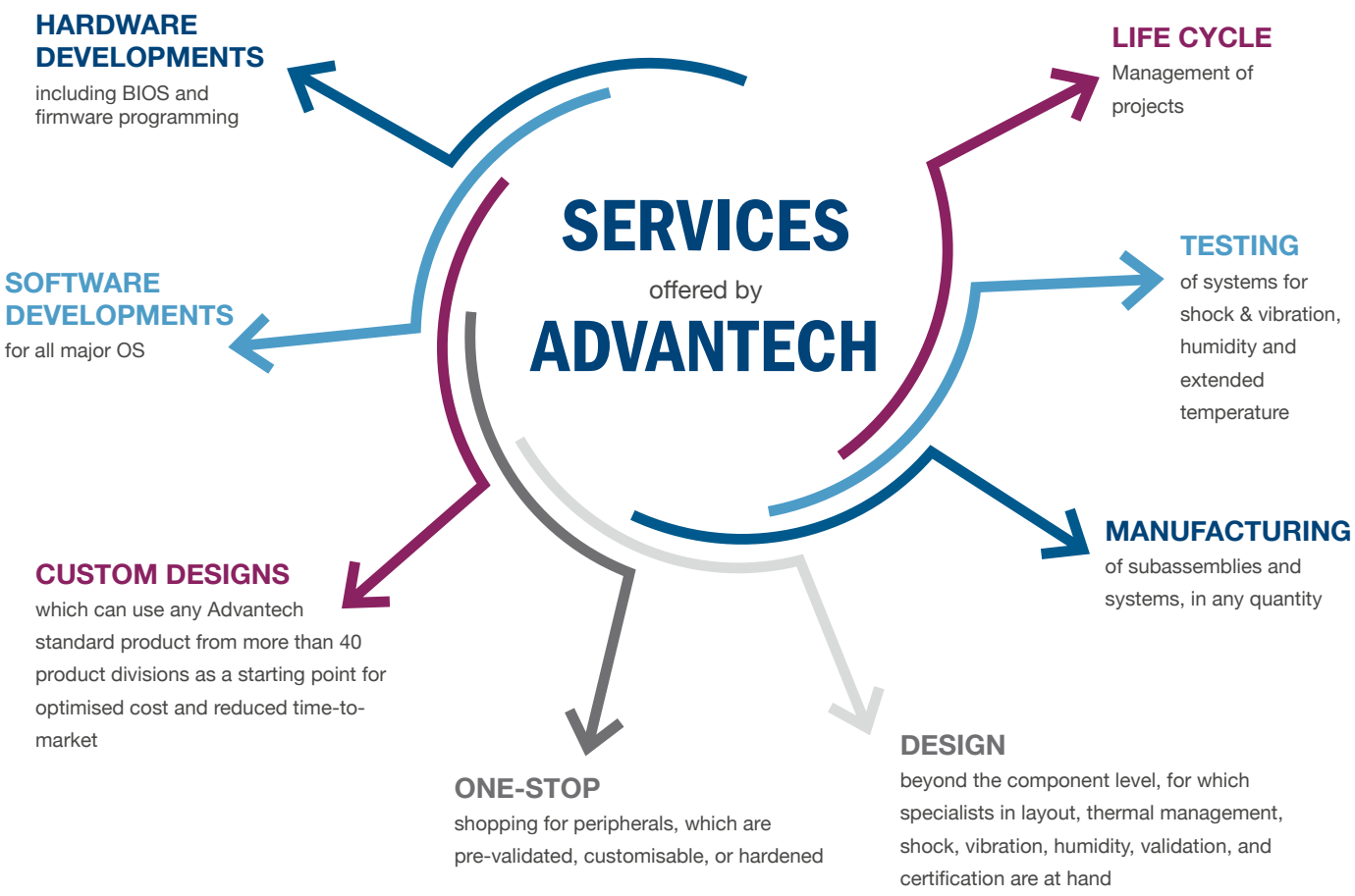
… it has the possibility to select the best fit and starting point from this technology pool

… it has a global footprint to help support your business

… it has been present in in Europe for more than 25 years

… it has more than 500 specialists in the region in the same time zone that speak the same language and share the same culture as its customers

… it continues to invest in new products, technologies and tools to keep the newest technology available for customers

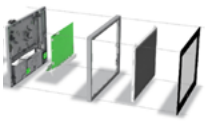


Advantech offers a broad range of Design Services

Based on the broadest product portfolio and most comprehensive technology pool in the industry, Advantech offers its customers a comprehensive range of design services that go beyond the design-in support of standard products. Whether customization of an existing board-level or system-level standard product, whether BIOS, firmware or software modifications are required or whether a full custom design is requested: customers can pick and choose the services that best suit their project from an extensive menu.

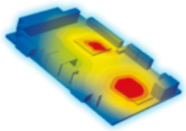
Even better, local experts are available to consult customers to make the best choices that meet their requirements, schedule and budget. In case requirements and implementation concepts have not been fully defined yet, these experts will also share insights into available platforms and technologies allowing customers to trade off the advantages and disadvantages for their specific application.

Design Services

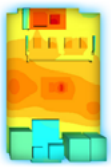


Mechanical Design

Peripheral Integration



Thermal Design



System Design

OS Integration

Software Design

Carrier Board Design

Board Customisation

Full Custom Design

Validation & Certification

BIOS Customisation

Firmware Design

Standard Products & Intellectual Property

RISC

SOM

x86

SBC`s

Motherboards

Box PCs & Gateways

Panel PCs

Peripherals

Hardware Design

No matter if customisation of standard products, development of custom carrier boards for Computer-On-Modules, full custom compute boards or add in cards: board design is part of Advantech's DNA. Extensive know how, best-in-class design processes from more than 35 years of industrial computing and verified IP from over 40 product divisions form a rock-solid basis for any design project. Not only the design, testing and validation processes benefit from this vast experience. It also injects design for manufacturing and sustainability into a new project from the start. Careful selection of components from trusted and approved vendors, DFM/DFT checks throughout the design cycle and active involvement of the project team in the technical transfer to the factory are a few key examples to highlight.

Due to close cooperation with all leading silicon vendors, Advantech is able to provide latest technologies no matter if x86 or RISC based. Our continuous investment in over 260 product lines and state of the art tool chain guarantees that the technology portfolio is always up to date and ready to be picked up for any DMS project.

BIOS and Firmware

BIOS modifications, optimizations and implementation of custom features is a natural and complementary service to board customization. Yet, the scope is extended far beyond traditional UEFI BIOS: Boot loaders such as UBoot may need to be modified for RISC platforms. x86 platforms may utilize alternate boot loaders such as Coreboot or Slim Bootloader.

Firmware for Embedded Controllers, USB microcontrollers, sensor devices or SSD controllers may need to be optimised, tweaked or designed from scratch. This may make a design truly special, tailored for the application domain and, in the end, differentiating. Of course, Advantech also supports the integration of firmware developed by a customer and knows how to keep this secret sauce secret.

Software

Tailored hardware may need specific support at operating system level. Our software teams can provide BSP customization services, device drivers and libraries. Middleware can be integrated and modified, regard less if it is open source based or Advantech's inhouse middleware such as SUSI or DeviceOn. Special utilities may be created that support the maintenance, diagnostics and upgrade of programmable components, boards and systems at integration sites or in the field. The Advantech team is ready to help and free up the domain experts of our customers to focus on what is key.

Mechanical Design

At Advantech, customization does not stop at the board level. Our mechanical engineers know how to design chassis and housings for various applications and deployment scenarios. 3D design concepts, renderings and rapid prototyping allows for alignment with customers and industrial designers early on. The selection of materials and production methodologies warrants that the design can meet requirements, quality objectives, component and onetime cost targets. Injection molding, sheet metal bending, aluminum extrusion, die casting and precision machined parts need to be designed with more than just mechanical stability and dimensions in mind: environmental conditions, safety, EMC, thermal behavior matter alike. The close alignment of mechanical and electrical engineering under one roof has allowed us to establish a pool of proven solutions for common design issues from various vertical domains. With the advent of the AIoT new challenges of integrating more and more capabilities in comparably harsh environments demand for such close alignment.

Thermal Design

No surprise that Advantech also has dedicated expertise and resources for thermal design. Tighter integrations due to added capabilities and intelligence emphasize the need for mechanical/thermal co-design. At Advantech, this starts at the concept phase: right when the first 3D mechanical design concept is ready, a thermal engineer will import the design and run an initial thermal simulation to eliminate flaws in the thermal system design before the first prototypes are built. Once more, the DMS engineers leverage standard building blocks and IP from Advantech's standard portfolio for passive or active cooling. E.g. Advantech's QFCS advanced CPU coolers reduce size and weight by 30% while doubling thermal performance. This additional design headroom can be used, for instance, to cool more powerful chips at higher ambient temperatures or to reduce the noise level of an active cooler in sensitive environments such as hospitals or meeting rooms. In other applications, system size may be reduced or higher shock and vibration levels may be tolerated due to the weight reduction.

Thermal simulation is a great tool during the initial design phase. However, once prototypes have been built, thermal validation and testing takes the stage. Besides validating simulation results and that component temperatures are well within specified limits, thermal validation also includes specialized reliability tests.

System Design

System design is a holistic approach to combine the various engineering disciplines. The goal is to provide an ideal system for the target application which is more than just the sum of the piece parts. Tailor made components are integrated with off the shelf components supplied by 3rd parties, the customer or from Advantech's product portfolio. In addition to functionality and reliable operation, usability as well as user-friendliness and ease of maintenance aspects are considered. Validation and certification services to domain-specific or common regulations and criteria are provided by Advantech to help OEMs launch quality products faster.

Refinements of existing products

In many cases, a custom system design does not demand for full custom motherboard designs. Often, standard boards and peripherals in Advantech's product portfolio with minor modifications such as assembly options and/or BIOS changes can be used for a custom system design. Such adaptation has obvious advantages of lower overall development time, risks, cost`s and economy of scale. Future proofing is also built in as next generation standard products will be readily available for coming technology refreshes.

A good example of a refinement would be integrating a computer board - with or without customization of the board and/or BIOS - with some peripherals into a custom enclosure, developing the cooling solution for it, possibly integrating or developing tailored software on the platform, going through the necessary validation and certifications, and then moving it into mass production. Quite frequently, customers bundle multiple Advantech off-the-shelf products such as compute boards, SQR memory modules, SQF SSDs, AIW wireless modules into one project to simplify life cycle management, enforce strict traceability requirements or to simplify the supply chain. Advantech's capability to perform adaptations on any of these products, small or large, open up the opportunity to create differentiating feature sets when merged at system level. Refinement of standard products into a custom system makes one plus one equal three.

Design Quality and Processes

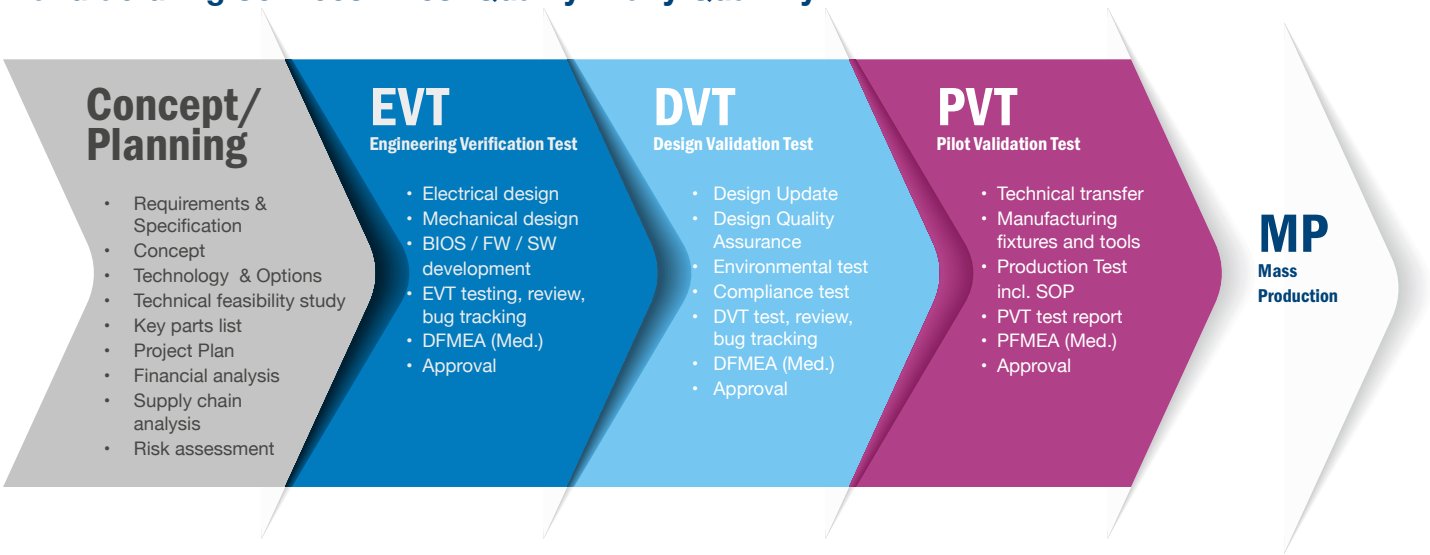
Advantech uses a closed loop quality assurance process and a new product implementation (NPI) flow with three main development phases to take a project from concept to mass production. This NPI flow has been hardened over more than 35 years in the embedded industry, audited by customers from numerous verticals and improved accordingly based on such valued feedback but also from internal closed loop cycles.

On addition to regular project status meetings, phase gate reviews between the NPI phases create transparency for the customer by summarizing the development results, the required actions and improvements for the next stage. Most of all, customer's consent is required at these distinct check points to proceed to the next stage to make sure projects are on track to meet the project requirements and objectives.

The use of common design tools, component libraries and design databases allow for efficient design re-use, collaboration between departments but also provide the basis for efficient supply chain management and, in the end, scalability of services. Separation of design engineering, design quality assurance and validation not only establishes a 4-eyes-principle throughout, it also lets each department focus on the respective tasks. With respect to design quality, this helps test engineers to establish known best practices for verification and validation with deep expertise in complex test scenarios and efficiency in using the most advanced, high-end test equipment. Signal integrity experts make sure that multi-gigabit interfaces perform to specifications while power integrity experts validate to meet the static and dynamic requirements of the latest silicon devices. Experts for thermal, environmental and reliability testing help to perform a 360° validation of the design before certification experts help to conduct regulatory and compliance testing.

Advantech DMS goes well beyond pure engineering services: It tightly integrates the Design and Manufacturing Services, as such, Design-for-Test and Design-for-Manufacturing are an integral part of the NPI process. The design team is also actively involved in the technical transfer of the project into manufacturing as design and product quality go hand in hand.

Manufacturing Services - Best Quality in any Quantity



Manufacturing quality plays a key role at Advantech and is well integrated in closed loop processes with R&D and after sales services. This approach emphasizes customer orientation throughout and fosters cross-functional synergies, leading to optimized manufacturing processes and outstanding quality.

The production processes at Advantech are flexibly aligned with the customer's requirements, starting with capacity planning, through variant management and material management, tailored production tests, integration of 3rd party content such as peripherals and software to delivery and logistics.

Advantech's product planning system ensures cost-efficient and timely production. Resources are optimized for a high utilization and scalability of production facilities in the medium and long term, without sacrificing the flexibility for meeting customer demands in the near term.

Full Transparency in Manufacturing

The use of a material control system ensures complete traceability of all parts which leads to higher quality through consistent and precise error analysis and optimizations in the production process. The option to have a “frozen” Bill of Material (BOM) and strict change management processes provide full transparency to customers, especially for applications where such control is critical due to regulatory compliance, interoperability and compatibility requirements.

Lifecycle Management

Advantech will support the full life cycle of the product which includes after sales services such as logistics, repairs, spare parts, extended warranty and advanced replacement support. Availability is managed via agreed safety stock levels of finished goods, semi-finished goods or at component levels. End-of-life and product change notice periods can be tailored alike to avoid supply interruptions and provide customers with proper transition times. Component shortages can be managed by qualifying 2nd source parts. Component discontinuations can be managed by form/fit/function compliant upgrades with or without an associated design change.

Global Logistics

With worldwide presence and logistic centers, Advantech can support customers’ European as well as global business. This includes project specific variant handling in local logistic centers by stocking barebones, peripherals or subassemblies which is extremely valuable to avoid long lead times caused by sea freight or excess logistic cost via air freight.

Packaging can be fit for purpose: bulk packaging may be the most economical and ecological solution to ship to integration and end-of-line production side while customer-branded unit packaging will be the choice for deployment ready systems or spare units used in worldwide service.

As different businesses need not only tailor made products but also tailored services, Advantech’s manufacturing and global services operations is more than willing to find solutions to support your business better.

And Your Next Design?

Digitalisation brings new opportunities but also new challenges. As complexities rise and innovation cycles accelerate, equipment makers and solution providers need to focus more than ever on core competencies. In the need of tailored building blocks, they need a strong partner who can combine latest, state-of-the-art components and technologies into an optimised board or system design without re-inventing the wheel. With industry's broadest portfolio, a global footprint, long standing history in custom design, Advantech offers such services from concept to production readiness from its European Competence Centre with specialized developers, project managers, and architects under the banner of „DMS – Design & Manufacturing Services". The optimised solution from a single source not only provides additional flexibility in development, combined with reduced risk and attractive terms; it also ensures long-term support for the product over its entire life cycle as design and manufacturing are closely linked together. Advantech offers these completely unique services to its industrial customers from a single source as a global – and at the same time local – technology partner.

So, for your next design, take advantage of our experience, portfolio and scalable services!

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