Capital® is a suite of software applications that efficiently creates and utilizes electrical design data. The applications respond to the ever-growing importance and complexity of vehicle and aerospace electrical & electronic systems. Powerful technologies help optimize business value by reducing the design, validation, manufacturing & servicing costs associated with electrical distribution systems and wire harnesses. In short, Capital helps compress the Systems V Cycle.

Developed for transportation platforms such as aircraft, automobiles and off-road vehicles, Capital is scalable from small, localized projects through to complete enterprise wide deployments. The suite spans an extended flow from platform concept and electrical architecture definition, through detailed design, to wire harness manufacture and in-service maintenance documentation. The core Capital tools can be implemented individually or deployed together in a unified flow that seamlessly matures data within a consistent environment. Robust integration with adjacent domains (such as MCAD and PLM) is fully supported, as is cross-organizational collaboration.
Key platform attributes such as cost, weight and configuration complexity are the result of early decisions made in both engineering and marketing domains. Once taken these decisions are usually hard to reverse, so they impact the long-term competitiveness of the vehicle. Capital tools link the engineering and marketing functions, providing quantitative decision support to aid architecture optimization.

Integrated with other stages of the Capital flow and with adjacent domains such as mechanical CAD, the tools support design carry-over from previous platforms and can flow data directly into the detailed design stage. They also support decision-making during the life of the platform by allowing quantitative evaluation of new feature implementation alternatives.

**Capital Desktop Architect** - provides a complete environment to study platform physical architectures: device placement, harness routing channels, in-line connector locations etc. Signal connectivity is mapped to architectures and wiring synthesized according to configurable rules. Flexible metrics such as cost, weight or component re-use are calculated and displayed in real time. Alternative scenarios can be captured and compared.

**Capital Level Manager** - supplements Capital Desktop Architect (or Capital Integrator: see below) to capture the vehicle product marketing plan (options offered, take-rates, etc). Precise configuration complexity data is then calculated to quantify how marketing and engineering decisions interact. This allows decisions to be examined and optimized, and helps quantify the impact of give-away choices. Final target configurations can be validated against the product plan.
Increased electrical system complexity, optional content, and reduced cycle times drive the need for more efficient design tools & processes. Other important considerations include managing rapid design change, integration with adjacent domains, and application of corporate intellectual property.

Capital's design tools provide powerful integrated functionality to capture signal connectivity, create vehicle wiring, and define wiring harnesses. Advanced data management capabilities such as design effectiveness, composite, and modular design are standard features. Integrated electrical simulation, functional verification and decision-support assist virtual prototyping.

- **Capital Logic** - provides a complete environment to author system connectivity and wiring schematic designs. Standard capabilities include easy to use electrical simulation, a powerful parts library, symbol authoring, configurable design-rule checks, controlled design change management and many other features that boost design efficiency.

- **Capital Topology** - provides platform level electrical design and validation, helping early stage platform layout. Capital Topology allows users to define device (equipment) locations and harness bundle layout within a platform. Devices can be placed manually or automatically using configurable rules, then wiring designed within Capital Logic routed through bundle paths.

- **Capital Integrator** - automatically merges signal connectivity with physical topology to generate complete vehicle wiring designs, which can be composite (150%) or modular. Configurable rules drive device placement and wiring synthesis, automatically applying corporate IP. This breakthrough technology automates systems integration - this saves time, improves quality, and frees engineers to innovate.

- **Capital HarnessXC** - enables engineers to create fully detailed, validated and manufacturing-ready harness designs. Standard capabilities such as automated component selection, composite breakdown into buildable derivatives, and rules-based data-driven diagram formatting (configurable styling) deliver a highly productive environment for high volume and specialized applications.

- **Capital ModularXC** - supports the modular (KSK) decomposition approach to harness design & engineering. This product also incorporates all of the capabilities of Capital HarnessXC.

Harness manufacturing is a cost sensitive undertaking where quality, accuracy and speed are critical. A mistake in specification of even the smallest component is magnified by large production volumes or tight regulatory control.

Capital's build tools allow designers and manufacturing engineers to rapidly create the detailed drawings, reports, and data required in harness manufacture. Data can be flowed seamlessly from harness designs to formboard layout, wire processing equipment, test equipment, and ERP systems. Design change management is fully supported. Extensive user controls and configuration facilities allow companies to leverage the expertise of their best engineers to increase corporate productivity.

- **Capital HarnessXC** - see above.

- **Capital ModularXC** - see above.

- **Capital FormboardXC** - enables engineers to create and engineer full-scale formboard drawings directly from design data: formboard drawings are synchronized to the baseline Capital HarnessXC or Capital ModularXC designs. Formboard fixtures and other manufacturing elements can be placed interactively or automatically using configurable design rules, ensuring efficient, best practice manufacturing engineering processes.

- **Capital Harness MPM** - enables manufacturing process engineers to create structured BOMs (hierarchical sub-assemblies) by automatically decomposing harness designs against electronic descriptions of production capabilities. Configurable rules-based elements support all harness manufacturing processes, capturing and applying corporate IP. Capital Harness MPM can ensure production patterns known to be efficient are systematically applied, thus helping to reduce manufacturing costs. Automatic detection of sub-assemblies common to more than one harness boosts economies of scale and helps minimize WIP inventory & obsolescence.
Electrical system documentation is needed to meet regulatory mandates and support maintenance/repair/upgrade activities. As electrical system sophistication, configuration complexity, and pace of change rise, timely/cost efficient creation of accurate documentation becomes ever more challenging. Furthermore, rapid electrical system troubleshooting during vehicle lifetime is vital in terms of cost, brand image and vehicle duty cycle.

Capital delivers breakthrough technology to automatically create electrical system documentation and a rich, highly navigable environment that significantly boosts service technician productivity. Carrying almost zero IT footprint, the technician application can be easily integrated with web based or standalone corporate maintenance environments.

**Capital Publisher** – provides a complete environment to author electrical system documentation directly from design data. Many automatic capabilities such as data re-partitioning, diagram styling, language translation and automatic hyperlinking to adjacent information (2D & 3D models, connector faceviews, repair procedures etc) deliver rapid, error free documentation. Outputs are available in a range of formats such as Web-CGM and S1000D.

**Capital Publisher Client** – delivers a highly productive troubleshooting environment for service technicians. Seamless navigation between multiple data elements (diagnostic trouble codes, schematics, wire lists, location views etc), electrical functions such as signal tracing & progressive design navigation, and the ability to present vehicle or configuration specific information are all supported.

### DATA MANAGEMENT, DIGITAL CONTINUITY & AUTOMATION COMPRESS THE V CYCLE

All the Capital tools are underpinned by a sophisticated data model and rich data management capabilities. Unique capabilities transform the electrical design discipline from the traditional drawing focus to a data centric paradigm. The automation delivered substantially compresses the “Systems V Cycle”: development costs are reduced, designs improved and time to market minimized. Symbol, component and simulation model libraries can be authored natively or re-used from external sources. In-application & configurable web based reporting are available, and a rich API allows secure implementation of specialized behavior & corporate IP (such as custom design constraints & DRCs) with zero ongoing maintenance overhead. Other Capital technologies include:

- **Security & Enterprise Deployment** – Capital is designed for deployment across large, extended enterprises and complies with typical IT security policies. Granular user authentication, concurrent working and cross-organizational data protocols (example: KBL) are all supported.

- **Project & Process Management** – configurable controls are available to implement project & process norms such as naming conventions, release constraints and component usage restrictions, ensuring respect of corporate procedures.

- **Intuitive Electrical Analysis & Decision Support** – multiple simulation capabilities are available ranging from functional verification, through steady-state & transient simulation, to whole vehicle validation, automatic component sizing and FMEA analysis. Fully integrated with the design environment, these tools have been developed for use by all design engineers, not just simulation specialists.

- **Design Change Management & Configuration Control** – multiple capabilities are provided such as difference reports, version management, configuration build lists, audit trails, and effectiveness tracking. Granular, configurable cross-domain and cross abstraction change control is available.

- **Diagram Generation & Styling** – Capital can automatically synthesize schematics from connectivity data. Automated diagram layout and data driven conditional formatting can be applied to block diagram, schematic, topology, harness & formboard diagrams, freeing engineers for creative design tasks.

- **Built To Integrate** – Capital offers best in class SOA & OSLC based integrations with leading PLM & MCAD platforms, and can be easily integrated with adjacent applications such as project & workflow management tools.

For the latest product information, call us or visit: www.mentor.com/electrical

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