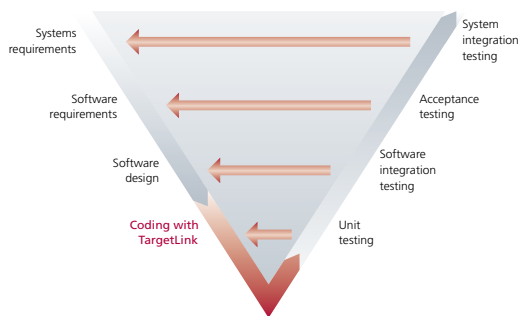


TargetLink: What Developers Make of It

TargetLink has by now become a quasi-standard for successful and efficient production code generation. It is used in numerous companies from different industries and in a diversity of situations, including safety-critical applications. Below are some of the challenging applications in which TargetLink plays a major role, and the reasons the developers give for using it.

ATENA: Proven Development Process

A software development process with TargetLink support for the implementation phase has been in use at ATENA since November 2002. TargetLink is embedded in a project-specific tool chain. The tool chain ensures compliance with the quality criteria for safety-critical applications and also allows a high degree of automated implementation. It is used to develop safety-critical vehicle systems that are classified according to IEC 61508 SIL3 and whose software comprises up to 25,000 lines of code. Automatic code generation plays a very important part in all this. Using TargetLink, ATENA has succeeded in automatically generating approx. 80% of the entire production code, including hardware interfaces.



Why TargetLink?

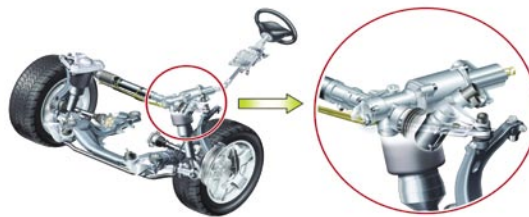
- Reliable – Compliance with quality criteria for safety-critical applications (e.g., IEC 61508 SIL3)
- Flexible – Embeddable in a project-specific tool chain through TargetLink API, allowing a high degree of automated implementation
- Consistent – Simulink®/Stateflow® models consistently converted into C code

Audi: Dynamic and Safe

Audi Dynamic Steering is a new superimposed steering system that will provide both more responsive vehicle behavior and increased safety. All the function prototyping for developing the system was done using MATLAB®/Simulink and dSPACE Prototyper.

Automatic production code generation using TargetLink plays an essential role in meeting deadlines and fulfilling the software consistency required for Audi Dynamic Steering. To optimize the time, quality, and cost factors, great importance was – and is – placed on a seamless tool chain throughout all development steps, from the initial design to production level, with MATLAB/Simulink providing the reference standard. For example, a seamless transition is guaranteed from function prototyping to automatic production code generation.

(more details in dSPACE NEWS 3/2003)

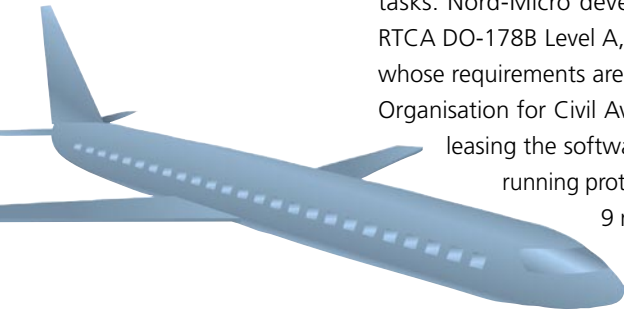


Why TargetLink?

- Consistent – Seamless integration in MATLAB/Simulink
- Efficient – Time, quality and cost factors optimized by using a seamless tool chain
- Flexible – Flawless transition from code generation for function prototyping to automatic production code generation

**Nord-Micro:
C Code for Cabin Pressure Control Systems**

Nord-Micro develops and manufactures cabin pressure control systems (CPCS) for aircraft manufacturers worldwide. The systems include software that has to meet the highest requirements regarding safety and comfort. With TargetLink, Nord-Micro successfully generated C code for all demanding control tasks. Nord-Micro developed software according to RTCA DO-178B Level A, the most demanding level, whose requirements are laid down by the European Organisation for Civil Aviation Equipment. From releasing the software requirements to the first running prototype, the team needed only



9 months in comparison to 18 months for former projects that were conducted without TargetLink.

Why TargetLink?

- Reliable – Code fulfills the tough aviation standard RTCA DO-178B Level A
- Flexible – Easy code division into useful function blocks to meet testing requirements
- Time-saving – Early function test results due to processor-in-the-loop simulation on the evaluation board and other intelligent verification features

Conti Temic: Getting There Faster

The electronics of diesel injection systems interact with electromagnetically controlled injection nozzles. This imposes tough demands on the electronics, which have to improve injection and combustion processes and considerably reduce fuel consumption and exhaust emissions. Conti Temic is developing an elec-



tronic control unit (ECU) for diesel engines that will meet these demands for use in DaimlerChrysler's commercial vehicles. Conti Temic feels that the improved quality and clarity provided by model-based software development are key factors in the endeavor to cut development times despite

the growing complexity of projects. These aspects are relevant to almost all automotive electronics projects, so at Conti Automotive Systems, TargetLink has been defined as a mainstream development tool.

Why TargetLink?

- Reliable – Code reliability confirmed by consistency of MIL and SIL tests performed within TargetLink
- Consistent – Model, code, ASAP2 file, and documentation automatically kept consistent
- Efficient – Meets real-time requirements due to processor-optimized code provided by a Target Optimization Module

Honda: Electric Power Steering

A significant step in the development process of ECUs is automatic production code generation. Honda applied TargetLink to set up electric power steering (EPS), and found the generated code completely satisfied the requirements for production code. Honda verified the proper behavior of automatically generated code by performing offline fixed-point simulation (software-in-the-loop). This provided time histories of input/output data to and from the control algorithm. The behavior of the test ECU was identical to the behavior Honda obtained by fixed-point simulation – a result of the highly reliable code generated by TargetLink.

Why TargetLink?

- Reliable – Early code reliability confirmation by comparing MIL, SIL and PIL tests
- Flexible – Convenient integration of hand-written and automatically generated code
- Time-saving – Considerable improvements in development efficiency, for example, due to early offline fixed-point simulation

**Nissan:
First Ever Partial-Zero Emission Vehicle**

Reducing vehicle emission levels has become a big issue in recent years. For example, California, USA, introduced the strict Partial-Zero Emission Vehicles (PZEV) standard. The Nissan 2000MY Sentra CA is the first car ever in series production to meet the PZEV requirements. Having chosen TargetLink for code generation, Nissan shortened the development time

down to 60% for the air/fuel controller. After the Sentra project, Nissan used TargetLink to generate production code for the air/fuel controller of Bluebird Sylphy – an “Ultra-Low Emission Vehicle”. So the TargetLink-generated code is successfully running on production ECUs at Nissan, and they will continue to rely on TargetLink for further projects.



Why TargetLink?

- Efficient – Readable, reliable and efficient code
- Time-saving – Up to 60% faster compared to previous development process
- Flexible – Configurable to Nissan’s development environment

Delphi: Tool Chain for Control Applications

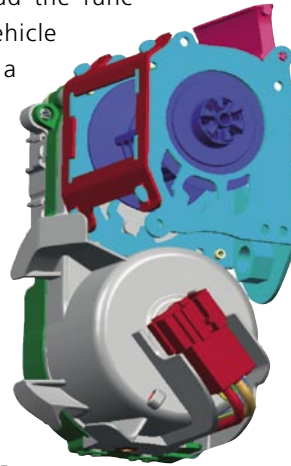
As a part of its effort to increase the quality of products and minimize its development cycle, Delphi is rapidly adopting algorithm modeling and code generation techniques. TargetLink is a major component of the tool chain that Delphi has been using in a new development environment. Many of Delphi’s control algorithms are modeled in the Simulink/Stateflow development environment. Some of these models are more Stateflow-centric. Others are more Simulink-oriented. In all cases TargetLink-generated code has the same quality as handwritten code for a similar application, and satisfies Delphi’s criteria.

Why TargetLink?

- Efficient – Optimum memory (ROM, RAM, stack) usage and throughput mean projects stay within budget
- Consistent – The same type of model-to-C-code implementation is repeated
- Time-saving – It takes much less time to code a model and test the generated software

TRW: Active Control Retractor

TRW has developed a reversible belt pretensioner that gives the driver and other vehicle occupants enhanced protection compared with conventional seat belt systems. When vehicle dynamics become critical, the seat belt is pretensioned by an electric motor. TRW’s client already had the functions for evaluating vehicle dynamics in the form of a MATLAB/Simulink model. TargetLink was ideal in this situation, because it could create and integrate the vehicle dynamics software model straight from MATLAB/Simulink. Developers became familiar with TargetLink’s easy-to-use development environment quickly, resulting in faster implementation and verification of the specification. Module testing was carried out completely on an evaluation board. This meant that TRW could assure the quality of the production code very early on.



Why TargetLink?

- Flexible – Easy integration of vehicle dynamics software model with existing software project
- Time-saving – Faster implementation and verification of the specification due to complete testing of fixed-point code on a PC and an evaluation board
- Efficient – Easy controlling of requirements regarding microprocessor constraints such as RAM, ROM, stack size, and computing time



TRW received the PACE Award (Europe) for this application on March 8, 2004 (Premier Automotive Suppliers’ & OEMs’ Contributions to Excellence Award).

20 TargetLink application examples are currently available on the dSPACE Web site www.dspace.com