

## SHINE: Real-Time Inference Engine

***Minimal Delivery Environment \* Real-time Performance \* Guaranteed Response Time***

### Introducing SHINE

Originally conceived to meet the rigorous artificial intelligence (AI) demands of NASA spaceflight programs, the Spacecraft Health Interface Engine (SHINE) is a unique expert system development environment for demanding real-time environments where embedded knowledge based reasoning can dramatically impact the performance of a wide variety of applications.

SHINE was built to act as a multi-mission reusable knowledge based software tool for monitoring, analysis, and diagnosis of spacecraft and ground systems through forward and backward inference logic.

SHINE allows systems and applications to easily embrace knowledge based inference or reasoning logic capabilities into complex systems such as:

- Any Sensor or Data fusion intense applications
- Advanced Surveillance and Domain Awareness
- On-board Diagnostics and Prognostics
- Industrial Applications
- Quality Control Systems
- Vehicle Health Management Systems

Its design allows developers to deploy systems that can analyze and diagnose real-time systems, fielding millions of sensor inputs per second and making decision/support choices based on expert human knowledge and streaming data or other peripheral and environmental information.

The SHINE system uses a Knowledge Base created for your **specific** application and offers the ability to reason conclusions based on both absolute and abstract data. In addition, SHINE allows the creation of high

level abstractions of knowledge or declarative logic which is ideal for Sensor and Data fusion applications where real-time reasoning of complex input across multiple domains becomes a critical factor.

### Proven, Efficient and Flexible

Utilizing a highly optimized compiler and a mathematical representation of knowledge based on data flow analysis, SHINE maximizes performance and minimizes the amount of processing power needed in order to deploy a reasoning based system.

SHINE's efficiency means that real-time performance is always possible, while allowing it to seamlessly integrate with traditional applications written in conventional programming languages such as C, C++, or Java.

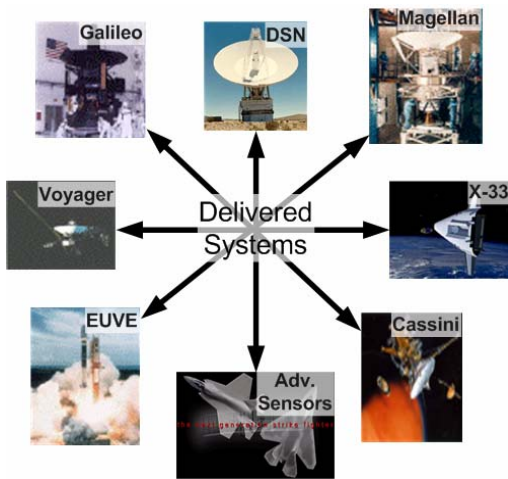
SHINE has two modes of operation, a development/prototyping environment, and a compiled run-time executable mode for creating highly optimized "C" source code for embedded or distributed applications with zero run-time support.

### Unique Real-Time Performance for Sensor Fusion, or Real-Time Diagnosis/Prognosis Applications

Today, SHINE drives state-of-the-art inference systems in real-time environments. By offering expert system capabilities on an efficient hardware and software processing level, SHINE allows one to address real-time problems that were previously considered intractable due to issues such as:

- Software recursion or memory management constraints.
- Complexity of integration with external systems.
- Difficulty of portability or deployment on limited or special-purpose hardware.

SHINE's optimized inference engine runs without pausing for hardware or operating system level activities that consume processing power, such as memory management and garbage collection activities. All necessary storage is statically pre-allocated in the final representation state, giving SHINE a much more predictable execution profile, thereby guaranteeing performance response times.



### SHINE Benefits

- Fastest inference engine on the market with real-time performance capabilities benchmarked at over 1,500,000,000 rules per second on conventional hardware.
- Suitable for real-time embedded applications previously deemed unsuitable for expert systems, such as on-board diagnostics, sensor fusion, security, and other reasoning-based applications.
- Available across multiple platforms, including PCs, Macs, SUN workstations, and special purpose hardware

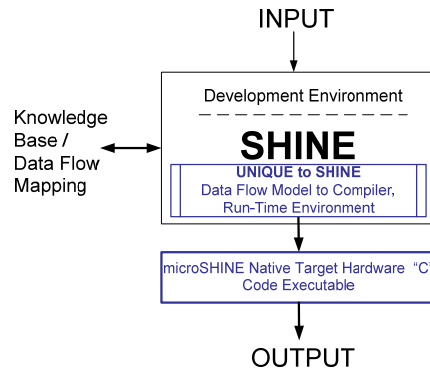
### The SHINE Advantage

SHINE provides offers a valuable method of building high performance reasoning systems based on declarative logic and traditional software development tools and methodologies

SHINE can outperform traditional development systems in terms of both development time and resultant source code size.

With multi-platform compatibility, SHINE can cross-compile a knowledge base into "C" or C++ source code with virtually no run-time support. The resulting executable size is a direct function of the size of the knowledge base and not the SHINE development environment.

This small optimized footprint enables deployment on targets with limited memory or processor resources, making real-time expert system capabilities available to developers constrained by size, memory, and power.



As the first inference engine designed and developed for hard real-time applications is uses minimal resources to allow flexible deployment to constrained environments and guarantees predictable response times.

A flexible and standards based architecture allows seamless integration with any application program through the use of tight programmatic integration and multiple language support