

## ESCHER: The Embedded Systems Consortium for Hybrid and Embedded Research

The US research community has established a reputation *par excellence* for aggressive commercialization of innovative developments. Despite the reputation, the path of *technology transition* an innovation takes from the lab bench to the marketplace remains the most risky and unpredictable part of the process. It is at this point where commercial potential must be determined and monetized as an investment in a complex calculus that includes the opportunity cost for pursuing this investment and not another. The permissive milestones set in the research environment are replaced by the demanding timelines required to produce adequate return on investment to justify the investment. At the end of the day, this process leaves many worthy developments by the wayside that simply do not fit the investment, development, and commercialization model. Adoption of a more diverse set of paths by which innovations can research the marketplace will lead to better payoff from research investment and subsequent benefit to society.

Innovations such as open-source licensing and community software development projects such as Linux have pointed the way to alternative models that have already yielded many benefits. In 2003 non-profit ESCHER Research Institute ([www.escherinstitute.org](http://www.escherinstitute.org)) was founded in this spirit, as an alternative technology maturation and commercialization path for innovations in the area of *Distributed Real-time Embedded Systems* (DRE's). The prime customer for DRE research is the Department of Defense, as DRE's play a role in many large weapons systems. The automotive industry is also interested in results that may be produced by the government programs, because the market for software in this area is still too small and the work is too premature to support a standalone industry. As such the founding sponsors of ESCHER are Boeing, General Motors, and Raytheon.

The ESCHER model relies on a mix of Government and industry funding and to identify and mature pre-competitive embedded systems technology, using pooled funding to gain leverage that would otherwise not be achievable by the sponsors acting alone. A road mapping process is used to identify key cross-industry developments that will significantly advance technology in areas that are critical in these areas, but are not yet a large enough market to support an independent venture. Pooled funds are used to fund key contributions by leading research groups. Oversight provided by the industrial team is essential in keeping the academic groups focused on the highest value advances. The results are released to the public upon completion to promote advancement in the field. ESCHER currently has funded projects with the University of Michigan, the University of California, Berkeley, and Vanderbilt University to adapt research results for the realization of embedded systems *tool chains* that address aspects of embedded system design that are common across many industries.

ESCHER's mission to provide services that enable the transition of Government sponsored research results includes additionally the operation of a quality-controlled software repository. The ESCHER has developed a set of objective quality criteria to ensure that the repository contents are living, growing useful tools for developers, and function as more than monuments to past projects. The repository provides a single focal point for software allowing easy-finding for software users, and the collection of bug-reports and other information that can be used to improve the software. The repository aids in the transition

of government research results by making them widely available through a central portal thereby creating a wider audience for the technology and increasing the chance that it will be adopted by an industrial concern.

In an *honest broker* role which does not compete against universities or other research labs, ESCHER seeks a role as an integrator-broker in ongoing government research projects, that are looking toward the eventual transition of the research products. This activity may include the development of industry roadmaps or other services and the maintenance of architecture or other elements of configuration management that are critical in bridging funding in specific research areas.

ESCHER as an organization is unique in identifying a crucial but unfilled niche in embedded system development in particular, and for technology transition in general. ESCHER does not compete with groups hoping to commercialize their results, but on the contrary looks to serve as a way station for technologies on the way to full commercial acceptance. We look forward to the working with community members in this exciting venture to enhance the value of research efforts by smoothing out the difficult road of technology transition.