

Hypres' New Products, Services and Contracts

It may be tucked away in a small village of New York state, but Hypres Inc., a digital superconductor company, is hardly provincial. For more than three decades, the company has delivered a variety of complex superconducting ICs to customers worldwide.

During the last decade, the company started building cryocooled advanced digital-RF receiver (ADR) systems and delivering them to various government agencies. Modular and multi-functional in nature, these ADR systems can serve a variety of applications, ranging from radio-frequency (RF) communications to medical imaging systems. "Over the last five years, we have reconfigured each of the third-generation ADR systems multiple times in the field by installing new superconductor ICs and changing the digital processing and recording functions with state-of-the-art room-temperature electronics," says Dr. Deepnarayan Gupta, executive VP, heading Hypres' RF Circuits and Systems business division. "However, such reconfiguration can only be done by a few experts and takes a couple of days to complete. Therefore, we created a new laboratory product, called ICE-T, with which any student designing a new chip can quickly test it without having to worry about how it gets cooled."

The company unveiled the Integrated Cryogenic Electronics Test-Bed (ICE-T) at the Applied Superconductivity Conference in Denver CO last month. Hypres engineers designed ICE-T for quick and convenient testing. It is modular in design, allowing users to configure the unit with electrical inserts to test a wide variety of devices and ICs—from cryogenic semiconductor devices to superconductor ICs, multichip modules (MCMs) and any other device that functions in a cryogenic environment. "The most efficient use of ICE-T would be for repetitive experiments on cryogenic devices," says Vladimir Dotsenko, manager MCM at Hypres. "Compact custom insert can be configured for a specific device, whether it is a superconductor IC or mechanical cryogenic valve or any other. Such a configuration is conveniently done on a lab bench before quickly inserting it into the cryogenic



Inserting a probe into a Hypres ICE-T (Integrated Cryogenic Electronics Test-Bed) unit. Image: Hypres

apparatus and making thermal contacts by turning a couple of knobs. ICE-T makes prolonged cryogenic experiments economical."

While ICE-T was designed to address the challenge faced by many working with low temperature electronics to efficiently and effectively test circuits and devices in a cryogen-free environment, it also serves as a versatile, multi-stage, variable-temperature apparatus for experienced researchers in cryogenic materials, devices, circuits and systems. For example, Hypres researchers and its university collaborators are using ICE-T for hybrid superconductor-semiconductor circuits, combining the advantages of different technologies to achieve unprecedented performance.

ICE-T units are completely cryogen-free and run on a single standard 110V/20A power supply. The versatile design allows inserts to function as liquid helium immersion cryo-probes, without the associated cost of liquid helium. Other applications suitable for ICE-T testing include high-speed superconducting electronic chips for supercomputing applications, process-control monitors and digital diagnostics, high-performance cryogenic analog-to-digital converters for RF receivers, analog low-noise measurements for SQUIDs and SQIFs and cryogenic semiconductor devices.

Superconductor IC developers will also benefit from the company's recently enhanced

IC foundry services that include low ($<100 \text{ A/cm}^2$), medium ($1\text{--}4.5 \text{ kA/cm}^2$) and high ($>10 \text{ kA/cm}^2$) critical current densities. Today, in addition to offering customers standard superconducting IC processes and nanofabrication services, Hypres also promotes the availability of custom fabrication processes and superconducting and non-superconducting multichip module processes. "We have an exceptional foundry that can offer private companies, government researchers and national labs an incredible variety of services and support," says Dr. Oleg Mukhanov, CTO of Hypres. "For instance, we're now able to provide on-site foundry services to customers developing new nanofabrication processes. So, in addition to being the premier commercial foundry for superconducting ICs, we're working hard to also be known as the premier source for custom nanofabrication."

In August, the US Navy awarded Hypres a \$40 million IDIQ contract to research, develop, evaluate and implement cryogenic RF systems. This three-year deal includes a two-year option period that, if exercised, would bring the potential value of the contract to almost \$68 million. "This award recognizes the achievements attained with the latest delivered advanced digital-RF receiver systems and will push the state-of-the-art even further past the limits of traditional semiconductor technologies," says Hypres CEO Richard Hitt. www.hypres.com ■