

 **Single  
Iteration**  
Better Thermal Products Faster.



**engineering solutions**  
for your

**thermal**  
systems

Our goal is to help you develop  
**better thermal  
products faster!**



**F**or over 80 years, Watlow has provided innovative thermal solutions to a wide variety of industries. In 2002, this tradition of innovation continues with the creation of Single Iteration, a dedicated consulting service division of Watlow. Using advanced computation tools and a disciplined project-based approach, we specialize in solving complex thermal problems and ensuring the success of our client's projects.

Our service is unparalleled in the industry. Recognizing that there are engineering firms, thermal component firms and system integrators, our position is unique. While other firms specialize in only one area, our skills encompass all aspects of the development. With intimate knowledge of product performance and manufacturing capability, we are uniquely positioned to provide an independent assessment of our client's projects, measuring our success by yours.

As the relentless forces of global competition continue to escalate, one trend continues—the need for speed. Beating your competition requires the development of better performing and more cost effective products faster.

Many companies are finding a real benefit in using a qualified partner for their thermal and systems engineering needs. If you are managing a project with critical performance, schedule



and cost requirements, our staff can complement yours and help you reach your objectives faster while minimizing risk.

**We offer:**

- < Expert technical skills and resources in thermal engineering
- < Exceptional program and project management skills
- < Rapid prototyping and bridge to volume production
- < Industry knowledge and experience necessary to understand your customer's needs

## Technical Skills

Partnering with Single Iteration on your next development project will ensure success. With our thermal expertise and your company's product and market knowledge, the requirements of the thermal system will be quickly defined.

By combining state of the art engineering software with today's programming tools and many years of thermal systems expertise, alternative concepts and technologies can be quickly investigated for feasibility. Once a path is agreed upon, the thermal sub-system can be rapidly prototyped and integrated into your product for validation.

Our team is a staff of engineers, scientists and development managers with solid academic credentials and proven experience. In addition, our intimacy with the manufacturing environment gives us a firm understanding of the current state of production technology in the thermal sciences. This ensures that designs can be manufactured cost-effectively—every time!

## Services offered include:

- < Electrical resistance heating, sensing and controlling
- < Requirements analysis and management
- < Thermal systems modeling and simulation
- < Designing for temperature uniformity and response

- < Custom control algorithm development
- < Thermal measurement, control and interface component specification
- < Performance optimization

## Expertise includes:

- < Finite Element Analysis (FEA)
- < Computational Fluid Dynamics (CFD)
- < Computer science, computational geometry
- < Thermal sciences
- < Control theory
- < Structural mechanics including thermoelastic and elastoplastic problems
- < Materials science, metallurgy

## Engineering tools:

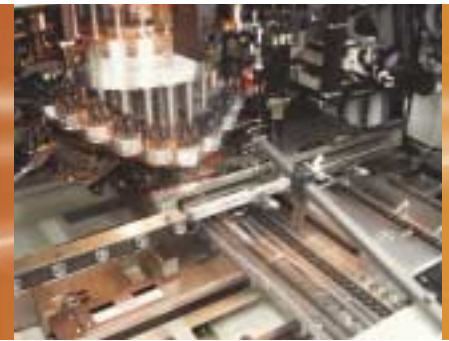
- < ANSYS®
- < FEMLAB®
- < Simulink®
- < XPC®
- < Fluent<sup>sm</sup>
- < StressCheck®
- < MATLAB®
- < Stateflow®
- < SolidWorks

We understand that the quality of your project depends on the quality of ours!

Our experience gives you the competitive advantage.

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# program management



## Phase 0: Discovery

Working closely with our clients, we strive to clearly identify the objectives from all the stakeholders in the development. Typically, an on-site engineering review is conducted, which defines overall project scope and creates top-level requirements and constraints. The discovery phase provides an early opportunity to assess the project with respect to level of risk and effort.

## Phase 1: Concept Definition

A concept development team is assembled based upon the unique requirements of each client. Working models and approaches for fulfilling development objectives are evaluated for feasibility and numerical analysis methods confirm that the requirements can be satisfied. Cost/benefit analysis techniques allow competing concepts to be objectively compared and a complete system description or development specification is prepared for concepts warranting further investigation.

## Phase 2: Design & Development

Detailed analysis, modeling and design is completed. Modeling, simulation and design tools enable concurrent engineering, design for manufacturability (DFM) and design for testability (DFT) to be utilized throughout the process. Our attention to detail in this phase minimizes the assembly and integration problems that commonly plague new system development.

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### Phase 3: Prototype Fabrication

Prototypes are produced for evaluation against the original requirements. Our intimacy with manufacturing process capability, extensive in-house manufacturing and test facilities and a list of approved suppliers enables us to build prototypes quickly. This assures you an optimal solution in the shortest amount of time.



### Phase 4: Verification & Validation

Direct access to manufacturing allows us to integrate and test a thermal system to meet your development goals. From design verification to system validation, test requirements are defined to minimize integration problems. Additionally, we employ industry experts who are familiar with the test criteria specific to your application as well as agency experts who work with you to assure compliance with any standard government or agency requirements.



### Phase 5: Production Release

A winning design is only of value if it can be reliably produced. Drawing from our manufacturing expertise assures a seamless transition from prototype to volume production and routinely includes integration of components from multiple sources. Development is complete when a product is produced to the quality and quantity levels specified by our client.

A team is assembled based on unique client requirements.

An optimal thermal system requires more than specifying components.

# industries



Industry leaders possess similar characteristics that can be directly linked to their business fortunes.

- < A focus on core competencies
- < Unwavering competitiveness
- < Superior product performance
- < A culture of innovation
- < Keen anticipation of customer needs

Utilizing Single Iteration's expertise in thermal systems can help you gain a competitive advantage in these areas. From concept through production, we can work with you to develop a high performance product on a shorter schedule allowing you to get to your market faster.

Whether you are pushing the limits of science and technology in the development of integrated circuits or trying to improve the performance of a forging operation, our engineers and scientists have a solid perspective on the forces that drive your industry.



Drawing upon market experts and a history of providing thermal solutions to industry leaders, we offer specific industry knowledge and experience to such industries as semiconductor, life sciences, analytical instrumentation, aerospace, packaging, food service equipment, plastics, automotive and many others.



**Semiconductor** – Photolithography, Deposition, Etch, Gas Delivery and Abatement, Assembly and Test

**Life Sciences** – Medical Instrumentation, Analytical Instrumentation and Clinical Instrumentation

**Foodservice Equipment** – Ovens, Griddles, Fryers, Steamers, and Warmers

**Packaging** – Material Handling, Sealing and Packaging Equipment

**Aerospace** – Aero Structure De-icing, Cockpit and Cargo Heating, Engine Temperature, Foodservice Equipment, Spacecraft Temperature Monitoring, Water and Waste Freeze Protection

**Plastics Processing** – Injection Molding, Hot Runner Injection, Molding, Thermoforming, Extrusion, Blowmolding, Rotational Molding, Compression Molding and Resin Processing.

**Power Generation** – Optimize Fuel Cell Performance, Thermal Management of Fuel Cells, Coolant and Exhaust Handling and Solar Panel Manufacturing



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