

## ELECTRONICS AND SEMICONDUCTOR

# Seiko Epson Corporation

Empowering engineers with computational fluid dynamics

### Product

Simcenter

### Business challenges

Fulfill market demands for brighter, more functional and smaller projectors

Reduce radiant heat transfer in projector designs

Accelerate product development cycles

Limited CFD analysis expertise

### Keys to success

Implement Simcenter FLOEFD for computational fluid dynamics simulation

Ease of use of the CFD software

Widespread adoption of CFD by the engineering team

Integration of CFD and CAD

### Results

Developed CFD expertise among designers and engineers

Established simulation as an essential part of the product development cycle

Solved complex thermal issues with semiconductors in products

## Simcenter FLOEFD helps solve thermal problems for leading maker of projectors

### Global leader in the projector market

The Seiko Epson Corporation (Epson) in Toyoshina, Japan, is home to the Visual Products Planning and Design Department. In March 1989, the Visual Products Operations Division was established, with liquid crystal televisions and liquid crystal projectors as its core products.

Epson used its liquid crystal projectors to develop an entirely new market that the company continues to lead: data projectors as multimedia presentation tools. It is here that they developed the technology for the world's first compact, full-color liquid crystal video projector. The first Epson branded projector, the VPJ-700, was built here with revolutionary technology that allowed the projector to use liquid crystal panels instead of a traditional three-gun cathode ray tube (CRT) to present a picture, thus showing the world an innovative application for liquid crystal displays. With the release of the VPJ-700, Epson became the company to watch in the visual instruments field, where it combined liquid crystal panel technology with optics to develop new products.

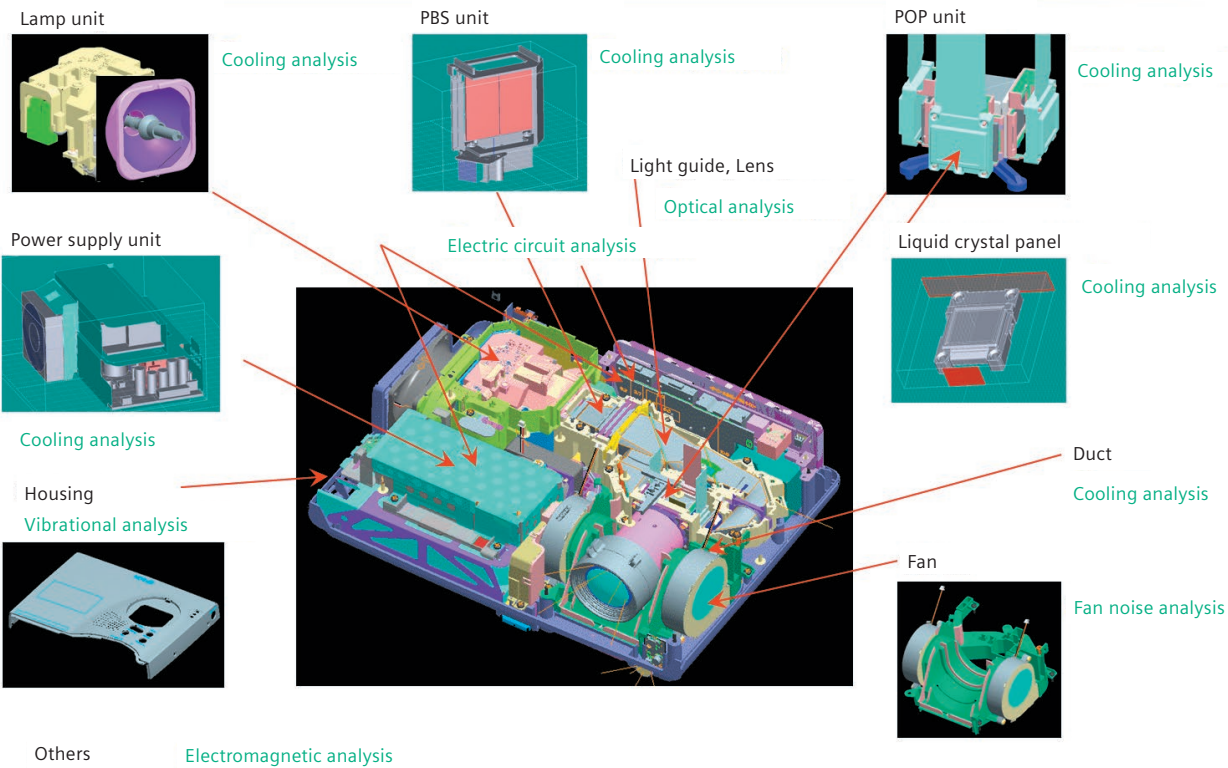
Epson's 17-year period with top market share for the global projector market has been achieved by empowering engineers and having an efficient design lifecycle.

Today, the company's projectors are used for business, education and home entertainment. For each application these products need to be compact, lightweight, portable and most importantly, durable. The challenge with all these attributes is of course thermal.

Heat sources in projectors like power supplies and lamps result in high temperatures inside the projector housing. As smaller, more compact portable projectors are continuously being developed, the first consideration for the designers at Epson is always making heat sources smaller. By the nature of the design and materials used, the units tend to retain heat in their body unless it is vented into the air or through other parts. Radiant heat transfer is the most important consideration in the development of projectors.

### The thermal challenge

Previously, projector models did not require intense brightness and therefore did not radiate high temperatures. With only a few models available on the market at the time, Epson could afford a lengthy development cycle. If any problems arose during testing, they were able to simply redesign the units. When LCD technology was introduced, the development period halved as there was now a demand for projectors that were brighter, smaller and had more functionality.



Analysis required to improve design quality.

As with many miniaturized devices, the path for heat radiation is limited; nevertheless, air cooling is required within the housing. In addition, development time-cycles are sometimes underestimated and can prove costly if they overrun.

**Empowering analysis engineers**

Thermal analysis simulation started at Epson in the 1990s by a team of in-house analysts. This team analyzed all Epson products, including projectors and other electronic devices. Despite the new challenges faced in thermal analysis, there was still a requirement to reduce development times and costs. The solutions tended to be focused on each type of device Epson manufactured in order to solve the more complex problems for physics analysis. Hence a new team of dedicated analysts was established to analyze projectors in 2007.

It soon became apparent that with the need to accelerate development, it was difficult to complete within projected time frames. Designers found it frustrating that they had to wait for the results of analysis by specialists, which reduced the time they had in the design cycle to modify geometries as necessary. Consequently, Epson introduced Simcenter™ FLOEFD™ for Creo software in 2009 to empower designers to analyze their own designs and improve productivity.

**Why Simcenter FLOEFD was the right choice for Epson**

“The most important consideration in selecting an analysis software tool was that all team members could use it regardless of their level of ability,” says Hiroshi Abe at Epson. “We evaluated the prospective solutions using three criteria.”

	<p>VPJ-700 (1989) World-first 3CCD LCD projector          Brightness: 100lm Weight: 7.6kg          Pixel number: (320x320)          Price: US\$4,670</p>
	<p>ELP-3000 (1994) World-first data projector          Brightness: 250lm Weight: 7.7kg          Pixel number: (640x480)          Price: US\$8,650</p>
	<p>ELP-730 (2002)          Brightness: 2000lm Weight: 1.9kg          Pixel number: XGA (1024x768)          Price: US\$3,400</p>
	<p>EB-1775W (2010)          Brightness: 3000lm Weight: 1.7kg          Pixel number: WXGA (1280x768)          Price: US\$970 ~ 1,750</p>

Epson LCD projector history.

**“After we tried one license as a test, there were many people who wanted to use it because its good reputation had spread from other users.”**

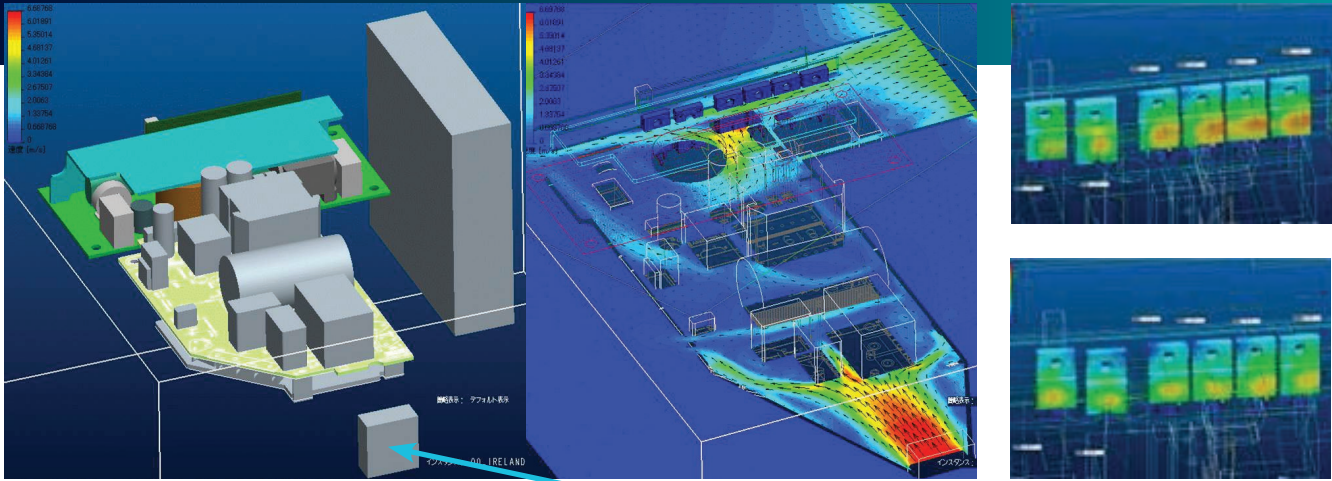
Naoki Ishibashi  
 Seiko Epson Corporation

First, the solution had to be easy to use, so that personnel who do not have much experience with analysis can use it. Meshing the model for analysis is one of the most difficult processes, and the automatic meshing of Simcenter FLOEFD enabled users to simply specify an area of the model for analysis. In addition, Simcenter FLOEFD included a step-by-step wizard that only required engineers to select “yes” or “no” in a guided workflow. Engineers could also learn through practice what should be specified for the analysis process.

It was also important that the tool was tightly integrated with Pro/ENGINEER®, Epson’s computer-aided design (CAD)

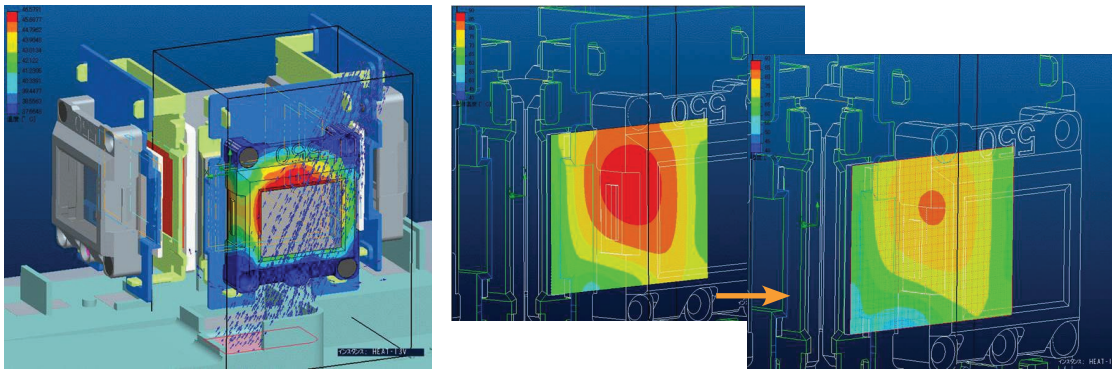
solution. With this integration, the company did not need to create another model for analysis, and because the analysis was embedded in the CAD environment, Epson could validate various models repeatedly. The engineers could easily switch between design and analysis processes.

In addition, Epson needed a comprehensive database for analysis models and results, and Simcenter FLOEFD includes a world-standard database. The company was also able to leverage other databases in the Siemens suite of electronics software products such as Simcenter™ Flotherm™, to deliver additional benefits for users.

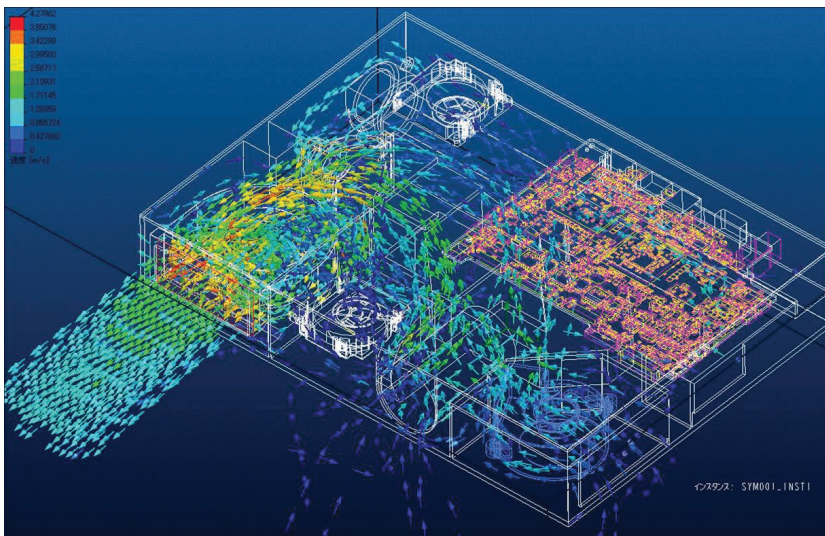


Verification of cooling airflow after changing a geometry path.

Cooling air



Design study based on a deflecting panel's temperature.

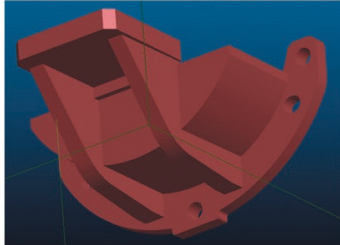


Cooling airflow verification inside of the whole enclosure.

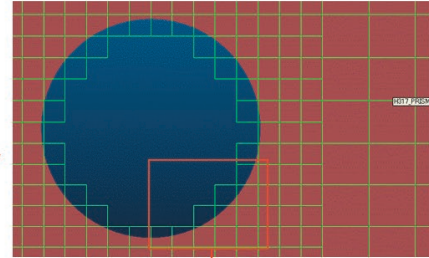
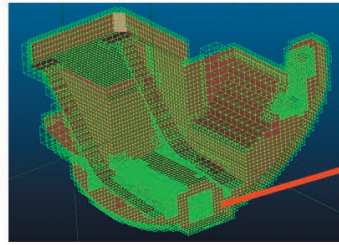
### Improving electronics cooling simulation

One of the primary challenges when introducing new software tools is the rate of adoption and use within established teams with conventional processes. When Epson employed Simcenter FLOEFD, the adoption was swift. The product's intuitive environment was a contributing factor that quickly saw the number of license requests spread. "I didn't have confidence in the growth of users in the early days," says Naoki Ishibashi at Epson. "After we tried one license as a test, there were many people who wanted to use it because its good reputation had spread from other users. Now, we have six licenses. Sometimes I tried to convince people that the software was really comfortable and easy to use. Then the number of users increased. I didn't force them to use it at all."

3D model

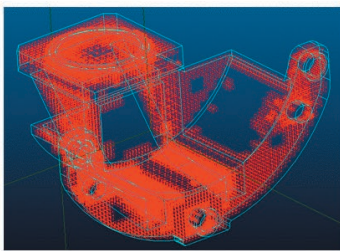


Partial cells

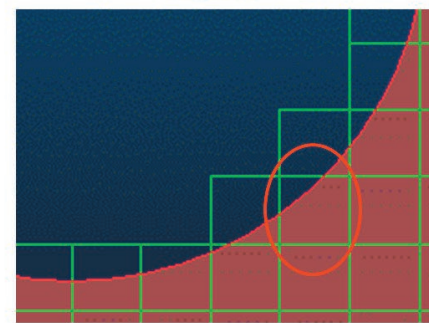
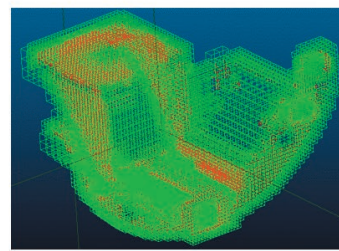


Cut cell

Solid cells



Solid cells + Partial cells



Solid cells: All of cells are inside of solid domain

Fluid cells: All of cells are inside of fluid domain

Partial cells: Cells include both fluid domain and solid domain

Optimization of mesh calculation.

**“Simcenter FLOEFD is essential in our daily work. In many cases, we can’t predict the results of analysis but Simcenter FLOEFD leads us to correct results automatically.”**

Fumio Yuzawa  
Seiko Epson Corporation

By adopting Simcenter FLOEFD, Epson designers were able to affect designs as they developed, with the confidence that any discrepancies in results would be picked up by the analysis team during testing. Simcenter FLOEFD users found new ways to solve difficult problems that they were not able to deliver in the past with their newly acquired analysis skills as they serviced all the products in the

company. Simulation is an essential part of the product development cycle at Epson, so the usability of any tool by engineers is crucial.

“Computational fluid dynamics is difficult for me even though I’ve been experienced in analysis for 20 years. However, the first time I tried to use Simcenter FLOEFD, I was amazed by its simplicity,” says Fumio

**“ Typical high-end CFD software uses really complex meshing techniques. Simcenter FLOEFD requires you only select the resolution level.”**

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Yuzawa at Epson. “Typical high-end CFD software uses really complex meshing techniques. Simcenter FLOEFD requires you only select the resolution level. However appropriate the mesh resolution levels are, a number of cells is entrusted to the operator, so we have accumulated know-how. If we have a lot of time and a high-spec machine, is it better to use high level mesh? That’s not necessarily so.”

Fuzawa cites a specific example: “I had some difficulties with the analysis of fan air cooling. The difficulty was solved by using Simcenter FLOEFD for Creo. I didn’t consider creating a one-to-one relationship between the P-Q curve and the cooling system. I succeeded in analyzing the cooling fan.”

Simcenter FLOEFD was able to assist in the challenges the team faced with design of semiconductors in projectors. Semiconductors reach high temperatures with natural air cooling and are typically designed under the 60 percent attainment of industry standards. Designer knowledge and experience will not achieve this level

of attainment easily, so Simcenter FLOEFD proved to be the key to solving this challenge. “As well as ease of use and versatility, Simcenter FLOEFD is accurate” says Yuzawa. “While some complex parts still require specialist analysis knowledge, there are others, such as enclosure air cooling, that can bypass testing altogether as we are extremely confident in the accuracy of the results we are getting. Simcenter FLOEFD is essential in our daily work. In many cases, we can’t predict the results of analysis but Simcenter FLOEFD leads us to correct results automatically.”

#### **The future brings new challenges**

“We want to tackle the problem of projector noise,” says Shigeki Kikuchi at Epson. Our projectors are distributed worldwide, not only in Japan. There are some countries with high temperatures, humidity and elevation. We have to design to accommodate different environments as these variables cause the projector to be louder, which is inconvenient for the customer. The difficulty lies in the ability to attach larger fans into modern compact projectors. We use five or six small fans for

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Hiroshi Abe  
Seiko Epson Corporation

### Solutions/Services

Simcenter FLOEFD for Creo  
[siemens.com/simcenter-floefd](https://www.siemens.com/simcenter-floefd)

### Customer's primary business

Seiko Epson Corporation is a Japanese electronics company and one of the world's largest manufacturers of computer printers and information and imaging related equipment. Its Visual Products Operations Division is the global market leader in projectors.  
[global.epson.com](https://global.epson.com)

### Customer location

Toyoshina  
Japan

cooling. A countermeasure for noise is absolutely needed so I joined this team as a sound analyst. We started to measure unpleasant noise over the recent few years and reflect these results in our products."

The world of technology is constantly evolving, but Epson is at the forefront of projector innovation. The company is in the privileged position of being the pioneers as well as the leaders of their market space. Epson's projectors are widely utilized in offices, schools, retailers, museums, movie theaters, and living

rooms. In 2011, Epson developed a revolutionary product that was the world's first standalone see-through mobile viewer that allows users to enjoy the big-screen experience anywhere and at any time. The breakthrough signaled Epson's intention to create a new visual communications culture. Going forward, Epson aims to leverage its original projection technology to create more innovative products that will deliver a big-screen experience to all kinds of customers worldwide.

### Siemens Digital Industries Software

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Europe 00 800 70002222  
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