

VISIONS OF THE FUTURE:

Turbomachinery in the Power Generation Industry

Keith Hanna of Fluent News recently interviewed Charles Soothill, a Vice President at ALSTOM Power Turbo-Systems, to discuss current and future trends in turbomachinery power generation.



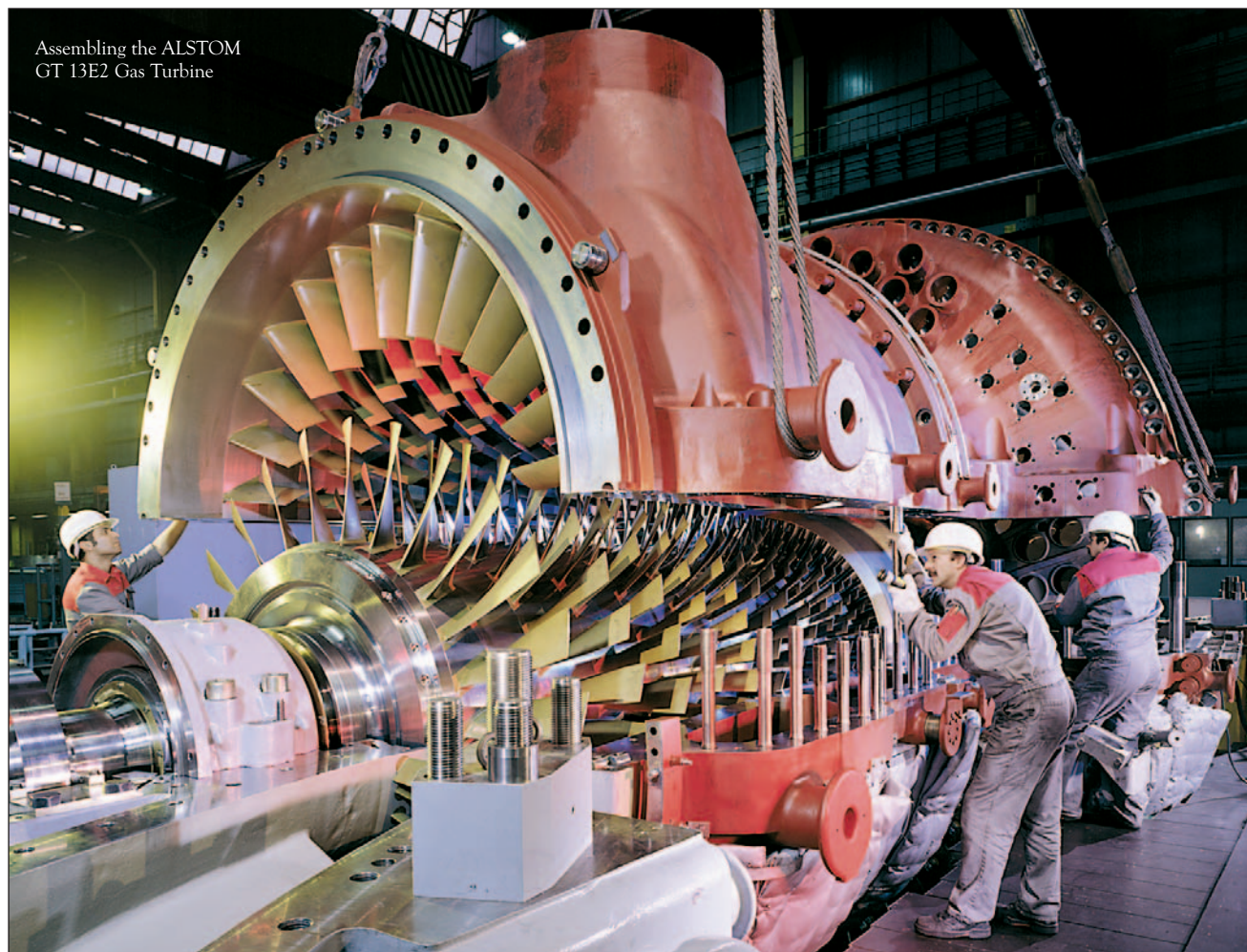
Charles Soothill
VP, ALSTOM Technology

Q. What does ALSTOM Power do?

A. ALSTOM is a €14 billion power and transportation company present in 60 countries. It is the world leader in hydroelectric equipment, combined-cycle electric power plants, energy production services, and environmental control systems. ALSTOM works with all energy forms (hydraulic, fuel-oil, gas, coal, and nuclear) and is a leader in reducing fossil fuel emissions. Employing 34,500 people collectively in its power divisions, it is estimated that one in four light bulbs worldwide is powered by electricity generated through ALSTOM-made equipment (turbines, alternators, boilers, or combined-cycle power plants, for example).

Q. What are the main drivers in your industry today?

A. In the 21st century, power generation technologies will become a major player in international politics. Depletion of fossil fuels, the rapid development of the



Assembling the ALSTOM
GT 13E2 Gas Turbine

Chinese and Indian economies, the rush for sustainable energy sources, the nuclear power debate, and the specter of climate change will all contribute to this effect. Currently, there are four major drivers that govern the power generation industry worldwide:

- **GDP Growth and Power Generation Growth:** In the developed world GDP growth is typically averaging 4% each year, while power generation growth averages 2.5%.
- **Deregulation and Re-regulation:** Prevailing political philosophies and national power generation strategies set the priorities in different countries. For example, in recent years the majority of the hydro-electric projects in the world are taking place in China, while other countries have a renewed interest in nuclear plants.
- **Aging Fleets:** Most power generating equipment has a lifespan of 20 to 30 years whereas nuclear plants are being stretched to 40 and even 60 years. As a consequence, many power plants from the 1960s and 1970s are reaching the end of their planned lives today. Modern technology and computer analysis can extend equipment life, however, through retrofitting and servicing enhancements.
- **Environmental Issues:** Because of climate change and concerns over carbon emissions, more and more legislative constraints are being imposed on power generators. Hence, there is a drive towards retrofitting pollutant control systems for CO₂, NO_x, SO_x, and mercury in coal and other fossil fuel plants.

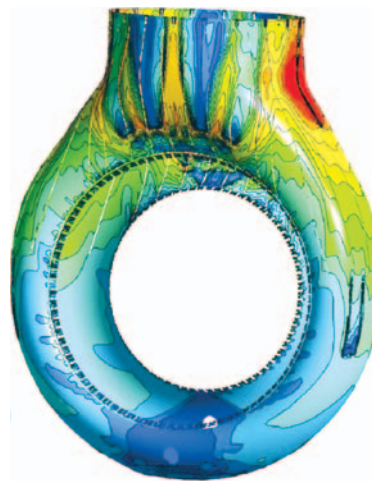
Q. What is ALSTOM's history of embracing CFD and CAE technologies?

- A.** ALSTOM was an early adopter of CFD technology in the 1970s, creating its own in-house codes, which were used for turbomachinery applications. Since then ALSTOM's CAE analysis capabilities have grown to include aerodynamic, mechanical, (stress, heat transfer, and fracture), and solidification (castings) analyses. The in-house codes are still used for conventional turbomachinery analyses such as parametric steady state simulations and best- and worst-case statistical models for performance and reliability predictions. For transient or more complex flows, involving erosion and corrosion, coating, spraying and deposition, acoustics, combustion, and fluidized beds for example, commercial software such as FLUENT and CFX is used.

Q. What products and services does ALSTOM offer in the power generation sector?

- A.** ALSTOM has four levels of products:
- Projects that are direct and short term with customers
 - Plants that take two to three years to design and build
 - Products and equipment that take up to 10 years to design and build
 - Services, such as environmental, or contracts for retrofitting existing equipment to meet emissions compliance or to extend life

At the Plant level, ALSTOM has created software to model a complete power plant cycle, including multiphase flows, optimization loops, physics-based component models, and embedded solutions with subroutines. Once created, these models can simulate steady-state plant operating conditions in real time,



Velocity contour plot of hot gas casing cooling flow

and even transient plant loadings during start-up conditions. This allows us to predict control parameters and build simulators before on-site construction begins.

Q. Can you describe ALSTOM's current CFD and CAE usage?

- A.** ALSTOM's main CFD simulation area is still turbomachinery by an order of magnitude. Being able to do reverse calculations in a design tool mode is critical for us. If we designed something 20 years ago in a software program we must also have supporting legacy data in our processes. Indeed, we still use old tried-and-tested FORTRAN code embedded in modern GUIs because it is validated, it works, and it can connect with today's CAD geometries. CAE tools are currently being deployed across ALSTOM's worldwide offices. With common platforms and user interfaces, these tools are available for 24-hour access, allowing designers and manufacturers to make use of common CAD/CAM software and data. This means that the analysis tools can access the same geometry from any location and create an effective link between design and manufacturing. In addition to providing this data to staff, customers, and suppliers worldwide, the ability to store data once and draw upon it repeatedly from a data management system is an important feature, since it allows the company to maintain a history of successful analyses on any given component or system.

Q. What are your customer drivers?

- A.** ALSTOM's customers are demanding, and if its designs and products are defective, the company incurs penalties, so both time to market and quality are critical. Toward this end, ALSTOM is coupling its technology tools with product development and product manufacturing more and more. Validation is important and the company aims to reduce the time between specification launch and product delivery. By taking time out of a process and being more consistent in the technology applied, the business risk is reduced. There are thousands of software tools in the offices worldwide and while ALSTOM spends millions of Euros to maintain and run them, these tools have brought great value to ALSTOM's business and customers.

Q. What do you see happening in the future in your sector?

- A.** Looking to the future, it is likely that PC-based analysis platforms and clusters will grow more dominant throughout the ALSTOM simulation network. The use of CFD will broaden to new application areas and will be used more as a predictive tool. Systems will evolve to become more focused and cost-effective. Backwards compatibility with earlier software versions will continue to be a challenge for designs and design data, but incorporating the company knowledgebase into future systems will always be a top priority. ■