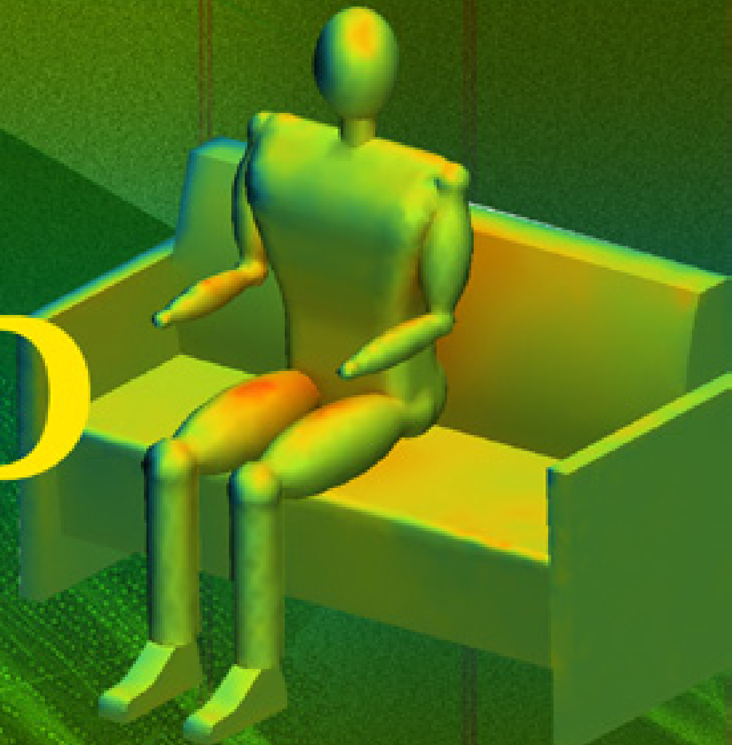
BUILT ENVIRONMENT ISSUE

UPFRONT CFD



LEED

Air Quality

Human Comfort

Data Centers

BIM to CFD

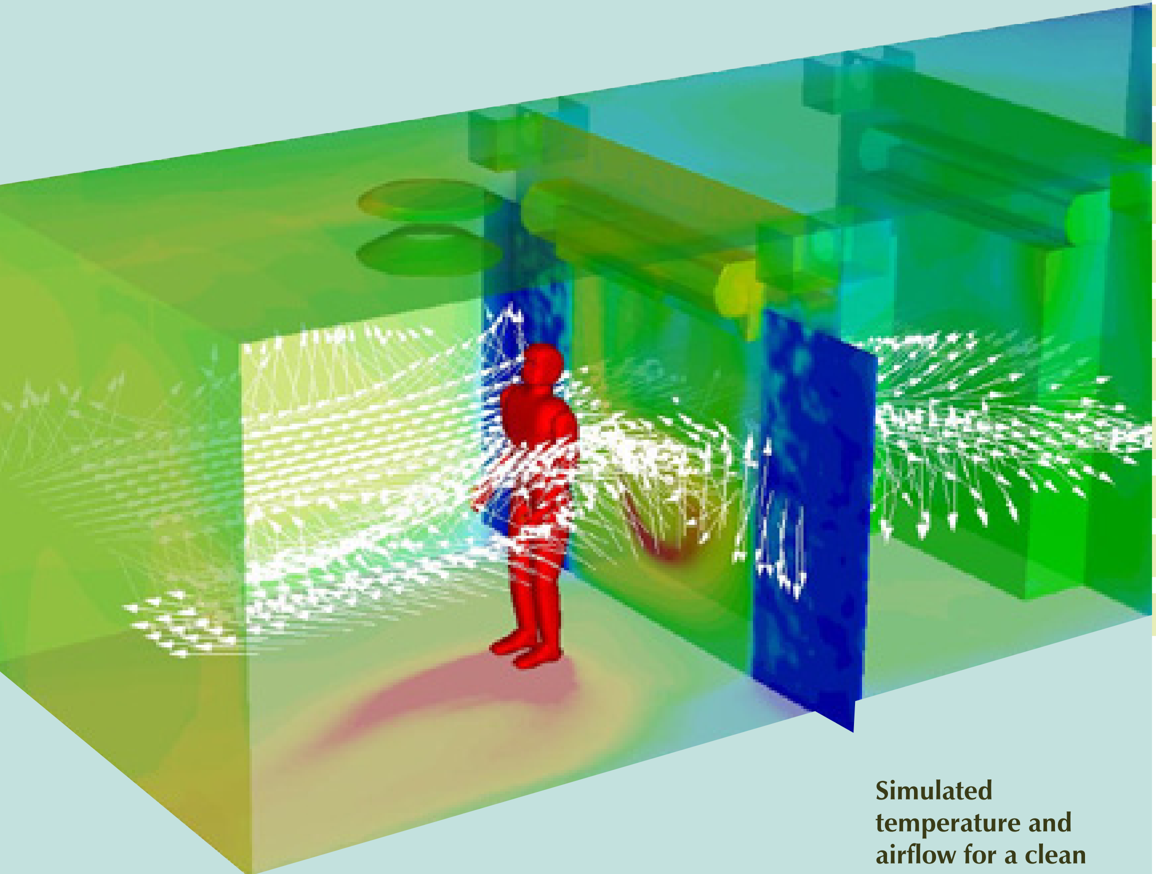
Smoke Visualization

CFD in Action

ASHRAE

UPFRONTCFD

Built Environment Issue



Simulated temperature and airflow for a clean room air door.

UpfrontCFD e-zine is a service of Blue Ridge Numerics, maker of CFdesign software.

Editors: Parker Wright, Jonathan den Hartog, Jim Spann – Blue Ridge Numerics

Managing Editor: Bob Cramblitt – Cramblitt & Company

CFD moves sustainability upfront

When it comes to designing a building, there are few places left in the world that are not influenced or governed by environmental impact. The old rules are no longer acceptable. Buildings are being designed, built and retrofitted according to a new set of values.

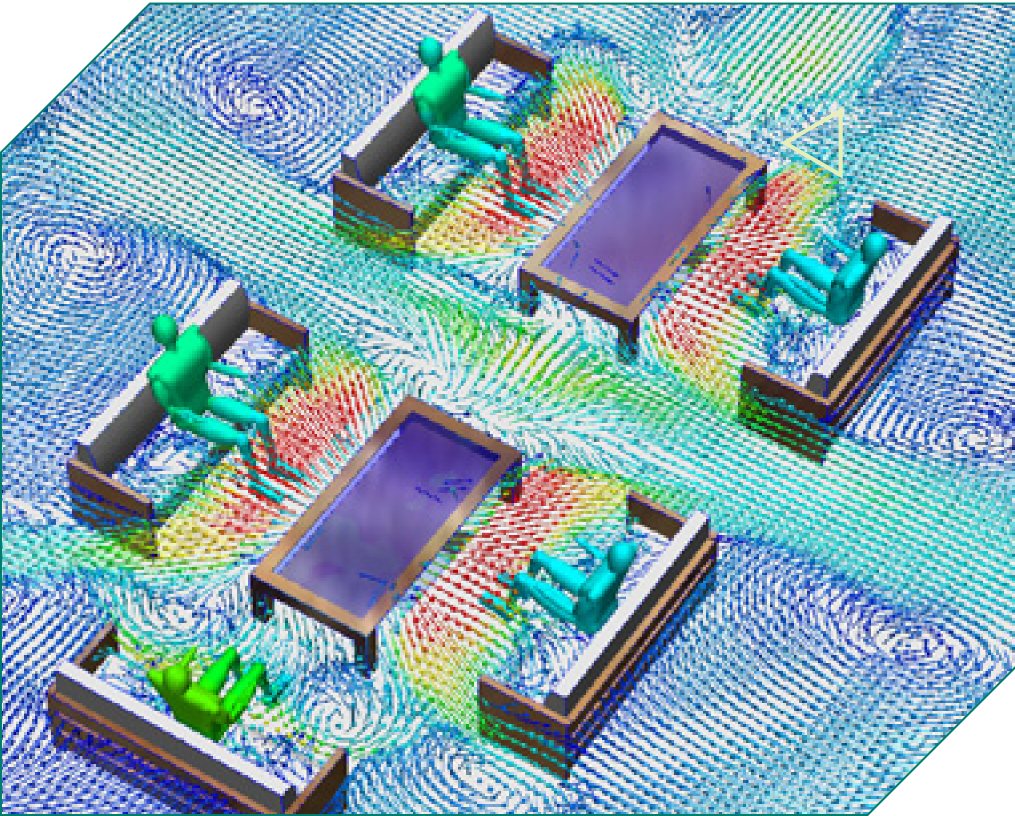
In the U.S., LEED and Energy Star are frequently specified by clients, and BREEAM, NABERS and CBA Green Mark, among others, are prevalent internationally. Inextricably linked to these standards are digital technologies such as BIM and computational fluid dynamics (CFD) that emphasize sustainability very early in the design process.

A prime example of the impact of CFD can be seen in the LEED points system: More than half of the possible points a building can be awarded go to areas where CFD adds considerable value, including energy and atmosphere, indoor environmental quality, and innovation in design.

At its core, sustainable building design is about ensuring that factors such as aesthetic appeal, occupant comfort, indoor air quality, and safety needs are considered for both the present and the future. CFD informs energy-efficient design and takes advantage of natural resources to significantly improve sustainable development.

Understanding cause and effect

Upfront CFD – defined as using CFD early in the design and engineering process – provides real-world validation and optimization directly from building information modeling (BIM) systems. Architects and engineers are able to understand how design changes can help achieve environmental objectives,



Underfloor air distribution (UFAD) is becoming a popular alternative to traditional ventilation systems, improving air quality and thermal comfort while reducing energy consumption.

meet government certifications, and increase human comfort over the long term, all well before anything is built.

Jonathan den Hartog, AEC application specialist with for Blue Ridge Numerics, cites the following ways upfront CFD can help maximize energy efficiency and maintain air quality:

- It enables performance of a new technology or design approach to be studied for effectiveness early in the development stage before significant time investment or design resources are committed. An example: natural ventilation, such as fresh air cooling for data centers.
- It gives architects and engineers a way to demonstrate how a design approach will achieve energy efficiency standards, energy certifications or air quality requirements before construction.
- It offers tools for maximizing efficiency of a given design approach, such as varying the thickness of the air layer in a ventilated façade.
- It provides tools for making fast, accurate comparisons of thermal comfort and air quality issues for different types of HVAC and structural designs.

CFD for mere mortals

What makes this all possible is the evolution of CFD from highly specialized software requiring years of expertise to software that can be used by designers, architects, engineers and others right out of the box.

"A cultural shift is underway, marked by a high rate of CFD adoption among AEC and MEP firms," says Parker Wright, AEC segment manager for Blue Ridge Numerics. "It's driven by a combination of increasingly stringent sustainability requirements, continuing

What's upfront CFD?

Upfront CFD enables architectural designers and mechanical engineers to perform computational fluid dynamics (CFD) analysis early in the design cycle, when it is most cost-effective to explore and validate designs.

Using CFD for real-time assessment of alternative design strategies has become especially important when designing the built environment for sustainability. Insights gained through simulation help firms maximize energy savings, safety, air quality and human comfort.

Upfront CFD has been made possible by ever-increasing CPU and graphics power on the desktop combined with a new generation of software that gives non-experts access to powerful analysis capabilities. Today's typical BIM workstation is well-suited for CFD simulations; 8GB RAM and a 64-bit OS are sufficient for the vast majority of architectural applications.

Architects and MEP professionals can now take advantage of CFD throughout all phases of the design and engineering process. The result: better, more sustainable designs in less time and at reduced cost.

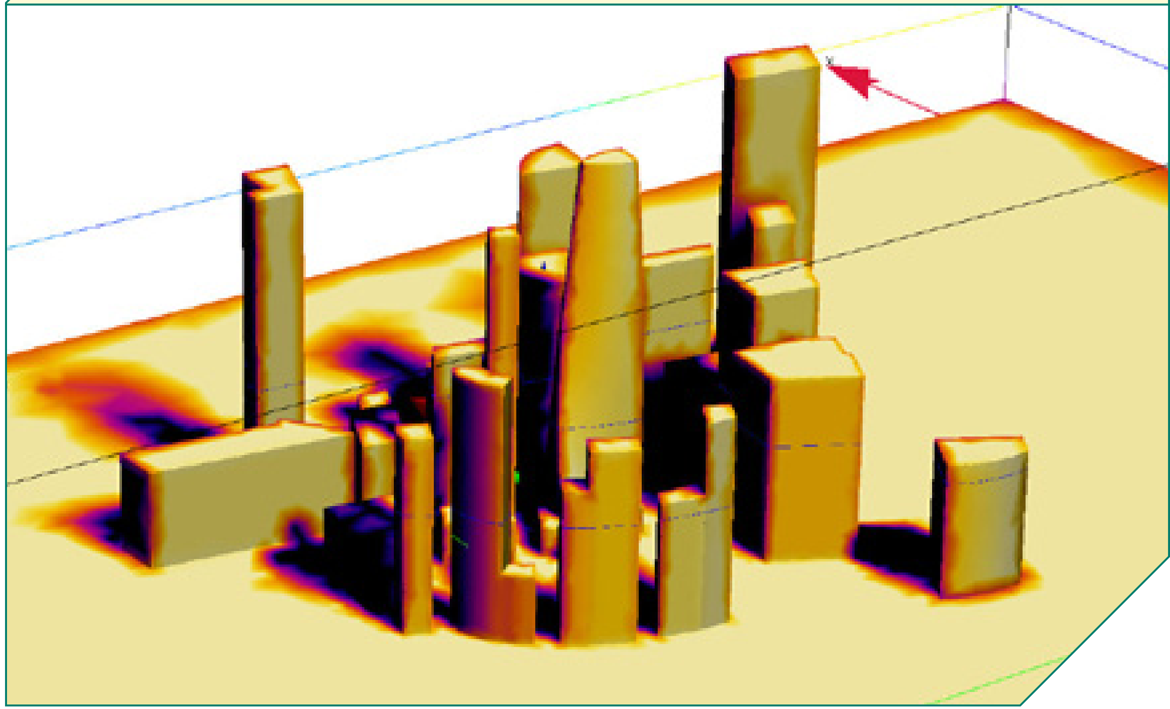
computer hardware advances, and CFD software that is now accessible to mere mortals. Integrating CFD into the design process is helping firms increase agility, differentiate themselves from the competition, mitigate risk, and positively impact the bottom line."

Architects and engineers sharing

Both architects and engineers can benefit from using CFD in early development stages, according to den Hartog.

"Architects and engineers can leverage existing geometry and share a similar understanding of results and design impacts. Architects may be involved in the very early stages, such as looking at building massing or façade material studies. Engineers might examine performance of somewhat more detailed models and determine, for example, whether or not a ventilation concept is feasible or to characterize wind loads on a structure."

Studying solar gains on facades allows early master planning decisions on building placement and orientation. When combined with wind analysis, firms can more creatively design spaces that are activated and enhanced by the sun and prevailing breezes.



Diversity of applications

The democratization of CFD goes beyond who can use it and when. The newest generation of CFD software accommodates a wide range of architectural studies, from micro (diffuser) to macro (master planning).

"Thermal comfort, humidity, radiant and solar panels, wind/ wake effects, smoke migration, exhaust concentrations, and stack re-entrainment are just some of the applications where CFD is valuable," says Wright. "It's extremely effective for any application with flow or thermal design implications."

Size doesn't matter

Size – of the project or the firm – doesn't matter with upfront CFD, according to den Hartog.

"Upfront CFD can be applied to almost any architectural project, ranging from component-level studies to wind/wake studies on the scale of a city block. Similarly, it can be leveraged by large and small firms. Large firms typically have the capacity to have their engineering team apply CFD across a range of different applications. Small-size firms might specialize in a particular application – such as data centers or clean rooms – and use CFD as a competitive differentiator."

Wright says that all it takes is one motivated individual to start reaping the rewards of upfront CFD.

"There is a large contingent of consulting companies with three employees or less that are tremendously successful with CFD. Many have more work than they can accept right now because of the sales, marketing and engineering edges this technology provides."

Large AEC and MEP firms are claiming similar success, using CFD to share results with clients, improve communications, create new green initiatives and compress development time.

Growing hand in hand

Given the compatibilities between sustainability goals and upfront CFD, it's no surprise that leading vendors such as Blue Ridge Numerics grew by percentages in the upper teens during the past year, despite the weak global economy.

Demand is likely to increase as CFD becomes more widely recognized as a major vehicle for ensuring sustainability, whether defined as energy savings, air quality or human comfort.

As Jason Sambolt of SmithGroup concludes in the interview within this issue:

"The challenges of creating more environmentally responsible designs will increase and will begin to push the envelope of building design and technologies. Upfront CFD has allowed SmithGroup to confidently implement new technology and ideas."

Parker Wright, AEC segment manager for Blue Ridge Numerics: *"Integrating CFD into the design process is helping firms increase agility, differentiate themselves from the competition, mitigate risk, and positively impact the bottom line."*

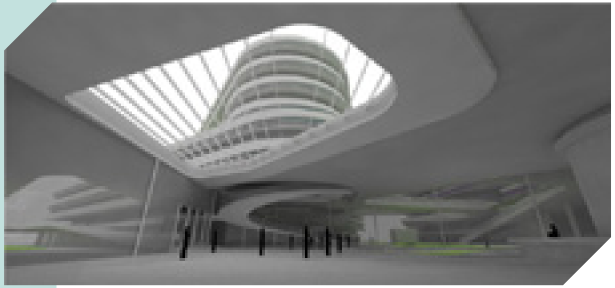
Jonathan den Hartog, AEC application specialist for Blue Ridge Numerics: *"Architects and engineers can leverage existing geometry and share a similar understanding of results and design impacts."*

BIM and upfront CFD in green practice

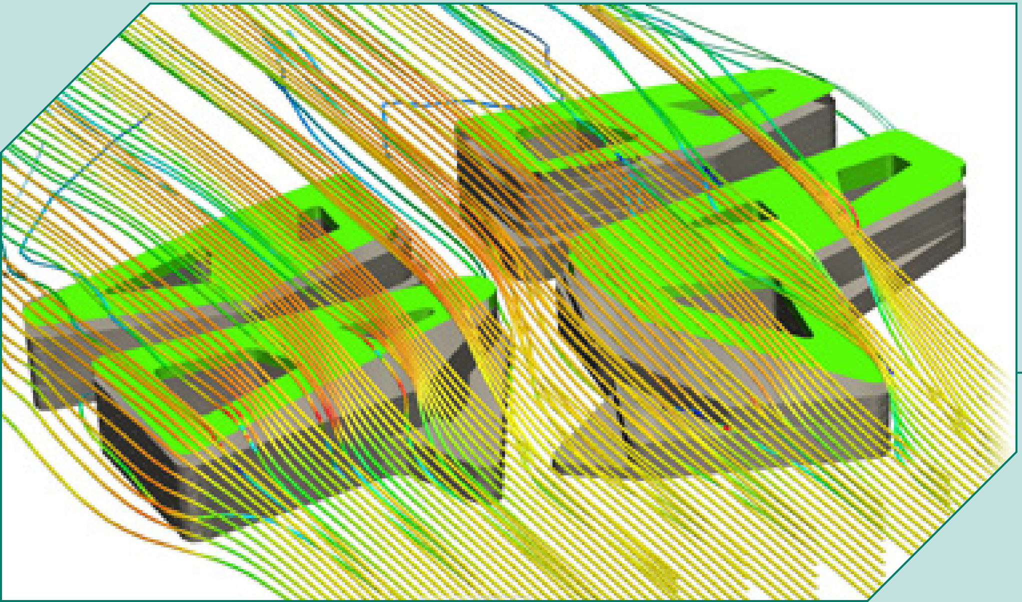
DP Architects in Singapore is working with UNStudio of The Netherlands to showcase the latest naturalistic design techniques for green buildings. The two firms collaborated on a winning design entry for sustainable structures at the Singapore University of Technology and Design (SUTD).

Autodesk Revit was used to model the buildings and CFdesign software was used for the simulation of key sustainability features, including an integrated, high-performance façade system; integrated thermal performance to offset UHI (urban heat island) and optimize heat transfer; and use of natural ventilation and buoyancy effects.

The Revit/CFdesign combination enabled DP Architects to quickly see and correct problems associated with airflow and implement specific strategies for greener designs.



Interior rendering of DP Architects' winning entry for sustainable design at the Singapore University of Technology and Design (SUTD).



Simulation of airflow over the exterior of DP Architects' award-winning design.

5 vanishing CFD myths

1. **CFD requires a specialist, usually a PhD, with a huge amount of experience.**

   Say goodbye to your father's CFD. Today's CFD software is integrated closely with popular CAD and BIM systems and works intuitively, from the graphical interface to model preparation to easy meshing for simulation.

   The best packages are designed specifically for multi-tasking designers and engineers who don't have weeks to learn new software and then days to relearn after they've not used it for a month or two.

2. **CFD is for large AEC or MEP firms that can afford the big hardware and software costs.**

   Some of the largest growth in upfront CFD software sales is coming from small consulting firms with only a handful of professionals. It is possible for an architect or engineer to set up a multipurpose upfront CFD operation for as little as $13,000 a year on a common desktop computer after a few hours of training.

3. **Results from CFD software take an expert to interpret.**

   Rich graphical output from CFD simulations makes it easy to communicate and share results with architects, owners and executives, providing insights into how a design works, or doesn't work. One of the greatest values of today's CFD software is to make visible what might have been hidden within complex designs.

4. **CFD is best used after selecting a preferred design.**

   That's where the term "upfront CFD" comes in. The best software enables architects and MEP engineers to assess key factors such as energy efficiency, air quality and thermal comfort early in the design process, when it is most cost-effective to assess a wide range of design options.

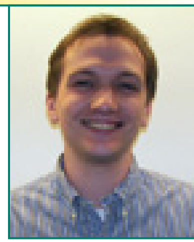
5. **CFD can't be trusted to provide accurate results.**

   Accuracy of CFD results has been proven in every realm of architectural design and engineering, so much so that organizations such as ASHRAE consider CFD an essential tool for sustainable design. But, as with anything, it's best to investigate for yourself.

Sustainability at every design level: Upfront with SmithGroup's Jason Sambolt

SmithGroup, a national architectural, engineering and interiors planning firm, says sustainable design is at the core of every one of its projects. And at the center of most of SmithGroup's sustainable efforts is Jason Sambolt, LEED AP, mechanical engineer and upfront CFD advocate.

UpfrontCFD *magazine talked to Jason about SmithGroup, sustainability, and the engineering tools that are fueling the green architectural movement.*



Jason Sambolt, LEED AP, SmithGroup: *"A relatively small effort early can produce invaluable information to help both the architect and engineer better understand a project."*

What is your role at SmithGroup and how important are LEED ratings and other sustainability issues to your projects?

The majority of my time is spent performing engineering design and construction support for new buildings and retrofits of existing facilities. Much of my time is spent performing comprehensive energy modeling, as well as computational fluid dynamics studies.

The importance of LEED implementation has grown exponentially over the last few years and SmithGroup has been fully committed to applying LEED practices in all of our projects.

What specific design, engineering and construction techniques are helping you improve LEED ratings and meet the rigorous energy standards of the Architecture 2030 Challenge?

There are multiple design approaches SmithGroup has used to improve building performance over the years.

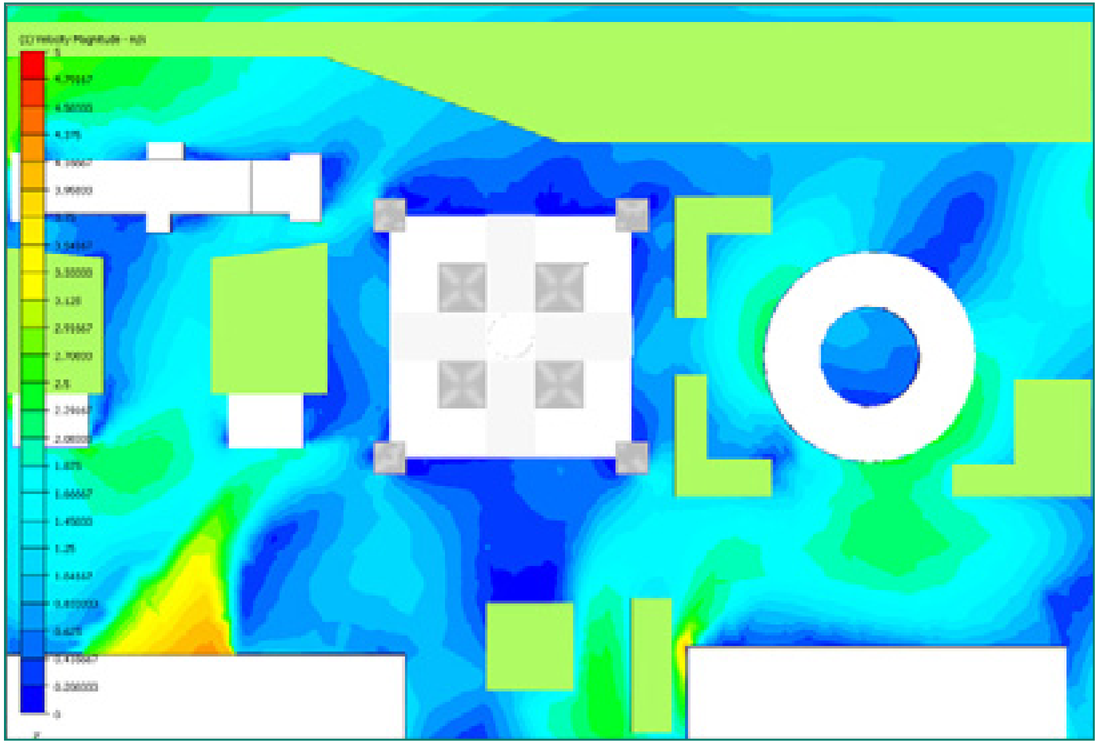
Constitution Center in Washington, D.C., was the first large-scale chilled beam installation in the United States. The active chilled beam system in combination with dedicated outdoor air units with energy recovery produced significant energy savings in cooling, heating and fan energy consumption.

A natural ventilation design strategy was implemented at the Chesapeake Bay Foundation Headquarters, which helped in achieving the first LEED New Construction Platinum rating.

How do you show clients energy efficiency of your designs as they are being developed?

Energy efficiency is evaluated throughout all design phases. During schematic level and early design development phases we often determine the passive design strategies we can use to reduce the overall building energy consumption without causing a negative effect on other elements of the building.

A good example of this is analyzing solar shading in order to reduce energy losses through glazing without reducing daylighting. These types of analysis are generally explained to a client through presentations or reports that run through all the scenarios analyzed and highlight which scenario is the best choice for the desired outcome.



SmithGroup used CFdesign to determine whether a building that originally implemented natural ventilation in 1881 was capable of providing enough natural ventilation after 100 years of urban growth around it.

In later design phases we often focus on the overall HVAC system efficiencies. The combination of passive and active strategies allows the overall size of the HVAC system to be smaller and use highly efficient pieces of equipment that greatly reduce overall energy consumption.

How does upfront CFD fit into your sustainable design efforts?

As the demand for sustainable design increases, so does the demand to be on the forefront of new technologies and to increase outside-of-the-box thinking. This often means dealing with long-term untested practices.

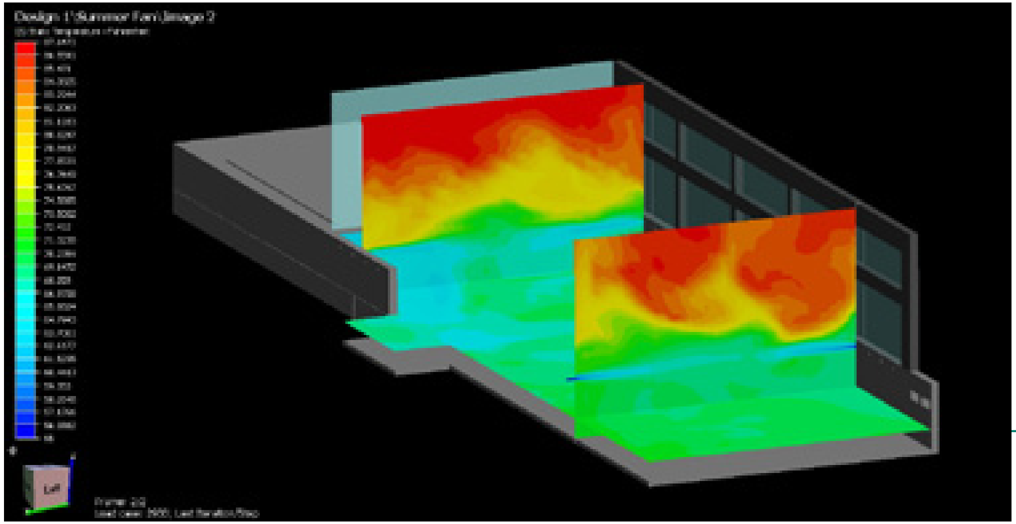
Upfront CFD using CFdesign software has allowed SmithGroup to confidently implement new technology and ideas through proof of concept verification. A room with a chilled beam system can be modeled quickly and easily during the design process to ensure thermal comfort will be maintained.

Another good example is the use of CFD to determine the feasibility of a natural ventilation design for a retrofit of an existing building. SmithGroup used CFdesign to determine whether a building that originally implemented natural ventilation in 1881 was capable of providing enough natural ventilation after 100 years of urban growth around it.

At what point do you bring CFD into your design/engineering work for a new building?

At SmithGroup, architectural and engineering design teams collaborate at very early stages of design in order to create a fully integrated practice.

During these early design stages important decisions need to be made based on schematic-level energy analysis and CFD studies that greatly affect the overall design. A relatively small effort early can produce invaluable information to help both the architect and engineer better understand a project. This information not only ensures we are creating an energy-efficient building but that we are also producing the best product for our client.



An atrium temperature study conducted by SmithGroup for the L'Enfant Plaza retail renovation.

What specific attributes do you look for in a CFD program and why?
A CFD program must be user-friendly. CFD programs have come a long way in this regard over the last few years. Earlier CFD programs were far from user-friendly and this created a misconception that CFD can only be done by a select number of users. That is far from the truth with today's programs.

Who uses CFD at SmithGroup and how do they interact with others?
Mechanical engineers are the sole CFD users at SmithGroup. After the simulation has been run the mechanical engineer working on the project will discuss the results with the design team, and improvements or changes to the design will be made. This process will be run through as many iterations as required to produce the results for which we are looking.

What kind of cultural changes are required to integrate CFD into design and engineering processes?
The biggest change needs to be early integration. Often times consulting engineering firms will be brought onto a job after the early phases of design have already been developed by an architectural firm. By this point critical decisions have already been made without a full understanding of the design.

What BIM or CAD program do you use and how important is the interface with your upfront CFD software?
SmithGroup was an early adopter of Autodesk Revit and has made a transition to working almost exclusively in Revit. The CFdesign plug-in makes exporting Revit models into the program as easy as a single button click. This helps streamline the process, allowing us to spend more time on the design rather than setting up a model.

Do you think sustainability is going to continue being a watchword for the future?
Sustainable design is here to stay. As we progress, the challenges of creating more environmentally responsible designs will increase and will begin to push the envelope of building design and technologies. This challenge will require architects and engineers to constantly expand their perception of sustainable design and push current boundaries to reduce our overall impact on the environment.

Lower acrylamide levels, much lower cost

AlaJor Engineering knows that improving air quality does not necessarily mean six-figure costs.

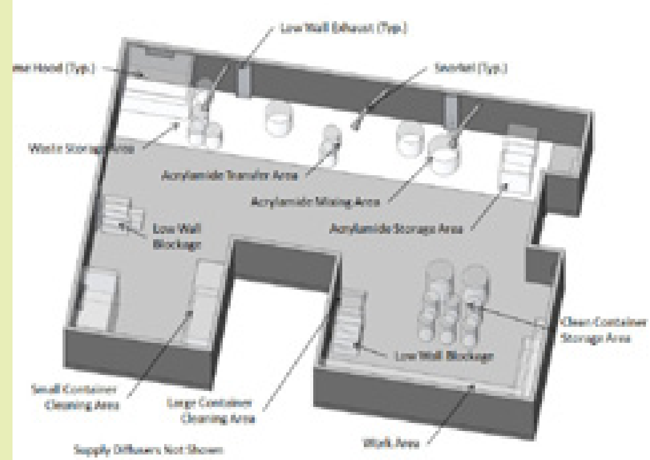
AlaJor's client wanted to lower acrylamide vapor levels in its mixing lab. The overall cost for a mechanical retrofit of the lab was estimated at $120,000.

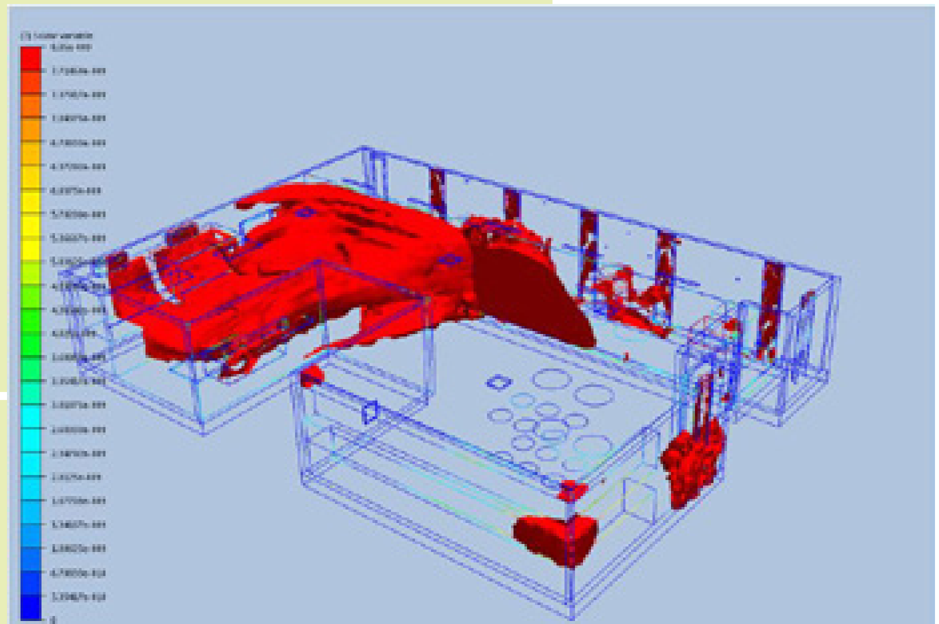
Using upfront CFD to test the effectiveness of seven different design options, AlaJor was able to reduce acrylamide levels below California OSHA requirements for the majority of the lab.

Only minor HVAC modifications costing $20,000 were required to achieve the reduction, saving an estimated $100,000. Additional energy savings from the modifications are estimated at $10,000 per year.

AlaJor saved an estimated $100,000 while significantly lowering acrylamide vapor levels in its client's mixing lab.

The layout of the mixing lab for AlaJor's client.



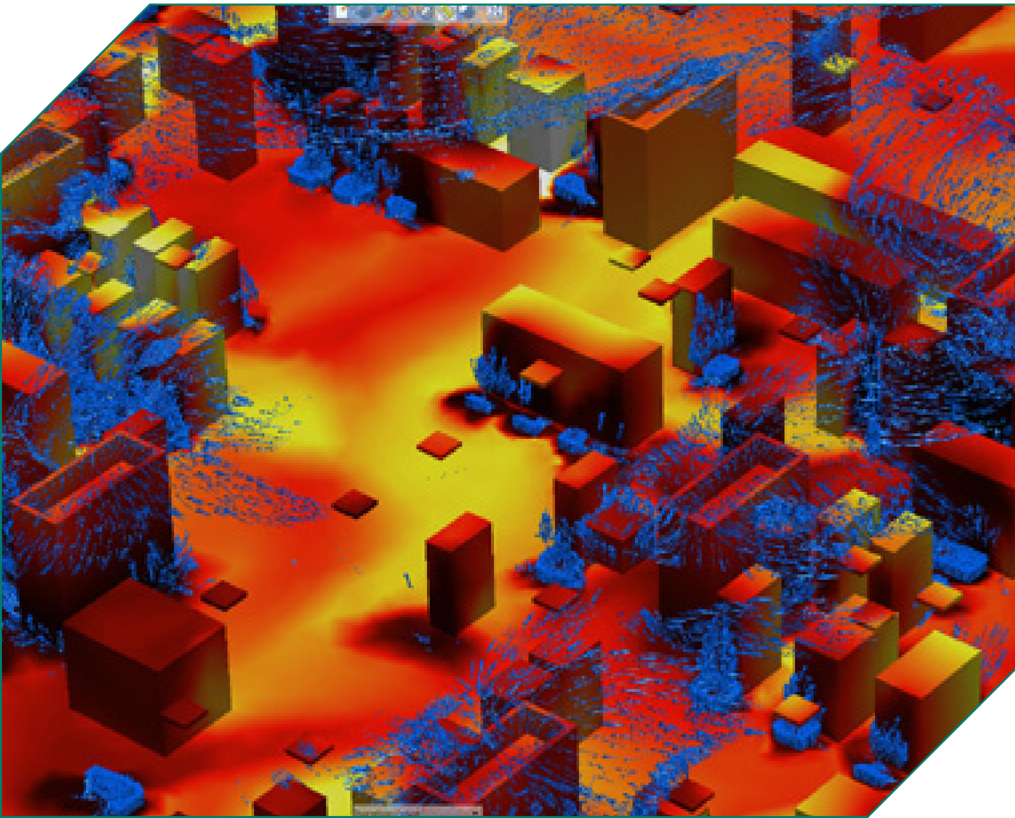


Controlling the data center's unquenchable energy thirst

by Parker Wright

Today's data centers consume approximately 200 terawatt hours (TWh) worldwide, with total annual energy expenditures exceeding $15 billion. The rise of cloud computing and workstation virtualization promises energy savings, but not nearly enough to offset the increasing demand for data and interaction.

Yahoo, Google and IBM are just a few of the firms committed to new strategies for reducing the strain on the grid and the earth's natural resources.



ECMs yield big payoffs

Whereas direct liquid cooling, direct generation (DG), and combined heat and power (CHP) have not been widely adopted by data center designers due to cost and risk, systematic implementation of energy conservation measures (ECMs) is an increasingly common thermal management strategy. ECMs frequently result in low-complexity/high-yield modifications that lead to significant energy and cost savings. And most of them benefit greatly from CFD analysis.

CFD contributes to ECMs by helping designers examine and improve airflow management. CFD analyses for data centers include hot aisle/cold aisle arrangements, intelligent placement of floor tiles, evaluation

Rack temperatures are monitored via virtual thermal cameras, while airflow profiles are observed using iso-vectors. Designers look for over-temperature warnings, wasteful recirculation, and areas needing optimization.

of free cooling, and baffle curtains or blanking panels to prevent improper mixing and exhaust recirculation.

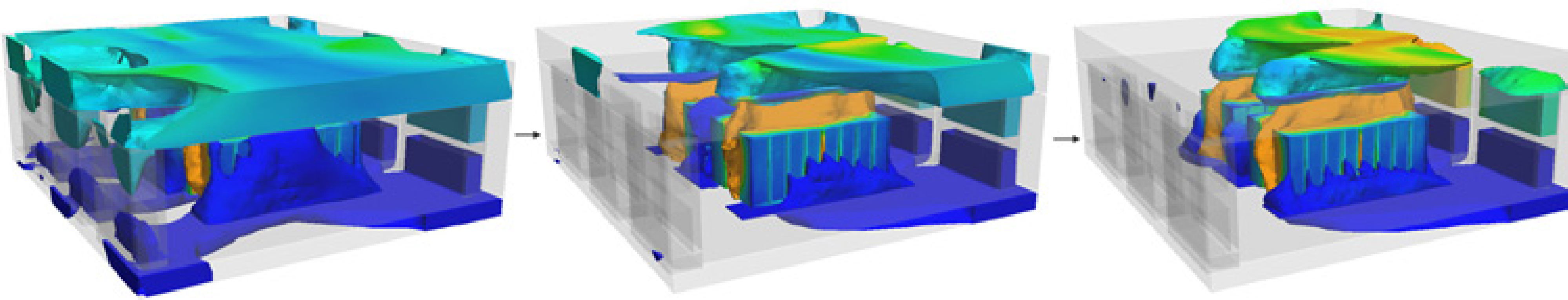
Retrofits or careful placement of CRAC (computer room air conditioner) or CRAH (CR air handler) units can also deliver major benefits. Close-coupled cooling, high-efficiency units, and newer plug fan units can lead to more than $100K/year in energy savings for moderate-sized data centers.

Insights early in the design process

Using CFD, data center designers can simulate the airflow and thermal response of new designs, well before ground is broken at the site. Retrofits benefit from CFD as well – the auditing firm can use existing drawings or site measurements to model the existing data center, characterize performance, and then implement ECMs virtually to determine energy savings, break-even points, and year-over-year cost savings once the changes are implemented.

CFD permits visualization of exhaust flow recirculation, understanding of pressure and flows in the subfloor, and quick identification of areas where cool air bypasses server racks. These insights allow designers to quickly optimize tile configurations, evaluate the impact of new CRAC units or

Owners are reducing redundancy in data centers, resulting in smaller margins during failures. A transient failure analysis using CFD allows engineers to study catastrophic failure modes and backup system response times to identify at-risk areas.



subfloor baffles, and experiment with failure scenarios or rack-load cycling.

Common analysis targets for data center simulations include pressure distributions, rack inlet and exhaust temperatures, CRAC set points and return temperatures, vectors, tracers, and even transient thermal responses when losing CRAC units. An unlimited number of virtual thermocouples and rack monitors can be included in the analysis. Once the baseline characteristics and outputs are defined, simulations examining other design options can be set up within minutes.

CFD simulations allow MEP professionals to investigate multiple design strategies to converge on the optimal solution for both new construction and retrofits. Data centers represent a tremendous opportunity for energy savings in the built environment, as their performance and energy consumption can frequently be optimized with simple, straightforward design changes.

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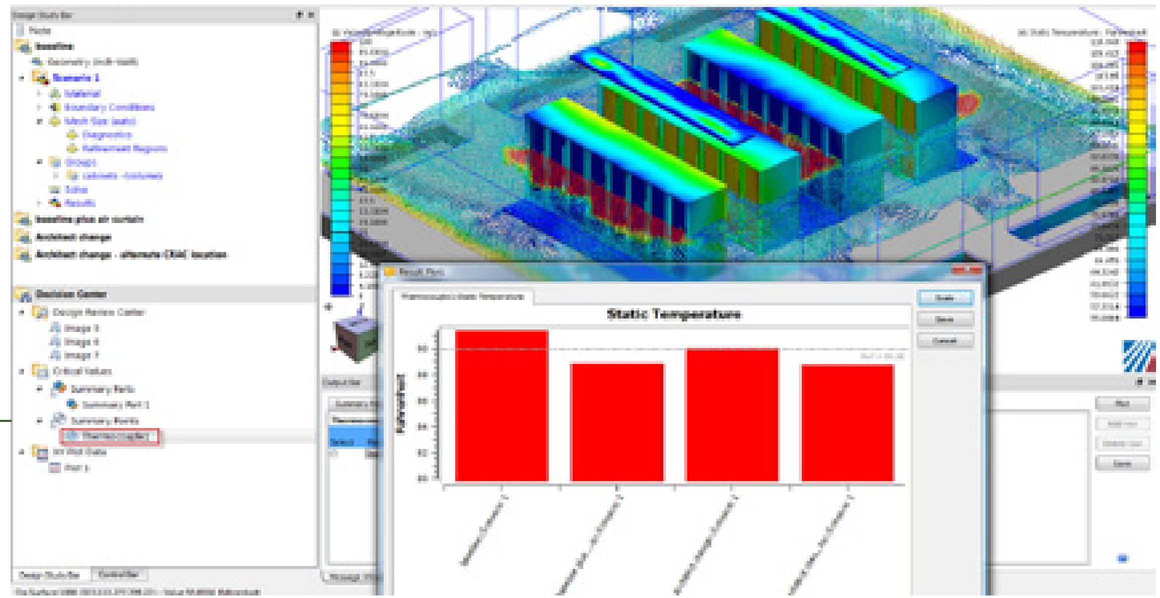
Parker Wright is AEC segment manager for Blue Ridge Numerics.



Virtual thermocouple readout from a critical location within the data center. The bars show temperature comparisons over multiple iterations.

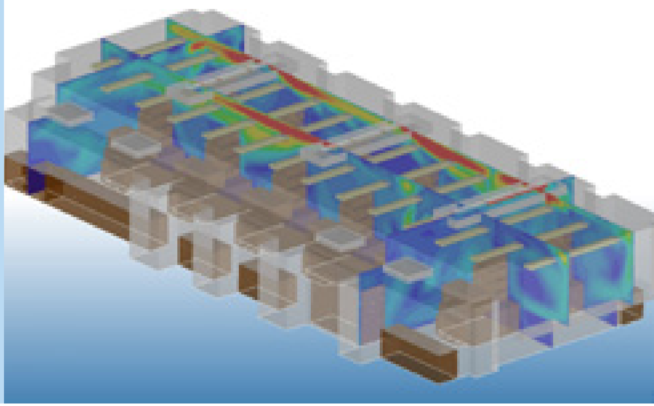
More comfort,
fewer contaminants

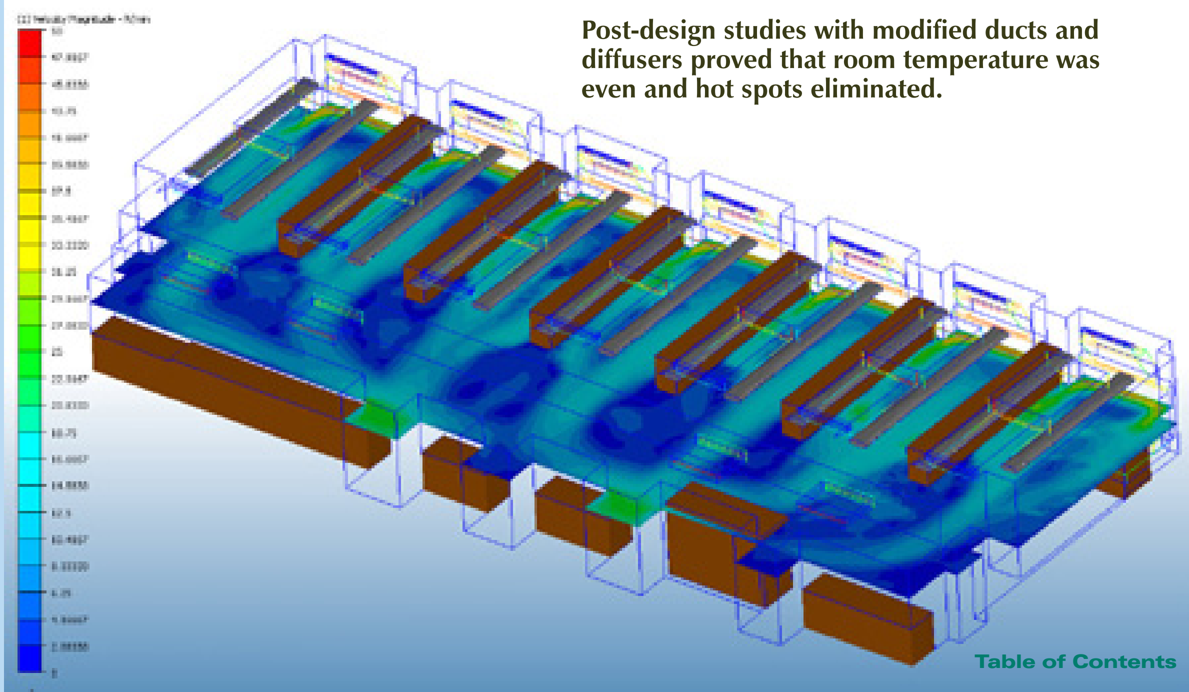
A routine energy audit by Genesys Engineering for an eight-year-old lab building at the Yale School of Medicine yielded much more than the client anticipated.

Working with engineers from Blue Ridge Numerics, Genesys came up with a new design that not only eliminates contaminants more effectively, but does so using nearly half the airflow of the existing configuration.

Visualizations generated by CFdesign software show both the turbulent airflow patterns within the existing structure (above) and the massive improvements made through design changes (below). Post-design studies with modified ducts and diffusers proved that room temperature was even and hot spots eliminated. Best of all, the lab's occupants have never been more pleased. Read more…

Visualization of turbulent airflow patterns within the existing structure at Yale School of Medicine.





Post-design studies with modified ducts and diffusers proved that room temperature was even and hot spots eliminated.

ASHRAE sets down challenge to model a sustainable world

In her address at last year's ASHRAE conference, Lynn G. Bellenger, the organization's current president, laid down the challenge to model a sustainable world. Here are excerpts from that presentation:

Powerful modeling tools

"In energy simulation, daylight analysis, computational fluid dynamics and building information modeling software, we have powerful modeling tools that enable us to create and refine our vision of a building – its appearance, systems, operation and performance."

From physical to virtual models

"Today, we have the tools to create a virtual model that can be completed more quickly and can be modified easily to consider options in size, shape and appearance. But more than just a visual representation, our models can simulate energy performance, assess daylighting options and predict thermal comfort."

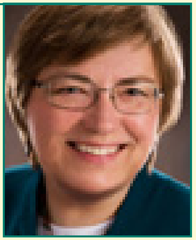
The cultural shift

"Our biggest challenge is implementing integrated design in daily practice…It is going to require a cultural shift in our industry to transform the design process, and it's a shift that has to occur if we are going to reach our goal of net zero energy buildings."

Rebuilding the past

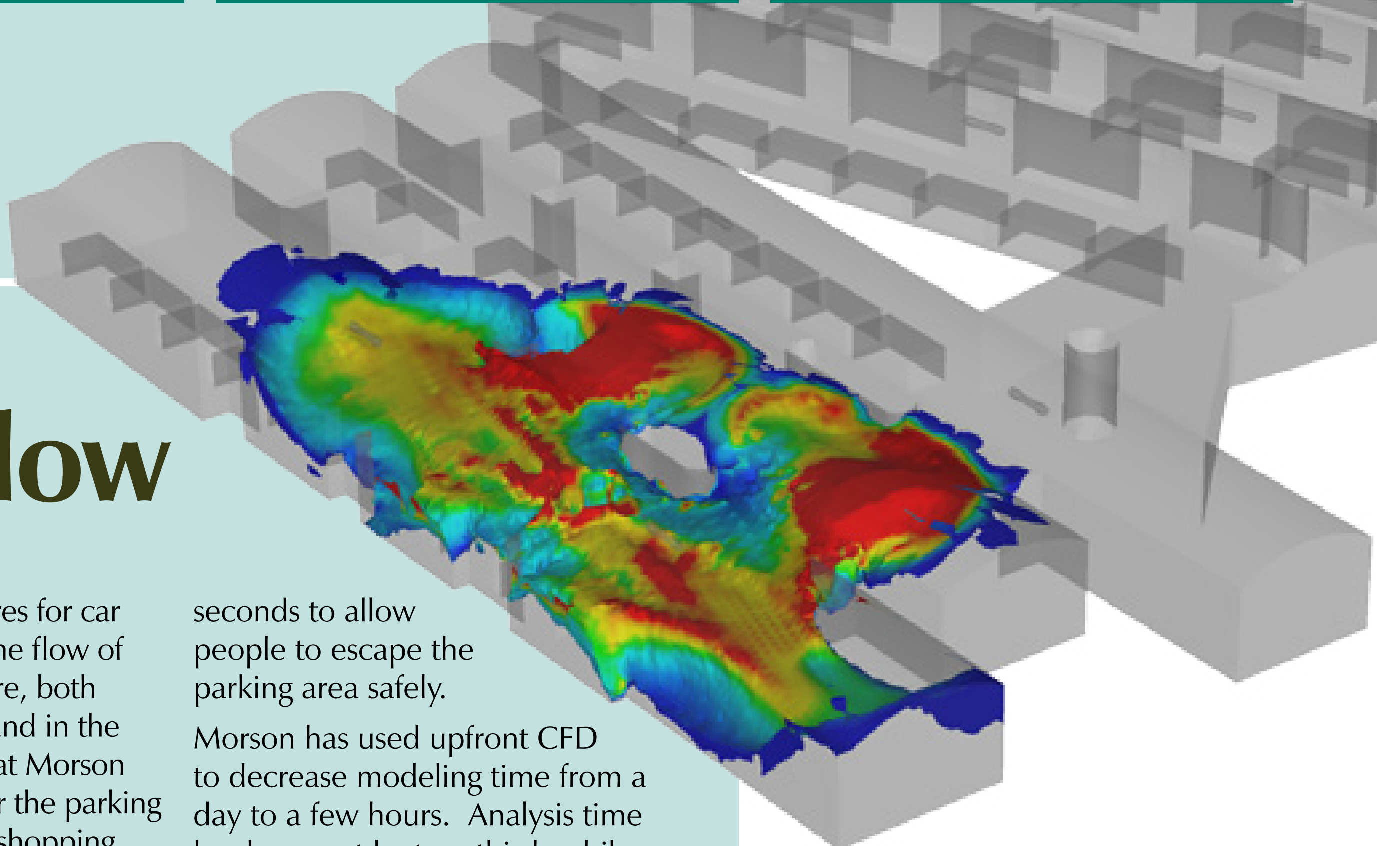
"Optimizing the design of new buildings is an exciting and challenging goal as we move toward net zero energy buildings. But…98 percent of construction dollars in the U.S. are being spent on existing buildings. While that percentage varies around the globe, sustaining our future by rebuilding our past remains our strongest opportunity to make an immediate impact on worldwide energy consumption."

Visit the ASHRAE website to see the full presentation by Lynn G. Bellenger.



Lynn G. Bellenger, ASHRAE president: *"But more than just a visual representation, our models can simulate energy performance, assess daylighting options and predict thermal comfort."*

Ensuring safe airflow

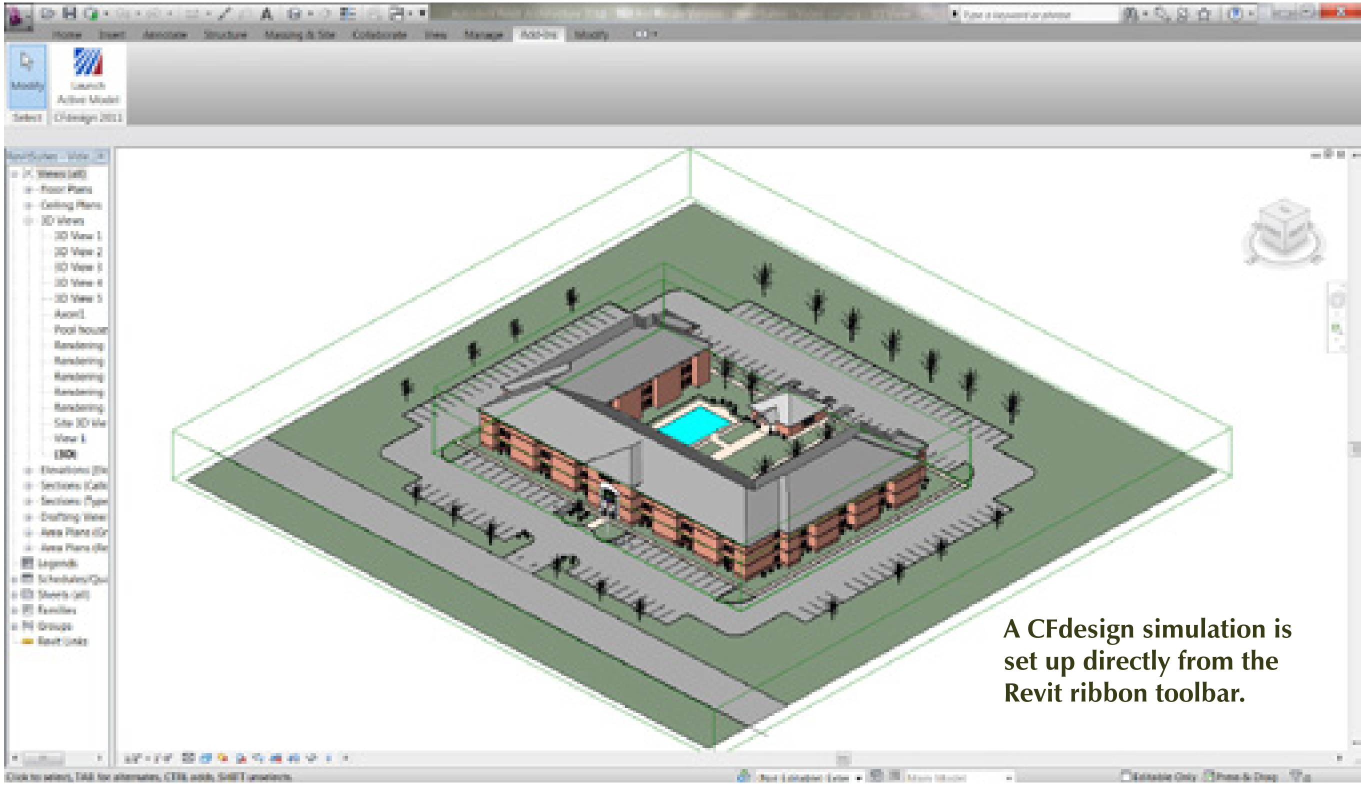


One of the critical measures for car park design is regulating the flow of air throughout the structure, both in normal circumstances and in the event of a fire. That's what Morson Projects was able to do for the parking garage at Granary Park, a shopping and tourist area in Leeds, U.K.

The image depicts one of the stages of an eight-megawatt fire analysis of the parking structure – the equivalent of the energy given off by two cars on fire. Results showed that the ventilation system will clear smoke adequately enough within 60 seconds to allow people to escape the parking area safely.

Morson has used upfront CFD to decrease modeling time from a day to a few hours. Analysis time has been cut by two-thirds while providing more detailed results than is possible with traditional CFD software. Read more…

Morson used upfront CFD to show that a ventilation system will clear smoke adequately enough within 60 seconds to allow people to escape safely from a parking garage.



A CFdesign simulation is set up directly from the Revit ribbon toolbar.

BIM-driven design simulation:

An idea whose time has come

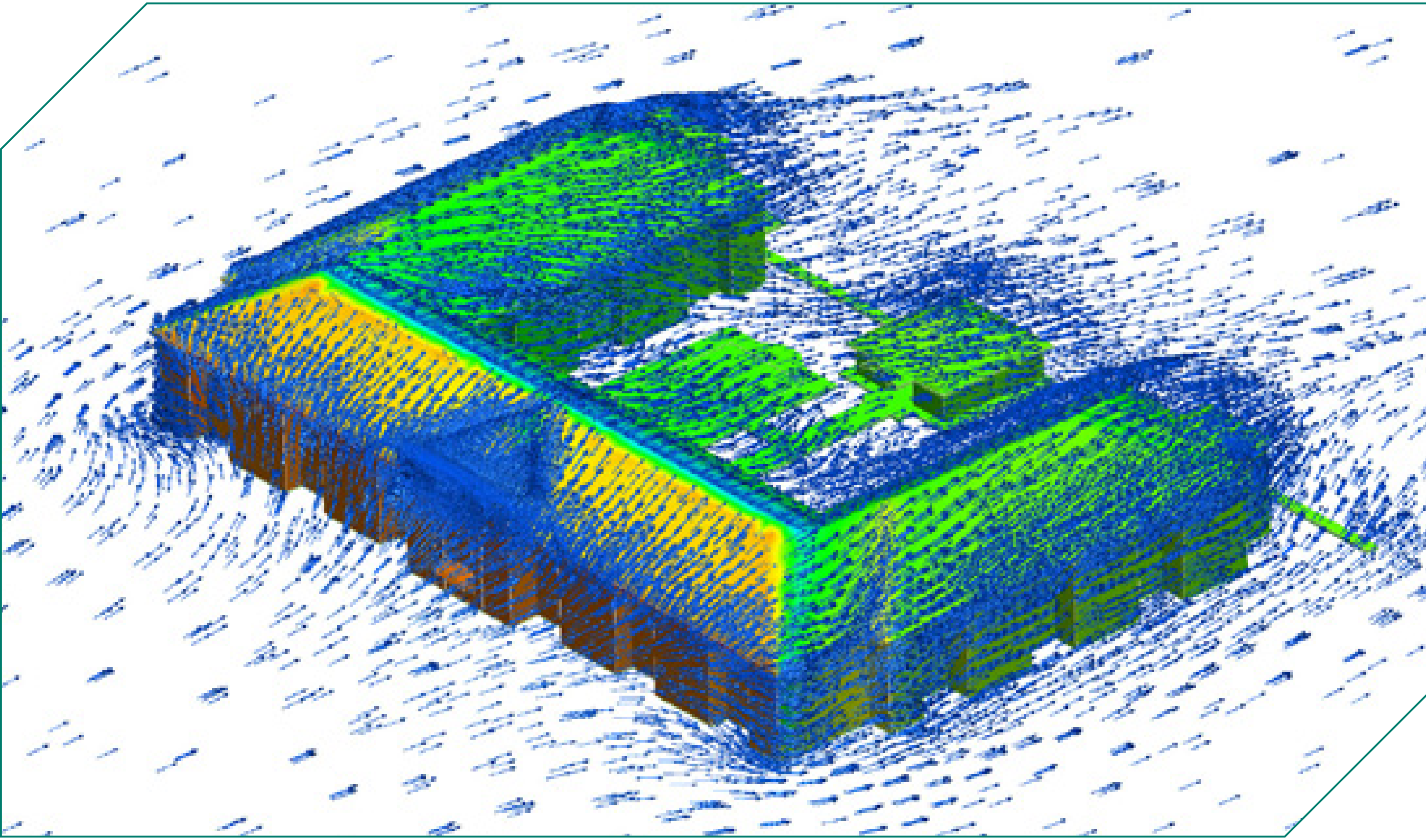
A prevalent worry with old-school CFD was how to get BIM models into CFD software and back out again when geometry revisions were required.

The clock ticked loud and long each time a model was exported or imported.

All that has changed: CFdesign allows AEC and MEP professionals to run air flow and thermal design studies directly from their native Autodesk Revit or other BIM geometry.

Instant associativity

A CFdesign simulation is set up directly from the Revit ribbon toolbar. The Revit geometry can be leveraged as a new CFD simulation model or incorporated into a design study to investigate the impact of a recent change.



Results from CFdesign can then be used to optimize designs in Revit.

Either way, the native BIM model is used so the simulation can keep pace with an evolving design.

Better decisions, faster

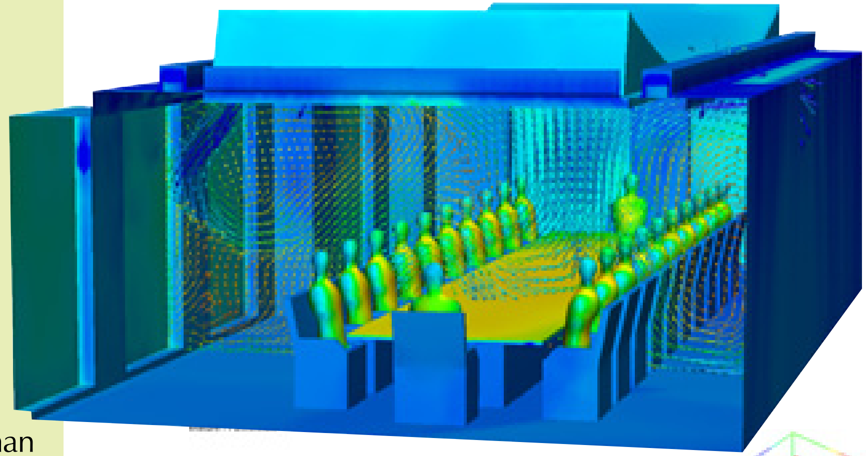
Another major breakthrough in CFdesign is the Decision Center. It helps users make smart design decisions by extracting and comparing specific results values from designs and scenarios. The software then creates a complete performance picture by comparing results against targeted performance values.

Visit the CFdesign website for short videos on how to set up a design study from Revit and to see the Decision Center in action.

California conference room chillin'

Advance Design Consultants (ADC) loves innovation, but only when it is tied to reliability, which is demonstrated by its record of less than 1% in construction change orders. A recent project for Fenwick & West in Mountain View, Calif., demonstrates the firm's use of new technologies in the service of efficiency.

Using CFdesign with Autodesk Revit, ADC simulated the use of active chilled beams as the primary cooling source for Fenwick & West's conference rooms. Upfront CFD simulations gave ADC insights into optimizing air flow and offsetting soffit and central ceiling obstructions. The room design maintains occupant comfort around the conference table with a continuous wash of cool air and minimal temperature variation in the occupied space.



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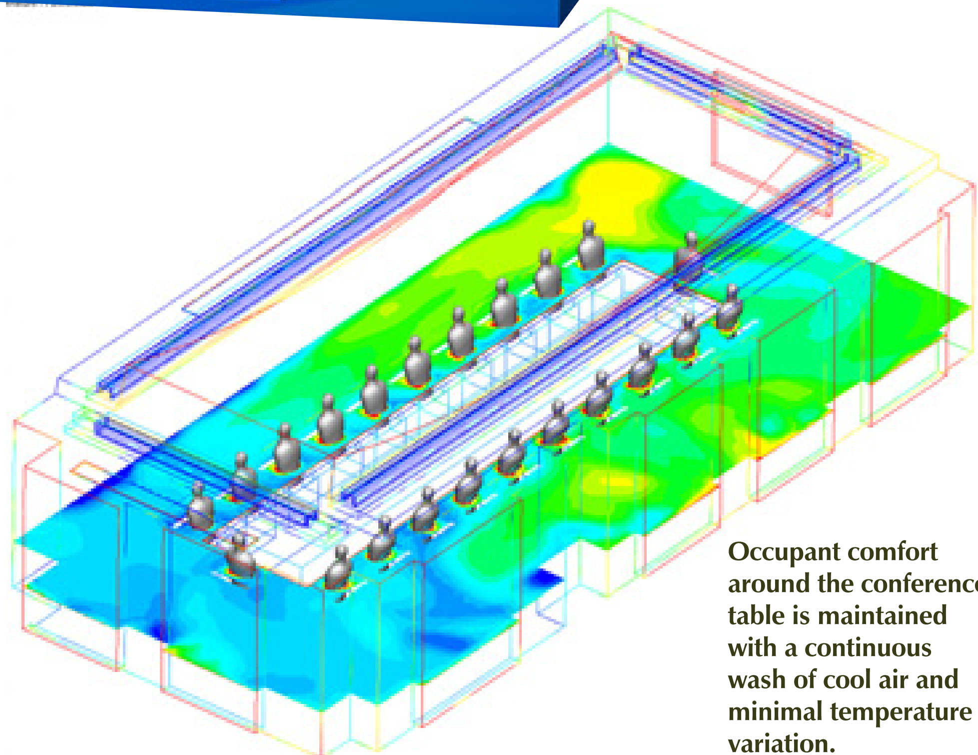


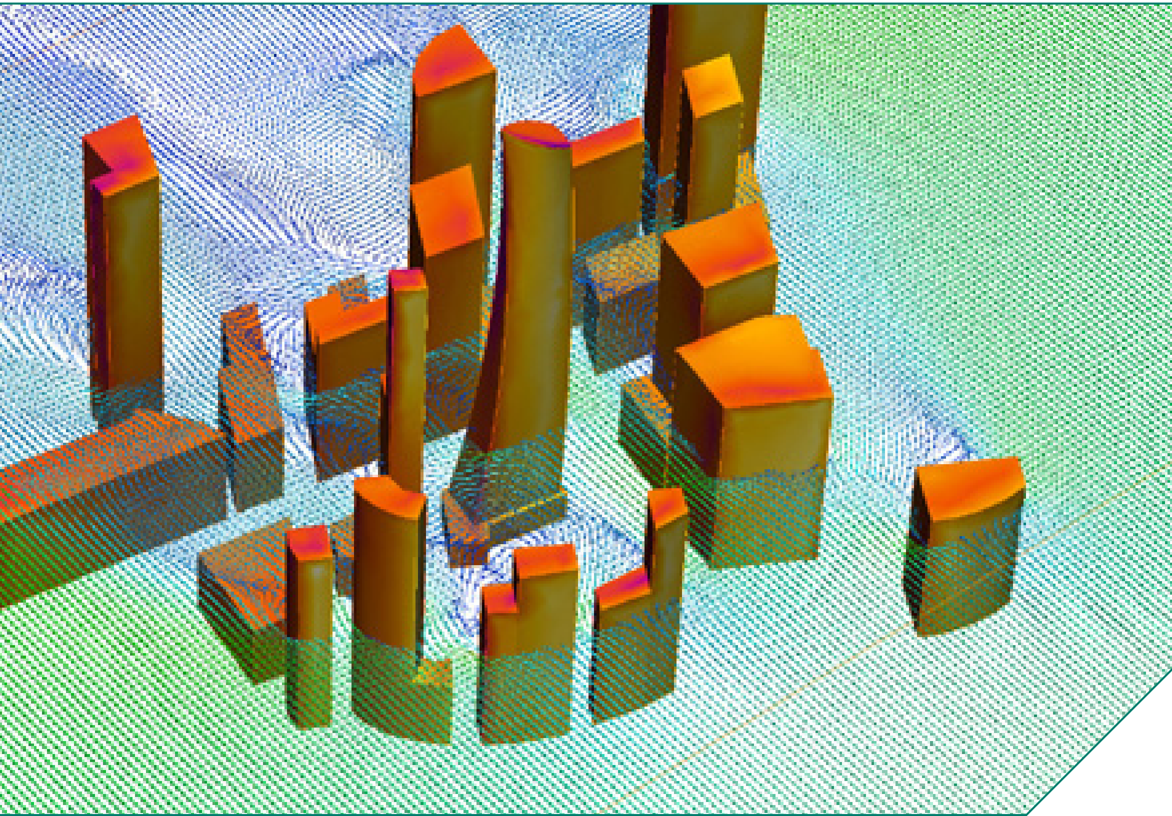
Occupant comfort around the conference table is maintained with a continuous wash of cool air and minimal temperature variation.

What to look for in upfront CFD software

OK, you're convinced that using CFD upfront in the AEC or MEP design process might be a good thing for your company. But, what do you look for in an upfront CFD package?

Here are the key attributes, courtesy of Jonathan den Hartog and Parker Wright, the AEC/MEP experts at Blue Ridge Numerics:

Quick and easy set-up and running of models. Building design is often determined very early in the project cycle. To be effective, CFD tools need to allow simulations to be completed in hours or days, not weeks and months.



Wind-wake thermal analysis for a downtown area. CFD software needs to provide a breadth of capabilities to simulate physical phenomena at the component, room, building and city levels.

Flexibility for handling a wide range of applications. Since upfront CFD helps examine novel design approaches and applications of new technology, CFD software needs to provide a breadth of capabilities to simulate physical phenomena at the component, room, building and city levels.

Simulation tools should be able to easily handle complex geometry. This includes detailed components as well as curved walls and other architectural features. The solver should be powerful enough to handle not just flow, conduction and convection but also radiant heat transfer, solar loading, contaminant migration, humidity, smoke, thermal comfort, and time-varying conditions (including failure analysis).

Results should be easy to understand by a broad audience. Architects, engineers, specialists and clients are involved in the building design process. CFD software should make it easy to understand and compare the performance of different designs and to communicate results and knowledge to everyone involved.

Tight integration with BIM and 3D CAD. Engineers and designers should be able to easily leverage BIM, Rhino, Revit or other CAD models to set up simulations, then go back and forth between design and simulation to experiment with multiple design alternatives.

Built-in intelligence and automation. The software should allow multi-tasking designers to quickly and easily take advantage of it without intensive training and years of experience.

Support of a dedicated partner. The company supplying and supporting the software should have specific industry knowledge, a singular focus on CFD, and a commitment to the customer base. It should also provide resources that minimize the learning curve and ensure success on each new project or design challenge.

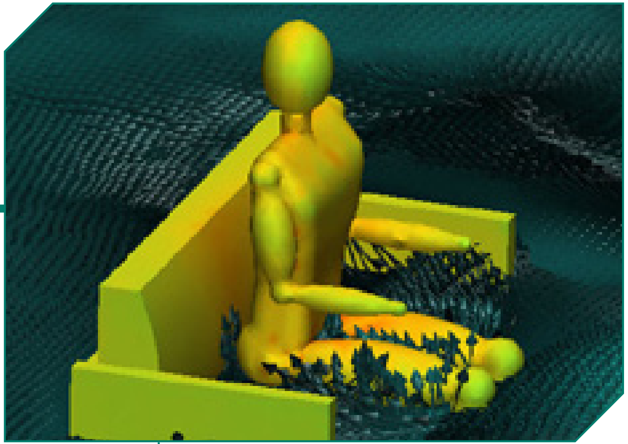
Sustainability for the people

The latest update of CFdesign 2011 brings some vital new elements into the sustainability equation: the comfort and safety of people.

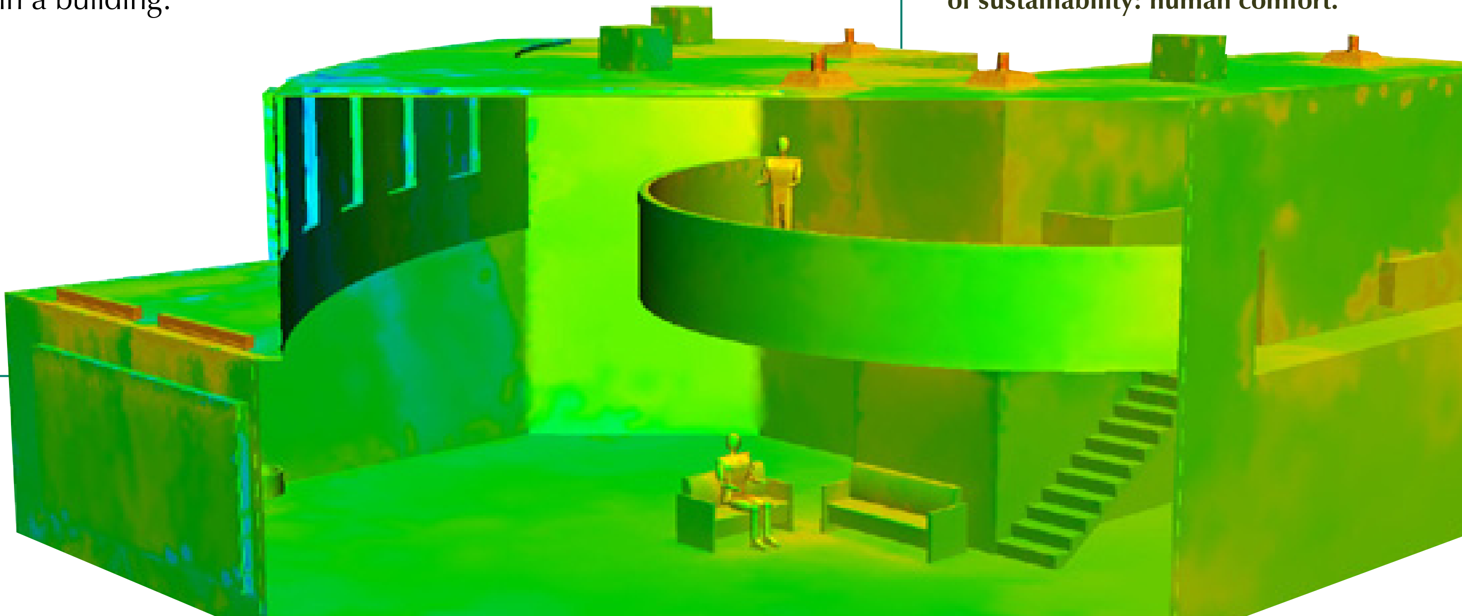
New tools within CFdesign software use virtual test dummies to predict the thermal comfort of rooms and visibility in case of a fire within a building.

Simulating human comfort

The new thermal comfort indices are designed to help guarantee client satisfaction by analyzing human factors within a building. The program takes into consideration



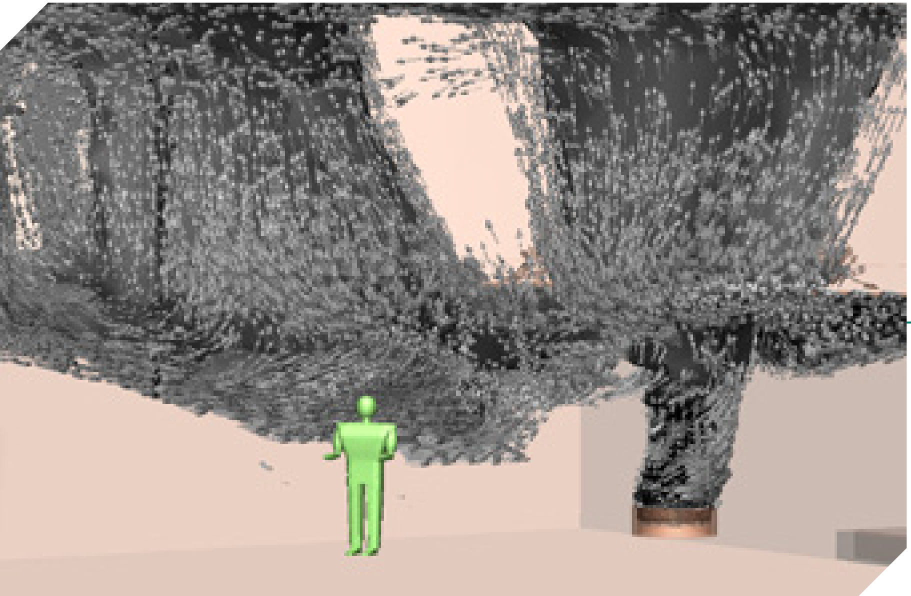
New software takes into account one of the most critical measures of sustainability: human comfort.



New thermal comfort functionality gives AEC and MEP professionals the ability to help ensure the comfort, productivity and health of the people who will use their buildings.

such factors as radiant temperature, clothing of occupants, activity levels and speed of air circulation.

Thermal comfort is assessed by measures called predicted mean vote (PMV) and percent persons dissatisfied (PPD), which can then be used to make design adjustments. This gives AEC and MEP professionals the ability to help ensure the comfort, productivity and health of the people who will use their buildings.



When smoke gets in your eyes

The new smoke visualization component helps designers meet National Fire Protection Association (NFPA) guidelines for removing smoke from buildings, especially atria and non-traditional spaces. It also takes into account efficiency and cost-effectiveness, so designers can meet building codes while optimizing make-up air (MUA) systems and reducing equipment sizes.

Smoke simulation within CFdesign generates visualizations that characterize the visibility of lighted exit signs within a smoke-filled environment. These simulations take into account such factors as the materials that are burning and combustion rates. Transient studies can be run to examine the rate of smoke build-up within a space as well as the effect of turning on exhaust fans after the fire starts.

"We incorporated this set of simulation tools in response to feedback from the user community," says Parker Wright, CFdesign industry segment manager for AEC. "These capabilities further expand the set of simulation tools that empower architects and mechanical engineers committed to designing safer, more comfortable and energy-efficient buildings."

Smoke control systems can be examined in atriums and other spaces to ensure the smoke layer remains above the occupied zone during egress. Insights gained from simulation allow designers to optimize vent, exhaust fan, and make-up air systems for meeting safety, cost and aesthetic requirements.

Upfront CFD resources

The CFdesign web site
Upfront CFD product capabilities, problem-solving, customers, applications and case briefs related to AEC and MEP.

upfrontCFD.com community web site
Technical articles, case studies, videos, opinions and surveys from the only site dedicated exclusively to upfront CFD.

***AEC Magazine* on Revit integration**
Article in *AEC Magazine* about integration between Autodesk Revit and CFdesign.

***Sustainable Facility* Magazine on Yale University**
Article on the use of upfront CFD to remodel Yale University labs for greater energy efficiency.

***AEC Magazine* on Granary Wharf airflow**
Article on using simulation to ensure optimal air flow and smoke removal in a heavily used parking garage.

***Desktop Engineering* Magazine on meeting EPA rules**
Article on how Severstal NA used upfront CFD to ensure emissions control performance of a new casthouse design.