What the innovation is:
Rapid prototyping of structural systems. The Structural Genome System (SGS) is a combination of customized databases, customized object based programs, and off the shelf software. The key ingredient in the proper functioning of the SGS is the knowledge captured in it, and the synthesis of all these various requirements into one compact and easy to use object. The ability to capture the essence or what we call "The Object Genome" or genetic code of systems like this into a program that is compact and can be adjusted and refined over time, is a knowledge that we feel is unique to AEC professionals. The system connects that knowledge with a pro-gram that can replicate and be used as a tool and increase the value of what we have to offer the industry.

SGS uses a database of rules that define the structural system as well as set the rules for factors such as local building codes. A programming script defines those rules and relationships and then creates a three dimen-sional model based on these rules. The rules driving the system are relational. One rule can affect how another part of the system functions. The entire object is a compact 45K file, yet it can build an infinite variation of structures.

Why is it innovative?
SGS was conceived as a tool to help architects use structural rules to design projects such as aircraft hangars. In the traditional design process, a project requires input and information from many sources. Much of this data is repetitive and some of it such as structural rules can be dynamic. For example an aircraft hangar needs to meet certain size requirements for a particular type of aircraft. These requirements vary based on location, user, and structural codes.

The logic embedded into the SGS system allows the user to design with confidence knowing that the rules and logic are being followed. This process is a great timesaver and the ultimate quality control tool for designers.

SGS captures all the rules related to the construction and design of hangar systems. The user can "stretch" the object over an aircraft to visually make it fit within the space and the SGS recalculates all the components re-quired to achieve the desired configuration. The result is that it is a tool that can be used to quickly design a large number of hangars or similar structures and also study "what if" scenarios.

In addition to being a three dimensional visualization tool, SGS is a 3D calculator. As the designer stretches the hangar out over a plane, the focus of the task for the designer is to make the plane fit into the requirement. In the background the SGS system can track all the components necessary to build that hangar based on the designers input. The end result is that SGS can be used as a design tool as well as a calculation and reporting tool for manufacturing of the components.

What is changed or replaced:
SGS was not conceived as a means to eliminate structural analysis. Its intent is to get as close as possible to the actual final design, based on actual rules. This system allows the user to input variables that define the re-quired function, such as type of aircraft, location, use, support facilities, and building code. In the AEC world when we hear those types of variables, a professional with experience can visualize the result in his mind and then either document it or instruct a junior person to draft the result. The problem with this traditional "gut feel-ing" process is that it cannot be easily replicated if the person with that "knowledge" is not available. Meanwhile, as the project gets complex, the potential for error increases. The strength of the SGS is the synthesis of knowledge, software, databases, and processes into one decision making system.

Where and when it originated, has been used, or is expected to be used in the future:
SGS is one set of tools of the Object Genome System that defines structures and design assemblies. SGS has been used in design charrettes for the US Government. A team of designers used this tool for a meeting and adjusted the design requirements in real time based on client requirements. It is also the basis for other pro-grams and tools developed for manufacturers of building products. The potential for systems like this is limitless. There is much inefficiency in systems being used in the design and construction process, and with new technologies and processes many of these processes can be streamlined.

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Structural Genome System ™ (SGS)
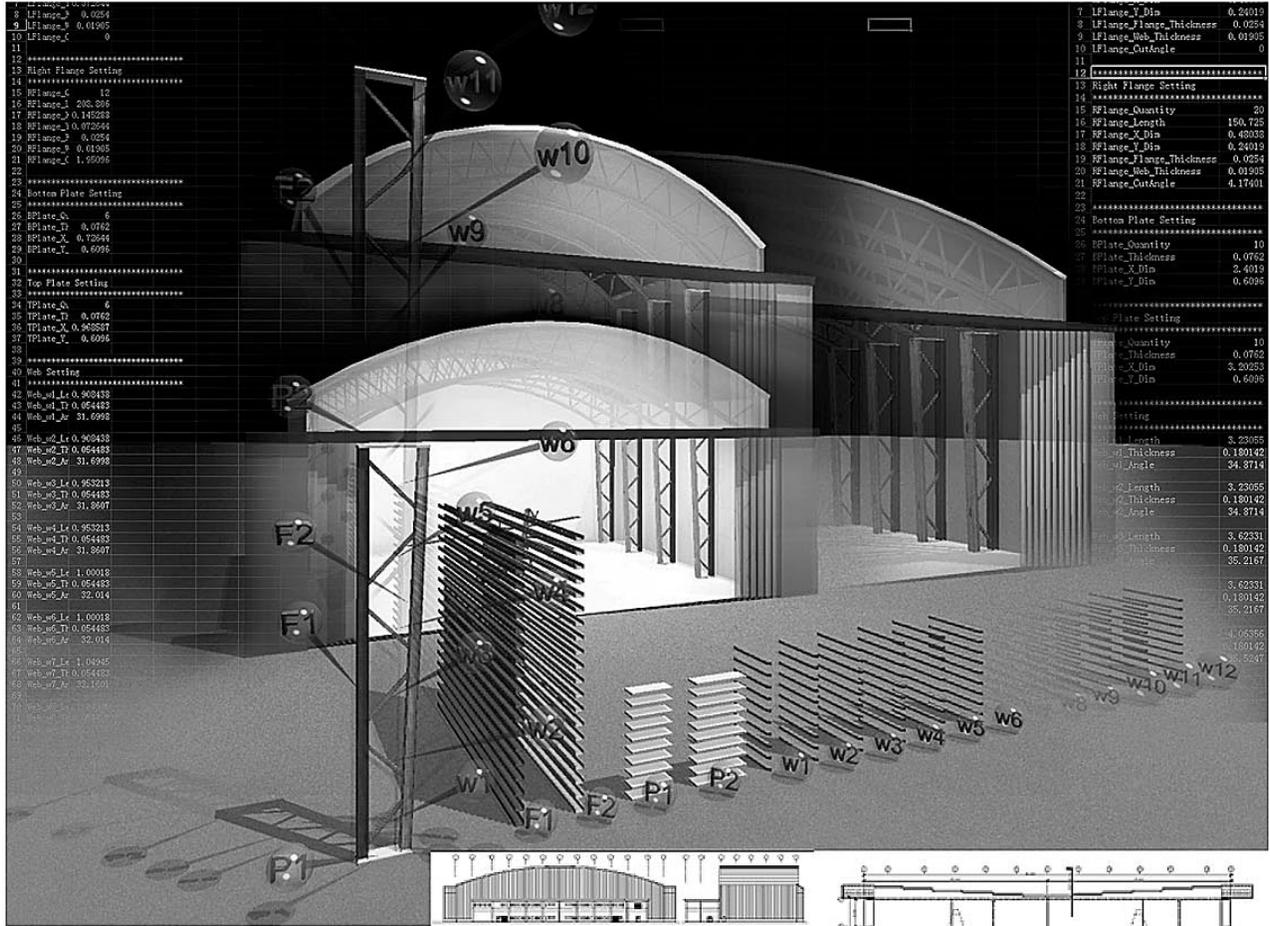
SGS is 45K and generates infinite variations. This image illustrates some of the variations and output of data and components based on user input.
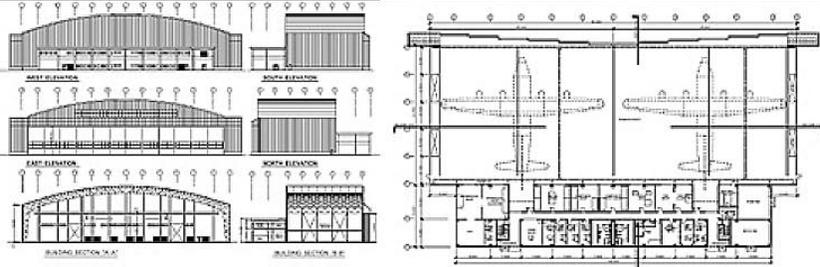
Plans and Elevations Generated from SGS

SGS Database Tracks All Components

SGS In Use During Design Charrette