

# ...And this seat is just right

As off-highway vehicles evolve, seating companies are developing and redesigning their technologies to ensure operator comfort in any working condition.

By Sara Jensen

As vehicle operators continue to spend more time in their machines, choosing a comfortable seat is becoming just as important to an OEM's design process as choosing the right gauges or displays. To help OEMs continue to provide the best seat for equipment operators, seat companies are constantly developing new seats to meet changing operator comfort needs.

Ron Mock, Director of Market Intelligence at Sears Mfg. Co. (Sears), says the company is designing new things all the time. From

large projects designing new cushion technology to smaller redesigns such as making wider and longer armrests, the company is always working on ways to keep operators comfortable.

## Combatting NVH

One of the biggest factors affecting operator comfort is the combination of noise, vibration

and harshness (NVH) caused by the various systems used in mobile off-road equipment and the terrain those vehicles drive over. Seat manufacturers attempt to combat NVH in a number of ways, one of them being the suspension system built into the seat.

Two commonly used suspension systems in seat design are mechanical and pneumatic

suspension. Mechanical suspensions use coil springs as well as energy-damping shock absorbers to provide a smooth ride similar to that of a passenger car. Meanwhile pneumatic suspension systems employ air springs which have a variable spring rate.

Active air and semi-active air suspension systems are two of the pneumatic offerings

from Sears. Designed with John Deere and Co., the active suspension uses the tractor's hydraulics to help alleviate vibrations. Speed sensitivity was built into the suspension system as well, so no matter how fast or slow the vehicle is going, the suspension system will keep the operator comfortable.

The semi-active suspension, according to Mock, is an electromagnetic damping system. An electronic controller sends a variable electric signal to the semi-active shock absorber as the suspension system travels up or down. This electric signal causes the shock absorber to create a softer or firmer ride dependent upon vibration inputs.

Iowa Export-Import's full adjustment seat with suspension which includes weight and three-position height adjustment.



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Sears now has a heavy-duty version of its semi-active suspension called the VRS 3. Designed for vehicles with extreme ride and vibration characteristics, the suspension has a 3 in. longer stroke, which "gives us a better

## Operator Environment

BOTH IMAGES COURTESY OF SEARS MFG. CO.



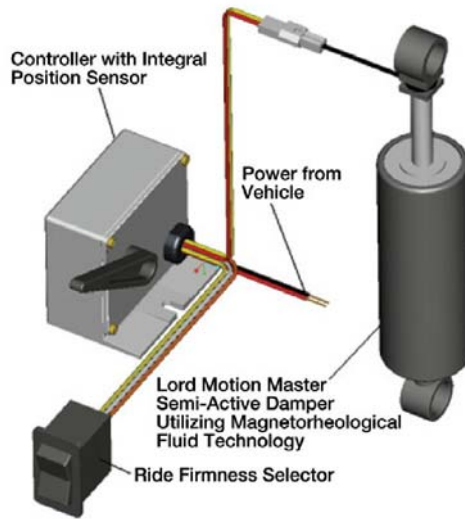
A diagram of Sears' semi-active seat suspension system which helps dampen the vibrations of heavy-duty vehicles.

isolation of vibration" says Mock. Stroke refers to the travel of a suspension system, such as up and down.

### Comfort features

Along with suspension systems, seat manufacturers offer a number of comfort features to ensure a more pleasant seating experience. Add-ons such as adjustable armrests, headrests, cushion heaters or height-adjustable seat risers provide vehicle operators with more comfort for their long workdays.

David Winkels, Senior Vice President, and Brent Clark, OEM Sales Director at the Seating Solutions division of Iowa Export-Import/Global Solutions (IEI) say the company is continually working to update its seats and seat options to enhance operator comfort. This is why the company not only offers components such as adjustable armrests or lumbar support as add-



The controller in Sears' semi-active suspension system creates a softer or firmer ride based on vibration inputs.

on options but as standard features, as well. Seats like IEI's premium high back seat have models which come standard with adjustable armrests, adjustable lumbar support, seat contouring and a taller seat back, which provides support without restricting the user's vision while operating the vehicle.

For its full adjustment seat with suspension, IEI includes a seat back that can be adjusted backward 28 degrees and forward 90 degrees. Weight adjustment and three position height adjustment are also included as part of the seat's comfort features. Since a vehicle can often have a different user every day, adjustable components such as these allow users to tailor the seat to their individual comfort needs.

### Operator cool-down

One aspect of comfort often overlooked is body temperature. Vehicle cabs can get warm quickly and OEM-installed HVAC systems can only do so much to keep operators cool and dry while sitting in the same seat all day. With this in mind, one German-based seat company designed an active carbon layer into its fabric seat cushion to help draw perspiration from the body then expels it out the front of the seat cushion as well as the top of the backrest cushion.

Sears also offers a seat cushion technology to keep operators comfortable. Cellular foam in the cushion has cutouts into which small fans are positioned. Hooked up to a motor, the fans push air out through the foam and seat cover. "As you're sitting, you have air blowing around you," to help take away perspiration, says Mock.

### Choosing the right seat

With so many available features, selecting a seat for a vehicle can be an overwhelming experience for any OEM. Features such as armrests, backrests and lumbar support always sound like great options, but will they be the right fit for a vehicle's eventual end user? This is why companies like Sears and IEI work directly with OEMs to help them choose or design the right seat for their specific application.

Winkels and Clark say working in tandem with an OEM enables IEI to modify or create

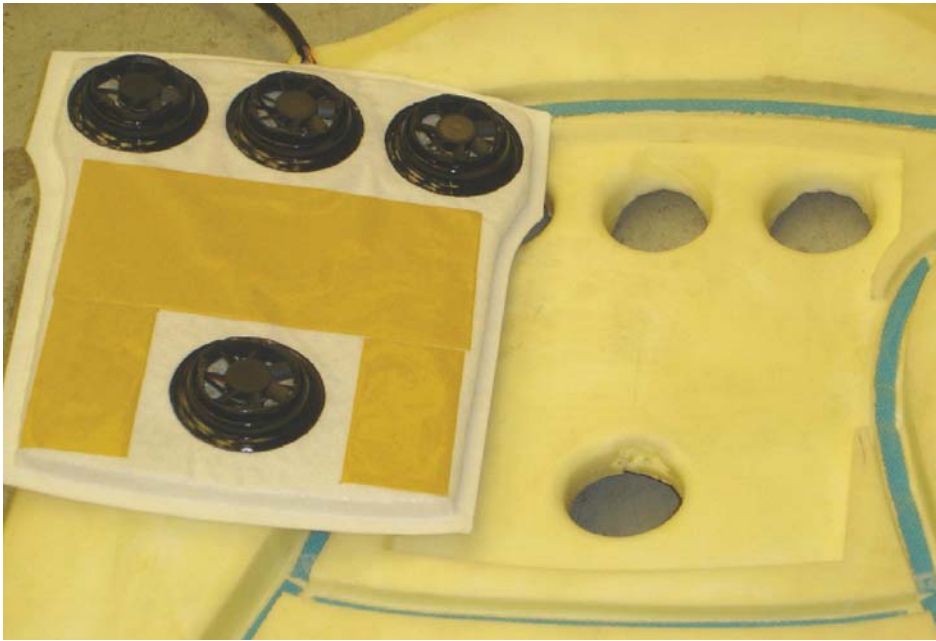
a whole new seat to match the exact comfort needs for a specific vehicle. It provides a more efficient working relationship by enabling the development of a seat with the appropriate features and dimensional parameters, as well as for the intended purpose of those features, they say.

Sears' Mock agrees that working directly with an OEM can help ensure the right seat is chosen for the vehicle being designed. "Working with the OEM helps us maintain our customer relationships," says Mock. "[Working with the OEM] provides us good customer feedback and continuous voice of the customer," enabling Sears to design and tailor its seats to customers' specific requirements.



The premium high back seat from IEI offers comfort to vehicle operators via three-position lumbar support. IOWA EXPORT-IMPORT

## Operator Environment



Sears' seat cushion technology utilizes fans in the cushion to push air through the foam and seat cover to keep vehicle operators cool.

SEARS MFG. CO.

Another way Sears helps OEMs choose the right seat is through utilization of the company's six-axis ride simulator. A data acquisition machine is hooked up to a vehicle's cab and seat to collect inputs from the actual ride of the vehicle. The information is then used to create a computer generation of the exact ride of the vehicle and the seat's performance.

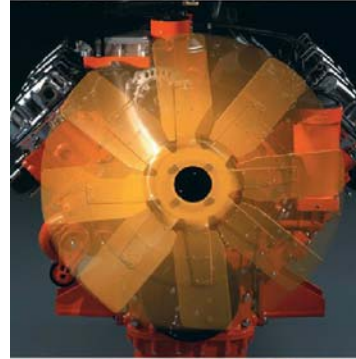
This data "allows us to fine tune the suspension," says Mock, and "do different spring rates within the suspension in order to make it ride for that particular vehicle." Mock also notes that the

ride simulator is "man rated," enabling an actual person to sit in the seat and tell the company how his or her comfort was affected by the seat.

### Design challenges

Beyond operator comfort, there are a number of other factors that must be kept in mind when designing a seat. Things like safety regulations and vehicle design can impact, and often cause challenges for, seating designs.

Available design space in the cab is becoming a more prevalent issue due to the new Tier 4 engines



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## Sears' LX Concept Seat

Several years ago, Sears Mfg. put together a seat that felt embodied where the seating industry was going. Automatic armrest movements, power slides, power swivel and power lumbers were all designed to make the LX Concept Seat a truly electronic seat. What sets the concept seat apart though is its incorporation of tractor controls into the seat.

On the left armrest of the seat are the seat controls as fore and aft adjustment, semi-active suspension adjustment (soft, medium or firm) and height adjustment. Meanwhile the right armrest houses the tractor controls. These include auto swivel, throttle and hydraulic controls. Incorporating so many controls into the seat itself not only enhances comfort and ease of use but helps to address the challenge of limited cab space.

The seat also includes other high-end seat features such as leather upholstery, an integrated adjustable upper back rest and seat cushions that are both heated and ventilated.

Though it hasn't been put into practical use yet, Mock says, having the LX Concept Seat enables Sears to show what technologies the company is capable of creating as well as "what we think the future might be."



Sear's LX Concept Seat is fully electronic, incorporating both seat and tractor controls in the armrests.  
SEARS MFG. CO.

which demand more under-hood space, affecting the cabin size.

Vehicle controls within the cab are another large part of the problem because some applications, such as agricultural, can require up to five or six control consoles. "We have to be able to fit their consoles to our seats," says Mock, "and trying to put that in the cab, making sure you can swivel and isolate properly" can be

difficult. Mock notes that vehicles with bigger viewing windows are contributing to limited cab space as well.

## Operator Safety

There are ISO and SAE safety standards for restraint systems each seat must meet as well as ride standards for each individual machine. Mock notes that standards for seats in agricul-

ture are different from those used in construction equipment, so seat companies must be mindful of a vehicle's application when designing a product. Standards also vary across the globe; the European Union's Physical Agents (Vibration)

Directive regulates how much vibration a vehicle operator can handle. Mock says technologies like Sears' semi-active suspension were designed and continue to be updated for vibrational standards such as the EU's.

One way IEI has been meeting the challenge of keeping vehicle operators safe is by designing its seats to accept an operator presence switch, or safety switch. According to Clark, the switch senses the presence of the operator as the vehicle is moving. If the vehicle tips or causes the operator to fall out of the seat, the switch detects this and shuts down the engine. This feature generally accompanies seats used in lawn and garden or turf applications where roll-overs are more common, but the vehicle has no cab or ROPS to protect the operator.

Through continuous seat design development and a variety of available seating options, companies like Sears, IEI and others are helping to keep vehicle operators safe and comfortable in any working condition. ■

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