Advances in wireless communications and mobile computing have turned today’s squad car into a fully functional office on wheels. Unfortunately, officers manning the squad-car-turned-office often discover that the benefits of mobility come at the expense of comfort and performance — and sometimes even health and safety.

At the heart of the problem is a disregard for ergonomics. Unlike the typical office or work cubicle — environments that have been shaped by decades of ergonomics research and development — the mobile office has, until recently, been largely neglected as far as ensuring the comfort of vehicle-bound workers. To the great relief of the hundreds of thousands of patrol officers across the United States who spend much of their shifts behind the wheel, the principles of ergonomics are finally beginning to be applied to the mobile workplace.

“Mobile Computing Ergonomics” is part two of a three-part series that presents vital information for the proper selection of mobile computer mounts in police vehicles. The final installment, addressing mobile computing mounting system reliability, will appear in an upcoming issue.
**Mobile Computing Especially Challenging for Officers**

Compared to the squad car’s assemblage of communications, warning, and mobile computing equipment, the typical civilian office desk is a truly bare environment. With so much more gear with which an officer must interface — often with great speed — the importance of optimizing ergonomic placement of important equipment, vital controls, and creature comforts is obvious.

The typical driver interacts with only about seven controls (shifter, steering wheel, three pedals, turn signals, horn). During aggressive driving a police officer is required to interact with three to four times the number of devices, including all of the “traditional” input devices already mentioned, plus light bar switches, multiple radios, computers, radar, and video systems. All of this interaction occurs under conditions that would normally stretch an officer’s abilities, even without the unique in-cabin challenges.

**Ergonomic Issues Affect Comfort and Performance**

Ergonomic principles are currently being employed to address several issues related to working within the confines of a squad car.

**Eye Strain** — Eye strain is caused by poorly lit mobile computing solutions. In contrast to the well-lit offices most of us are accustomed to, the squad car work environment provides multiple illumination challenges. During certain times of the day, for example, bright outdoor conditions can make it difficult to see the computer’s screen. Eye strain can also result from screen vibration caused by an unstable mount. Attempting to focus on a computer screen that vibrates while the vehicle is in motion can sometimes trigger migraines.

**Night Blindness** — Darkness can make it difficult to see the keyboard at night. Screen brightness, on the other hand, can adversely affect an officer’s natural ability to see in darkness and can greatly impact his or her situational awareness.

**Back Strain** — By far, one of the most common complaints related to poor mobile office ergonomics is user back fatigue. The stretching, twisting, and turning associated with improper placement of the screen and keyboard can make it difficult to see the computer’s screen. Eye strain can also result from screen vibration caused by an unstable mount. Attempting to focus on a computer screen that vibrates while the vehicle is in motion can sometimes trigger migraines.

**Wrist Strain** — Another common ergonomic hazard associated with both stationary and mobile computing is that of wrist strain. A glance at the pages devoted to supports, pillows, rests, cushions, and other wrist-related devices found in just about any office supply catalog provides convincing evidence of the importance placed on proper wrist alignment when using a keyboard. Most of the available wrist aids, however, are not designed to function in the mobile environment.

**Discomfort and Injury Are Not the Only Consequences**

Although the pain and discomfort associated with poor squad car ergonomics are significant problems in and of themselves, ergonomic deficiencies can result in another, equally serious consequence — typing errors. At first blush, this may seem like a trivial matter. But when you consider the frequency with which court cases are dismissed because of simple clerical errors, the importance of providing an optimized work environment becomes even more obvious.

Job satisfaction and productivity are intimately related to how comfortable a worker is when performing his or her duties. When deploying a mounting solution fleet-wide, simple things like access to cup holders and availability of armrests can influence user acceptance of the equipment, and can greatly affect the daily productivity of the officers. Too often, thousands of dollars are invested in a vehicle in the form of computers, while mounting and usability issues are totally ignored. It doesn’t make sense to let a lack of cup holders or difficulty reaching microphones undermine a high-dollar project when these minor — but important — issues can be addressed so easily.

User evaluations can help you identify and assess any ergonomic traps before you upfit your entire fleet. Once you have successfully addressed officers’ concerns, it’s important to make EVERY vehicle as consistent as possible so that officers can easily operate any fleet vehicle without concern for locating critical interfaces when called to action.
A Systems Approach to Mobile Computing Ergonomics

Since the mid-1990s, when the issue of workplace-related musculoskeletal disorders (MSD) first gained widespread attention, employers nationwide have invested billions of dollars to ensure the health of their workers. For office workers, this has meant investments in furniture and computer peripherals that are ergonomically designed to prevent workplace-related injuries.

For the mobile worker, ergonomic solutions primarily take the form of devices designed to properly position computers, peripherals, and other equipment to avoid the types of problems described previously. From a patrol officer’s perspective, an ergonomic mobile computing solution should contain the following elements:

**Tubes/Poles** – Tubes should be adjustable, allowing the solution to be set to an ideal height. Ideally, the solution must clear the center console and provide enough clearance for the officer to easily access the shift lever, radios, or light switches that are located under the docking station. The tube should also be as thick as possible to minimize vibration, reducing the likelihood of eye strain.

**Swing Arms** – These devices allow an officer to position the computer in several locations throughout the cab. While driving, the laptop should be positioned as close to the centerline of the vehicle as possible to avoid possible injury. During a stop or while completing a report, the laptop should be positioned as close to the driver as possible to improve comfort, and reduce the risk of injury or key-stroke mistakes. A swing arm that could come in contact with an occupant must lock into place securely to avoid possible injury during aggressive maneuvers.

**Radios** – Radios should be mounted in a way that allows easy access to critical switches. Always give priority to the radios that are accessed most frequently and mount them in a way that allows the officer to reach them without obstruction. Also ensure that all members of the department (both short and tall) can see the channel indicator.

**Screen** – Screens must be positioned as close to the horizon as possible to improve situational awareness, reduce neck strain, and improve daytime visibility. The brighter the better, but be sure to educate your officers on how to dim the screen for nighttime use. Most laptops offer shortcut commands to decrease screen brightness and improve the officer’s night vision.

If multiple screens are present (Laptop, in-car video, infrared cameras, etc.) ensure that priority positioning is given to the device most frequently used – typically the laptop.

**Keyboards** – Critical for data entry, keyboards must tilt to provide wrist relief during data entry. While using a laptop mount, the entire laptop will tilt, allowing the user to position it at an ideal angle. If a separate keyboard is used, it, too, should utilize a tilt mechanism. Never allow an external keyboard to be loosely stowed in the cab, as it could become a projectile during an accident.

**Microphones** – These devices should be mounted within easy reach of the officer. Once again, priority should be given to the microphone that is most frequently used. Keep in mind that the reach path to the microphone should be unobstructed as this is a critical movement during times of duress and call-to-action.

**Lightbar Switches** – Lightbar switches and controls for sirens, alarms, and other critical components should also be positioned to allow officers to activate them easily and comfortably during a pursuit.

**Printer Mounts** – Printer mounts should hold the peripheral securely and allow the officer to easily access printouts. Just as with laptops, the printer should be as close as possible to the centerline of the vehicle to avoid airbags, or it should be mounted in the passenger footwell area. A number of companies offer armrest printer mounts which not only provide a great mounting location, but also enhance officer comfort.

**Storage and Miscellaneous** – Traditional office workers don’t worry about where to store their pens or where to place their morning coffee. Too often, creature comforts are forgotten in the mobile world. A good storage console will offer cup holders and a place to store tissue, pencils, and paper. Don’t underestimate the impacts these items have on worker comfort and job satisfaction.

**Passenger Comfort** – Ergonomics in the mobile office do not apply only to the driver. Often, the solution used to create a proper ergonomic environment for the driver negatively impacts the passenger. If the solution interferes with passenger legroom, it could force the passenger into an awkward or uncomfortable position — one that is potentially dangerous in a crash. If the passenger seat will be occupied, special consideration must be given to how the mobile computing system’s components, especially the mounting base and tube, will affect the passenger.
The Importance of System Design and Installation

Regardless of the mobile computing mounting solution you select to enhance squad car ergonomics, it is important to remember that under no circumstances should officer safety be compromised. A poorly made ergonomic solution that poses a potential hazard is worse than no solution at all. Make certain that the solution is solidly constructed from quality materials, and be sure to install it according to the manufacturer’s instructions.

If you can get your hands on samples of the different mounts under consideration, compare them side by side, feature by feature. Note the thickness of the material, the quality of the welds, and other fabrication details. The presence of any sharp edges, rough surfaces, or other defect should send up a warning flag — if you see obvious signs of poor quality, there’s no telling what other problems may be lurking beneath the surface.

Finally, solicit the input of your officers. Have officers of various statures try out the proposed solution and assess it on the basis of functionality and comfort. To help ensure that all users rate the mounting solution according to the same criteria, use a standardized evaluation form. This will prove not only more convenient for the officers, but it will help you quickly identify any areas of potential concern.

Some day — hopefully sooner, rather than later — patrol officers will be able to take computing ergonomics for granted, just like the rest of us. But until that day arrives, the officers’ health, comfort, and safety rest in the hands of the managers who supervise the upfitting of their vehicles. The more you know about the equipment options available to you, the better prepared you will be to fulfill the role of ergonomic guardian.

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MSU Police Recognize Value of Ergonomics

The Michigan State University (MSU) Police Department has experienced both the good and the bad of mobile computing ergonomics. Previously, the MSU Police fleet of old-generation Chevy Tahoes was upfitted with tablet PCs and external keyboards mounted on swing arms. Radios were installed vertically along a center console and the radar was mounted on the dashboard. Light controls were positioned above the keyboard, and a camera monitor sat along the floorboard.

The highly unergonomic system generated plenty of complaints. Criticisms ranged from difficulty reaching climate controls and cup holders, to keyboards that would swing around and hit the driver’s hands while turning. The upfacing radios also presented a problem, as they forced the officer to direct attention downward in order to see the display.

The new setup, installed in the department’s fleet of 2008 Chevy Tahoes, features a horizontal radio mount console, a docking station mounted to a positive-locking swing arm that rotates and extends to meet the driver, light switches mounted above the OEM radio, and a padded armrest that incorporates a printer.

“Before we installed the new Havis docking solutions, the keyboard would swing freely during maneuvers, causing a distraction. Now the equipment is mounted in a way that is easily reached, but lockable. It’s ergonomics without sacrifice,” said Detective Robert Clugston, the MSU Police Department’s mobile computing point person.

In contrast to the old system, all switches are now easily accessible, with the most critical switches (radar, lightbar, primary radio) placed highest in the cab. The keyboard is backlit to avoid night blindness issues. Cup holders are conveniently placed, and an integral storage bin keeps pens and paper organized and accessible. System stability has also been greatly improved, resulting in less vibration.

“While our existing solutions required officers to access controls in many locations, the new solution places switches, radios, and the laptop close to the driver’s line of sight, greatly improving situational awareness,” Detective Clugston adds.