### Objective

- The objective of this research was to examine the impact of IVIS (in-vehicle information systems) interactions on the driver’s cognitive workload.

### Methods

- The selected tasks and experimental structure were designed to extend prior work using embedded vehicle systems:
  - Evaluated cognitive demands of 10 2015 vehicles’ IVIS
    - 257 subjects participated; 127 males and 130 females, with an average age of 44 and divided into three age categories: young (21-34), middle aged (35-53) and old (54-70).
    - 6 distinct tasks were given to participants utilizing the vehicles’ unique voice activated information system – including contact calling, number dialing, and music selection while they were driving.
    - Post-test evaluation captured participants’ results after a week of practice time with the tasks in the research vehicle.
    - Cognitive workload was assessed on a 5-point scale, where 1 represented just driving (no interaction with IVIS) and 5 represented the workload associated with the OSPAN task (mentally challenging math and memory tasks).

### Key Findings

**Major Findings:**

- (IVIS) use is associated with moderate to high levels of cognitive distraction for the driver.
  - Overall workload ratings associated with IVIS interactions ranged from 2.37 to 4.58, which depicts a moderate to high level of cognitive workload – while drivers were at no time required to take their eyes off the road or hands off the wheel.

#### 2015 Vehicles and Systems Tested

<table>
<thead>
<tr>
<th>Make</th>
<th>Model</th>
<th>IVIS</th>
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<tbody>
<tr>
<td>Chrysler</td>
<td>200c</td>
<td>Uconnect</td>
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<td>Chevy</td>
<td>Malibu</td>
<td>MyLink</td>
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<tr>
<td>Chevy</td>
<td>Equinox</td>
<td>MyLink</td>
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<td>Mazda</td>
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<td>Connect</td>
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<td>Ford</td>
<td>Taurus</td>
<td>MyFord Touch</td>
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<td>Sonata</td>
<td>Blue Link</td>
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<td>NissanConnect</td>
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<td>Volkswagen</td>
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<td>CarNet</td>
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</table>
Key Findings (continued)

- Practice doesn’t eliminate the cognitive distraction caused by IVIS interactions.
  - Practice improved IVIS interactions slightly, but intuitiveness and complexity ratings were not affected as a result of practice.

- Older drivers experience a higher level of cognitive distraction with IVIS interactions, compared to younger and middle-aged drivers.
  - Older adults also rated IVIS interactions as more complex than the two younger groups.

- There were considerable differences in the cognitive workload of the different IVIS systems
  - Chevy Equinox MyLink had the lowest rating, while the Mazda 6’s Connect had the highest rating on the cognitive workload scale.
  - Robust, intuitive systems with lower levels of complexity and shorter task durations result in less cognitive distraction.

- Cognitive distraction associated with task performance was surprisingly high
  - Serves as a warning that “hands-free” technologies can be very cognitively demanding.
  - Compared to our earlier research, many of the IVIS interactions appear to be significantly more demanding than typical cell phone conversations (rated 2.3 on the same scale).

- There were residual costs after IVIS interactions were over.
  - Just because a driver terminates a call or music selection doesn’t mean they are no longer impaired – impairment lingered up to 27 seconds after a task was completed.

For more information on this study and the AAA Foundation’s other traffic safety research and materials, please visit AAAFoundation.org.

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October 2015