



## **Display Trends Used in Passenger Cars**

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Automotive displays have always been important to convey information to the driver. But the importance of displays is increasing because they are integrated into the man-machine interface for both driving tasks and convenience/infotainment functions. TRG is focused on three display categories that will play an increasingly important role in insulating the driving tasks from distractions related to convenience and infotainment tasks:

- Driver information displays (DID) are replacing traditional analog instrument displays in front of the driver. DIDs will be used by many of the auto's electronic system such as telematics, navigation and the traditional driving information functions.
- Multifunction head-units are located in the auto's center area and are used by telematics, navigation, music systems and comfort control systems.
- Head-Up Displays (HUD) will be used for critical driving information and is projected on the windshield in front of the driver. HUDs are used for auto operational parameters, night vision, and navigation directions.

The following is a quick overview of key automotive display trends.

### **Multifunction Display Trends**

The multifunction head-unit display is the most popular display and is currently available for about 60% of U.S. models. However, since the availability is primarily options on luxury and high-end autos, the percentage of autos sold with a multifunction display is only slightly over 10% in 2006.

Today the display size is primarily 6.5 to 7 inches using color LCD technology. There is a strong trend towards 8 to 9-inch display for the luxury segment. Nearly 10% of autos with multifunction displays now offer an 8-inch or larger display. These large displays are also moving to the WVGA display format, which uses 800 by 640 pixels. Another important trend is increasing usage of LED backlighting to improve the display appearance.

Touch screen is used with many navigation systems and TRG estimates that over 50% of multifunction head-unit displays have a touch screen.

LCD is the dominant technology and will remain so in the next five years. Organic LED (OLED) and its many variants show potential for future usage. OLED's higher brightness, contrast and better viewing angle are needed in the automotive environment. However, the OLED technology

is still 3-5 years away from usage in multifunction head-unit displays. The limiting factors are high OLED cost and small OLED display size.

The key to long-term success in multifunction head-unit displays is the combination/integration with input technologies to improve the user interface for data input and function control. TRG believes the display needs to provide more information feedback to simplify the users' selection process. Such programmable feedback will improve the user interface.

### **Driver Information Display Trends**

The multifunction driver information display (DID) will eventually be standard on nearly all autos. It is not an if-question, but a question of when and how it will happen. Currently about 20% of U.S. auto models have a DID as option or standard equipment. TRG estimate that nearly 12% of autos sold in the U.S. in 2006 will have a DID.

The DID display size is usually 3.5 to 4-inches. TRG believes the size will increase over time, but it is unclear what sizes will be common.

LCD is the leading technology. OLED is a likely challenger in a few years. Since the DID size is smaller than the head-unit display, OLED is likely to first impact the DID segment. The DID resolution is likely to be similar to QVGA or 320 by 200 pixels. TRG believes it is important to use the main mobile device resolutions because the software and hardware interface infrastructure used by the mobile device industry can be leveraged.

TRG believes that the DID will be used for a variety of applications and the driver should be able to select what driver information should be displayed. Hence the interfaces and integration with other systems become an important design consideration.

### **Head-Up Display Trends**

HUD remains a niche market, but is likely to see considerable growth in the future. The growing importance of driver distraction issues will make HUD systems more desirable.

HUD technology has used a parabolic mirror with a mercury-based bulb, which generated a lot of heat and was too expensive for widespread use. Recent systems use LED as the light source and LCD as the content source and have many advantages over previous generations. The LED/LCD systems add colors and more resolution, which leads to more display content.

The need for a special front window will limit the growth of HUD systems. However, the technology used in the windshield is better understood and is easier to produce. Hence the outlook for HUD is improving and TRG forecasts that nearly 17% of U.S. autos sold in 2011 will have HUD.

HUD usage has similar characteristics to DID. TRG believes that the HUD will be used for a variety of applications and the driver should be able to select what driver information should be

projected on the front window. Hence the interfaces and integration with other systems become an important HUD design consideration.

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