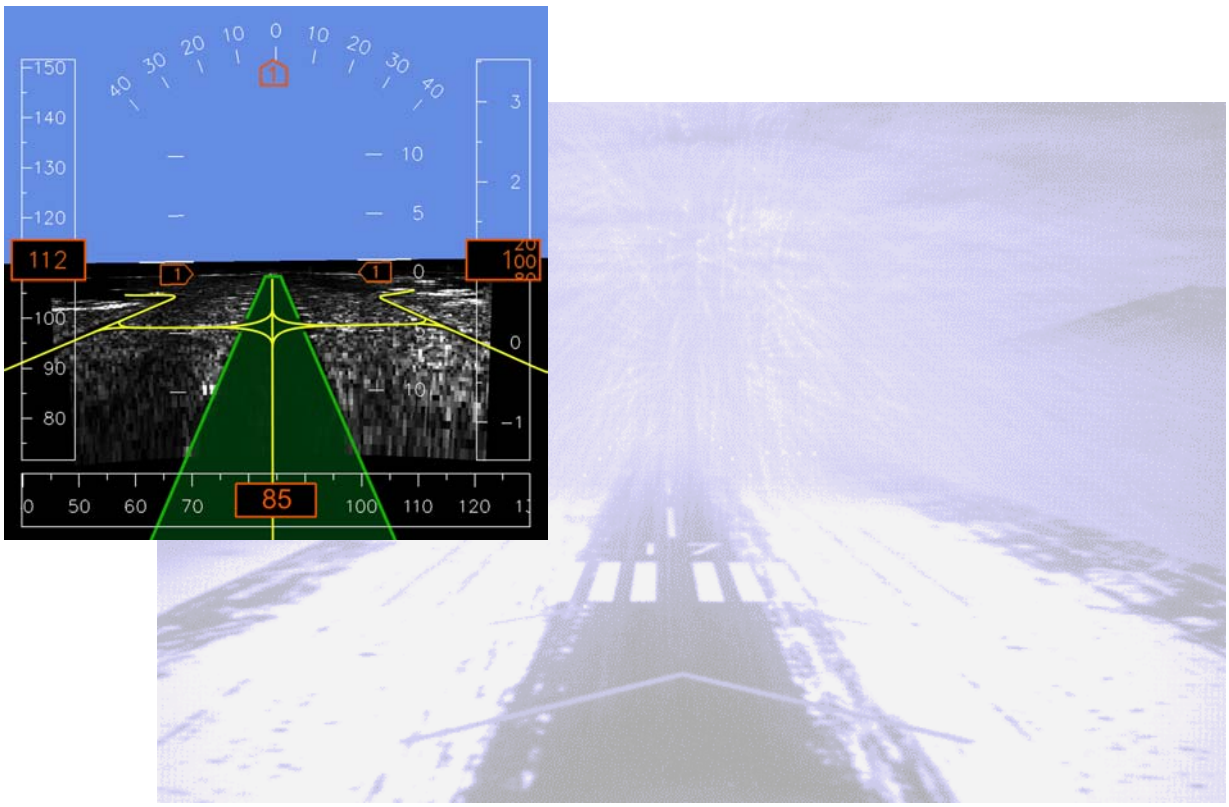
INSTITUTE OF FLIGHT GUIDANCE

EVS - Enhanced Vision Systems



Today's aircraft crews have to handle more and more complex situtations. Especially during approach, landing, take-off and taxiing the improvement of situation awareness can be regarded as a key task. Newly designed pilot assistance systems can aid the pilot and reduce his workload. In case of adverse weather conditions these systems can be augmented by synthetic vision as well as multispectral sensor vision. The intelligent combination of different visual information defines this prospering new field of aircraft guidance research, which is called Enhanced Vision Systems (EVS).

The development of EVS is an interdisciplinary task, which requires a wide spectrum of different technologies. The availability of new imaging on board-sensors, e.g. solid state infrared and radar, provide a real view through the darkness and adverse weather. High performance computer graphics systems are able to render synthetic images from terrain data bases using high precision navigation data. Data link technology brings the whole traffic situation into the cockpit. All these different data sets have to be combined and presented on a newly designed display, using modern head up or helmet mounted display technology.

The figure on top shows an example for the new generation of cockpit displays, which can be regarded as an augmentation of the primary flight display (PFD). The main task which has to be solved in the EVS research concerns image data fusion. The development of new methods for digital image processing and their combination with high speed computer graphics make it possible to extract complementary information from different imaging sources.

Figure: Enhanced Vision provides a clear view through adverse weather

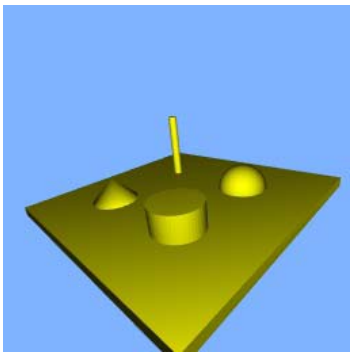
DLR

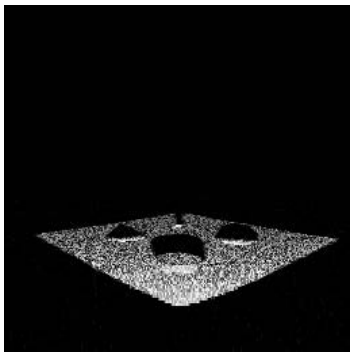
Beside the development of EVS concepts and algorithms DLR carries out flight tests as well as studies based on simulation.

A Dornier DO 228 aircraft has been equipped with a certified prototype of the HiVision radar developed by DaimlerChrysler Aerospace. Other imaging sensors such as an infra-red camera mounted on a stabilized platform are also available on-board. The Figure on the right shows the test aircraft on its maiden flight.

In addition, a „pilot-in-the-loop" EVS simulation environment has been built up. For a given aircraft status vector (position and attitude) and a given set of terrain data several real time sensor simulation tools generate virtual sensor images. Those images are fed into a data fusion processor. Depending on the implemented data fusion algorithms, sensor images are analyzed, interpreted and an EVS-display is generated. Furthermore, a datalink to ATC as input for EVS processing is simulated. The resulting enhanced vision display now can be evaluated by pilots flying virtual approaches in DLR's demonstration cockpit.

Within this environment the most interesting sensor simulation is the HiVision radar simulator. This tool simulates the image acquisition process of mm-wave radar systems. Most important features of this sophisticated tool are the real-time image update rate of 16 Hz, the standard hardware used for implementation (SGI-workstation) and the simple interface to standard terrain data bases as they are used for visual simulations. The Figures below show the difference between visual and radar images of the same scene. This example emphazises the challenging task of radar image processing and the indispensable usage of other visual information to interpret the image contents.





Figures left to right: artificial scene, simulated radar view

Figure top right :
DLR's DO 228 test aircraft with HiVision radar on its maiden flight

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