Virtual Display - Real Business

Hans Biverot, Lennart BM Svensson, Erik Dalén
Peter Runeborg, Andreas Duvmo, Bo Duvmo
Linus AB
Nettovägen 6, SE-175 88 Järfälla, Sweden
erda@linusdisplay.com, www.linusdisplay.com

ABSTRACT

The Linus display technology builds on a simple principle. A line display emits regular light to a vibrating mirror. The vibrating mirror unfolds an image in the eye. The viewer experiences an image in the thin air. When turning the head the viewer finds the picture remaining in one place. The linedisplay can be used in transport aircraft cockpits together with the ADS-B and VDL mode4, to give the pilot a situation awareness of the airport runway. Alternatively it can be used for cabin surveillance. The system also gives the possibility to be used in helicopters for search and rescue connected to a daylight-camera or infrared camera.

INTRODUCTION

The Linus linedisplay was first patented during 1991. The company Linus AB is a spin-off from SaabTech Electronics AB. It is focused on creating business opportunities for the many different applications that can be seen with the Linus linedisplay. Linus Aero AB has been established to exploit the first avionics application. This application is mend for the ADS-B and VDL mode4, arising the possibility to show a large virtual image of the airport runways in cockpit for the pilot. Several Linus demonstrators, both monochromatic and full color, have been built and tested mainly for military applications.

SYSTEM SETUP

Description of the Linus system

The Linus display shall not be regarded as a competitor to existing display techniques but as a complement with completely new applications. The Linus display is completely different from head-mounted displays as the Linus image is fixed in space and there is no need to supply a video signal to the observer's scanner glasses. In confined spaces such as in cockpits it is almost impossible to find space for large displays, however it is possible with Linus. A wide line transmitter, results in a large virtual image which results in an increased feeling of presence compared with looking at a reduced image.

One competing principle for creating images is the two-dimensional screens that consume the same area as they display. In the case of the classic CRT display there is also

considerable space consumption in depth also. Figure 1. The Linus display only needs the space of a thin line emitter. Figure 2

Fig.1 Two-dimensional ordinary CRT-display

Fig.2 One-dimensional linetransmitter-display

Three main different methods are used to produce visual information. In figures 3-5 these three methods are shown.

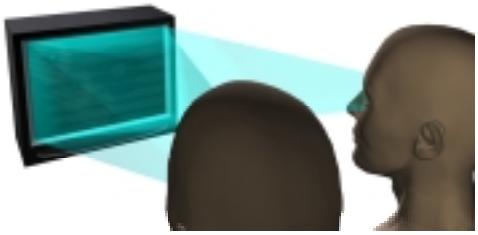

Fig.3 A panel display has a fixed image (CRT, LCD & Screen Projection)

Fig.4 Micro Display Images follow the head movements and may cause motion sickness

Fig.5 Linus is a "virtual panel display". As for the physical panel display, the image remains fixed in the room when the head moves

Principle of the Linus line-display

The Linus principle can be compared with the vertical deflection of a TV image being closed off so that the image collapses to a single horizontal line. All the image information remains, however, as all the TV lines are on top of each other. The TV set can therefore be greatly reduced in height which results in a saving of space.

The patented solution for constructing a 2-dimensional virtual visible image from the virtual 1-dimensional line transmitter image means that the observer uses an optical scanner which is placed in front of the eyes. Each TV line is thereby projected onto the retina by a small vertical shift in relation to the previous TV line as shown in figure 6. The eye's inertia enables the entire image to be perceived. An artist view of the personal Scanner Unit is shown in figure 7.

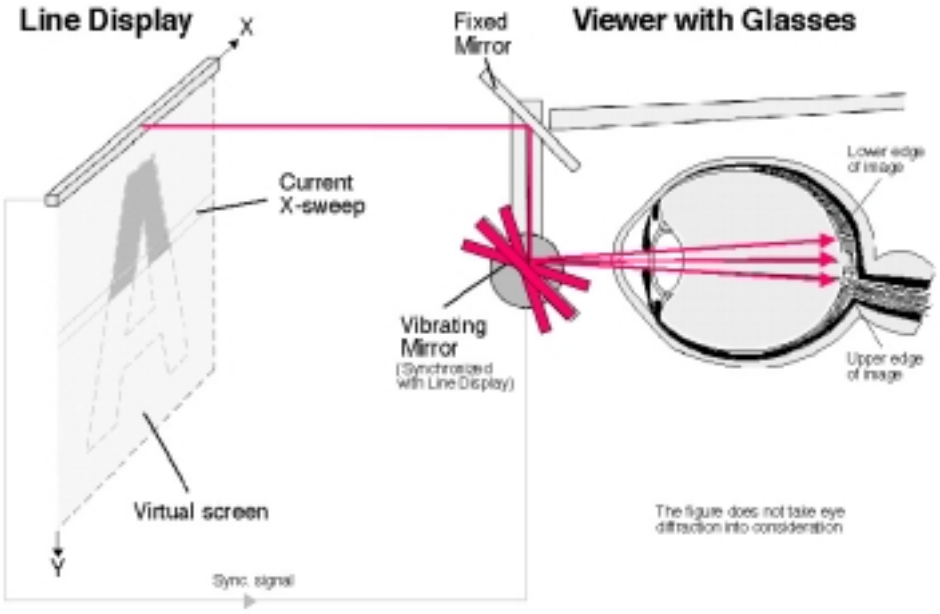

Fig. 6. The basic optical principle of the Linus system.

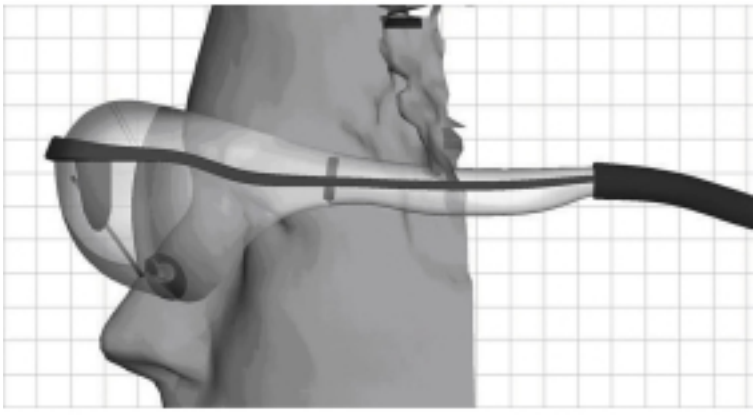

Fig. 7 Personal Scanner Unit (SU), artist view.

System description

The principle system structure is presented in figure 8. The system consists of three subsystems, named Video converter Unit (VU), Transmitter Unit (TU), and Scanning Unit (SU).

The Videoconverter Unit (VU) converts an incoming signal, analogue or digital video signal, to an analogue or a digital format that is proper for the Transmitter Unit (TU) to handle. The Video converter also holds a driver for the Scanning Unit's (SU) motor, AC-

power supply, DC/DC-converters, and EMG-filters. The Video converter Unit (VU) will also include controls for brightness, contrasts, and luminance.

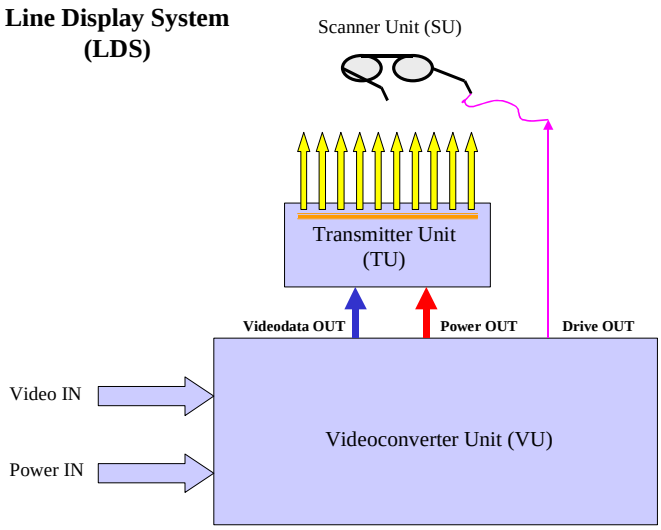

Fig. 8 Line Display System, principle block diagram of a cockpit display.

The Transmitter Unit (TU) shall be mounted on the cockpit panel. The optical line source of TU shall be visible to the pilot. The optical line shall contain and represent the whole information content of the virtual image presented to the pilot.

The Scanner Unit (SU) is a personal optical scanner device. It will reveal the virtual image for the pilot when used. It is electrically connected to the Video converter Unit (VU) via a cable. From the Video converter Unit (VU) the Scanning Unit (SU) receives its driving signal, which is synchronized to the video readout signal to the Transmitter Unit (TU).

SYSTEM APPLICATIONS

ADS-B VDLmode4 implementation

A typical cockpit installation is shown in figure 10. The line is preferably mounted slightly above the windshield. The user (pilot) is wearing his personal scanner unit (SU) glasses, whereby he is able to see the fixed line display image superposed onto the direct view as shown in figure 9. The see-through system does not restrict the lower part of his field of view, i.e. he will be able to see the flight head down instruments by just simply moving his eyes down while keeping his head straight. A system will be included to improve the contrast when looking at the display image during bright background conditions.

Fig. 9 Airport map shown with Linus display

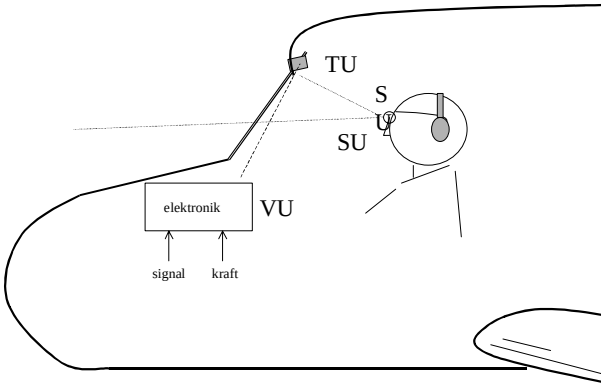

Fig. 10 Typical cockpit installation geometry. Virtual image as seen through the pilots scanner unit.

Search and Rescue

Transparent helicopter. Search and rescue (SAR), hang-load flying, and landing on ships are difficult to overview for the pilots. With Linus and cameras the pilot would be able to see through any part of the helicopter while looking in the right direction (figures 11 and 12). This would enhance the so important space awareness and control in a vehicle that can move in any direction.

Fig. 11 Line-display helicopter installation.

Fig. 12 Virtual Linus image as the helicopter pilot will see it.

Cabin safety

Cabin Surveillance from flight deck. The 11 September has actualized the question of being able to see what is going on in the cabin from flight deck. Linus is the only Display that can offer full cabin overview at a glance as shown in figures 13 and 14.

Fig 13.Example of Line Display System integrated into cockpit panel in

Fig 14. Line-display in cockpit showing virtual images from cabin

PROPOSED TEST AND EVALUATION

Aircraft

The Swedish CAA has promised to make their Beachcraft available for testing the Linusdisplay system.

Helicopter

Linus Aero AB is also in contact with operators in the Nordic sea who operates helicopters for offshore industry transportation. They are also interested to test the system.

Result

At this moment Linus Aero AB has presented a production and a supply chain for the Linus ADS-B VDL mode4 display, whereby the investors have approved the financing plan.

Discussion

The implementation of the Linus linedisplay depends on the introduction of ADS-B VDL mode4 system.

Mr. Erik Dalén is the President of Linus AB. Erik has a considerable experience of project management for high profile high cost projects, sales and marketing as well as production management. He is the great grand son of one of Sweden's greatest entrepreneurs of all times and Nobel-price winner Gustaf Dalén. He is a spitting image of his ancestor both in looks and in drive.
