3-D Fabricated Displays

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ABSTRACT

A high resolution, full field of view visual display is often the most expensive single component of a high fidelity simulation system. The design, development, integration, test, and other aspects of production of an extremely complex visual display which has to meet the performance requirement of a stringent training environment presents a variety of daunting engineering challenges.

The dramatic rise of additive manufacturing methods has made inroads into many areas of manufacturing. Rapid prototyping, custom tooling, distributed and rapid manufacturing of limited volume components are examples of current applications. The pace of the introduction of new technologies (materials, fabrication techniques, work volume size , speed, …) of additive manufacturing resemble that of the early computer industry.

The question is: How can this technology be applied to improving the manufacture of display systems? For example: 1) Reducing the overall cost, 2) Improving the capability of modifying an existing display system design, 3) Reducing the time and effort to provide the display, and 4) Lowering continuing maintenance costs?

It is certainly possible for additive manufacturing to radically transform the manufacture of complex display systems. To delve deeply into this issue each of the components of the display system will be examined and evaluated for its suitability for 3D manufacture. We are characterizing the major system components as: 1). The projection support structure, 2) The projectors, 3) The screen, 4) The cockpit and screen support platform, and 5) The support equipment (Alignment system, etc.).

We also will characterize what we believe are essential characteristics and limitations of each both the existing embodiment of the current display system manufacturing process and how we might envision it being implemented via additive manufacturing. This will allow us to see if additive manufacturing is appropriate and if it brings additional benefits.
An example of an essential characteristic is that the projector support structure is (often) made up of a large number of standardized metal components which must be laboriously integrated together by hand to fabricate the stands and structure which hold the display together. Or, for the screen, some manufacturers use custom tooling to create a large screen. Although this is an excellent approach to proving a highly reproducible product, the tooling represents a fixed cost which must be amortized and provides limited flexibility (since the tooling is a fixed size).

If additive manufacturing could provide some improvement in these, we might immediately a possibility of benefit.

An essential characteristic of additive manufacturing is that rather than being limited by existing molds or fixtures, the process is driven by model files which describe the object to be produced.

Once the model file exists, if a new requirement implies a different size or shape, the file can be modified and the process is potentially capable of producing the new object.

Additive manufacturing is changing the competitive landscape for many traditional manufacturing industries. As its precision, scope of materials available, workspace volume and other capabilities rapidly expand, disruptive change will impact many areas of technology. Display systems are not immune to this process.

BIO

Edward Quinn: Mr. Edward W. Quinn is a visual engineer working on both the Joint Strike Fighter and the F-15SA programs at Lockheed Martin. He is currently working on implementing advanced HMD systems and dual cockpit full field of view displays. He has also served as the lead for Lockheed in the Display Technology Working Group, used by other Lockheed Martin Akron programs to assist in initially defining and supporting visual requirements. At Lockheed he has been responsible for database development, simulation system design, image generator and display system selection and integration. He also served as an Adjunct Professor for 15 years at Kent State University (Computer Graphics, Image Processing, Pattern Recognition, Neural Networks, Data Structures, and Programming) as well as 5 years as an instructor in Computer Graphics at Case Western Reserve University.

Ed is named as the principal on five visual system patents and has other patents on which he is the principal.

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