# DIGITAL ARCHITECTURE FOR A COMPUTER BASED IMAGING SYSTEM

BY

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THESIS

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ABSTRACT

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There is a great need for a graphic simulation system used as a training device to take the place of actual flying. A good system will greatly reduce the cost of training men as well as cut down on casualties.

Several systems have been tried and are now in use. Among them are two that are worthy of more study. These are the CCTV or model board and the digital systems. Both have several disadvantages that create a need for a new system.

One such system is an optically based digitally processed system that combines the best features of two previous systems. This system uses charge-coupled-device memories that are digitally accessed by a microcomputer based system. The information from the CCD's is then processed and calculations are performed on it to transform it into a form that can be displayed on a cockpit-like screen. The system also allows for interaction between the pilot and itself.

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# I. REQUIREMENTS FOR A SIMULATION SYSTEM

Designing a graphic simulation system requires an initial set of guidelines or requirements for the system. Is the system going to be a visual or a radar system? Many of the requirements of both systems are the same although they are handled a bit differently.

The first consideration for the system should be the actual on-system time or flying time. The flying time requirement helps to decide the size of the data base and therefore the size of the memory for a system. Generally, the longer the on-system time, the greater the system's data base needs to be. In most systems, the data base and memory specify the design parameters for that system. This is true in most previous and proposed systems.

One of the foremost requirements of a good visual simulation system is that it resemble a real system very closely. This requires that the system change scenes quickly enough to approach an actual moving view and the resolution and other visual effects be similar to that of an actual view.

Since the human eye cannot discern movements much faster than 1/20 of a second, this timing can be used

as a benchmark for a simulation system design. In order to obtain the feeling of actual movements, the system should have a requirement of 30 frames every second allowing for people with faster reflexes and for those few cases where faster movements are needed (Beardsley 1975).

After the system's speed is defined, the criteria for the actual visual picture of the system should be outlined. There are many important aspects to consider, the first of which is the actual resolution of the system. Resolution in this sense refers to the fineness of detail. A useful system needs to have resolution of about 1 minute of arc which is normally the resolution of human vision (McGraw-Hill 1971, p. 389). This corresponds to a resolution of about two inches at a distance of 500 feet or 1/3,000 of the distance. Since most systems will consist of moving scenes and many items of interest will be much larger than that, we probably would not need a resolution that fine.

Shading of the image frame should be another consideration. It includes shades of gray as well as coloring and shadows (Newman 1973, p. 322). Among the subsets of this subject are:

1. Placement of the light source
2. Spectral components of the light source