INTERNALLY GENERATED DYNAMIC SYMBOLOGY OF AN AVIONIC DISPLAY DEVICE

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Abstract: Synthetic symbology is internally generated in Avionic Display System (ADS) which helps the pilot in situations of distress and also for testing purposes. Here we have discussed an internally generated dynamic symbology for meeting the requirements of ADS. Situations may arise during flight when the Mission Computer (MC) fails to deliver information to the ADS and the pilot face a blank screen in front. In order to overcome this drastic situation, static optical information helps the pilot to navigate and for landing. In view of the current and future requirements, a Digital Signal Processor (DSP) based circuit has been designed and proposed which provide dynamic symbology instead of static optical symbology.

Keywords: Avionic Display System (ADS), Mission Computer (MC), Synthetic Symbology, Digital Signal Processor (DSP), Longitudinal Fuselage Datum.

1. INTRODUCTION

Modern era fighter aircrafts are capable of flying at high altitude and high speed. They are equipped with advanced control systems populated in cockpit of the aircraft. One such system is Avionic Display System (ADS) that helps the pilot in providing instant situational and parametric awareness as well as in combat operations. The ADS gets this information from the Mission Computer (MC, the main computer of the aircraft) installed in the aircraft. The ADS displays flight information of several selectable modes in collimated form so that the pilot can view this information superimposed on his view of the outside world without having to change his line of sight or visual accommodation [1]. The display is either monochromatic (generally green) CRT display or an equivalent one. The display equipment is hard mounted to the airframe and bore-sighted to the datum line of the aircraft.

The ADS as a part of the complete display system presents flight information such as altitude, airspeed, angle of attack, artificial horizon, navigation and weapon aiming etc... This information is passed to the ADS from sensors through main computer of the aircraft. However conditions may arise when the main computer of the aircraft is unable to deliver signals to the ADS. In these situations of distress, the pilot is left blank with no visual information being displayed. Traditionally optical systems were used to help pilot in these situations. However these systems were static in nature. Here we have proposed a ADSP 21xx Digital Signal Processor (DSP) [2] [3] based design which displays internally generated dynamic symbology to aid Pilot in taking intelligent real time decisions.

2. DESIGN FEATURES

Dynamic symbology is generated based on the received real time parameters from different sensors mounted on the aircraft [4]. This dynamic symbology is superimposed on the ambient of the pilot's field of view thereby reducing the action response time. Some of the features of the internally generated dynamic symbology are as follows:

1. It is an electronic display symbology.
2. Aiming Mark will move in a step of 2mR.
3. Maximum depression angle will be of 240 mR below longitudinal fuselage datum of aircraft. The ADS display will be consists of a Vertical line showing the depression from 0 to 240mR and Horizontal Aiming Mark that move over the vertical line.
4. Numerical Readout display for Depression angle.
5. Width of Aiming Marks
   (a) 10mR for depression between 0 to 50mR
   (b) 20mR for depression between 51 to 100mR
   (c) 30mR for depression between 101 to 150mR
   (d) 40mR for depression between than 150mR
6. Depression angle setting control will be implemented by the switch provided on the control panel of the equipment.
7. Thickness of depression line would be 2mR.
8. Aiming Mark will be having a gap of 3mR at its center where the horizontal Aiming Mark and vertical line are intersecting.

3. GRAPHICAL REPRESENTATION

As shown in the Figure 1 the Aiming Mark will move at a constant acceleration on pressing 'UP' and 'DOWN' switch of DSP based processing circuit.

During the UP/DOWN movement, the size of the Aiming Mark would vary from 10mR to 40mR. The depression readout would be displayed on the right side of 000 position of depression angle. The whole range of dynamic depression angle would be 0mR-240mR.

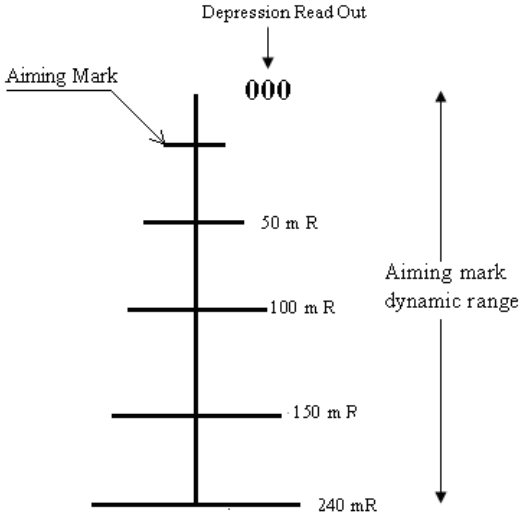

Figure 1

4. DESIGN APPROACH

The above symbology would be displayed on the 3" CRT of usable screen area of 65mm with resolution of 1024X1024 pixels [4]. The co-ordinates of CRT are show below;

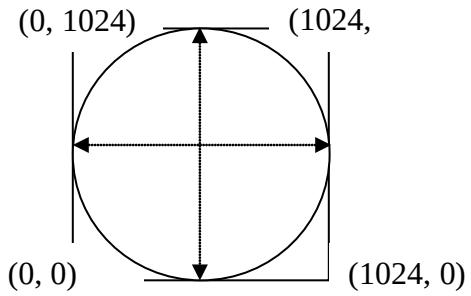

Figure 2

Since the deflection of electron beam of CRT is an electromagnet based, hence a linear Voltage to Current converter power amplifier would be used to deflect the electron beam to a specific position based on electrical signals generated by the proposed DSP circuit. The block diagram of the system is as shown below,

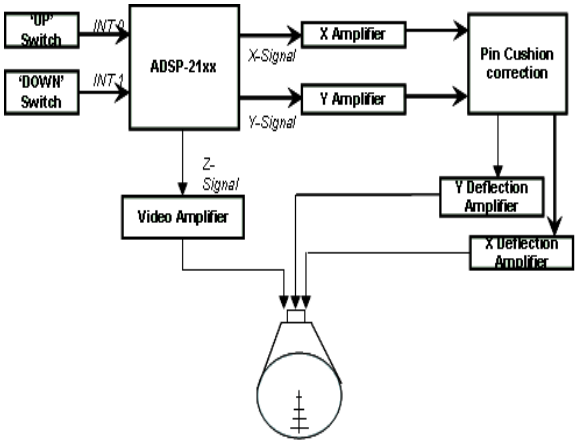

Figure 3

As shown above on the basis of input received from the pilot the information is processed by the digital signal processor and X,Y and Z signals are generated and are displayed on the CRT aiding the pilot in taking intelligent decision in situations of distress.

5. CONCLUSION

Internally generated dynamic symbology for ADS is a critical feature of the next generation avionic devices aiding the pilot in taking intelligent decisions. The work presented here is continuously evolving to accommodate more and more features, thereby assisting in decision making process of a pilot.

6. REFERENCES

[1] Specifications for Head Up Display, Issue 1, CSIO, Chandigarh
[2] Analog Devices AD21xx Family User's Manual Third Edition
[3] Analog Devices ADSP 218x Hardware Reference First Edition
[4] Design Document (Electronics Hardware) for Head Up Display Issue 1, CSIO, Chandigarh.