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RESEARCH LABORATORY**

**VISUALLY COUPLED ACQUISITION
AND
TARGETING SYSTEM (VCATS)
RESEARCH AND DEVELOPMENT EFFORTS**

**THE BOEING COMPANY
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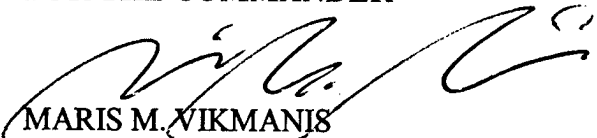
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This technical report has been reviewed and is approved for publication.

FOR THE COMMANDER



MARIS M. VIKMANIS
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13. ABSTRACT (<i>Maximum 200 words</i>) For over thirty years, the Crew System Interface Division (HEC: www.hec.af.mil) of the Air Force Research Laboratory (AFRL), located at Wright-Patterson Air Force Base OH, has advanced helmet tracker and display technology. This program developed the Visually Coupled Acquisition and Targeting System (VCATS). The VCATS program provides the capability to slew weapons/sensor with the head and provide dynamic feedback, and project the information on the visor. This program has developed numerous technologies including: helmet symbology, the high brightness CRT, the helmet vehicle interface, the upper aiming reticles, universal connector, and the helmet camera. Many of these technologies were directly incorporated into JHMCS.			
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1.0 Introduction

The Visually Coupled Acquisition and Targeting System (VCATS) Program developed an advanced helmet-mounted tracker & display (HMT/D) system that was deployed to Nellis AFB, NV and is currently being employed in Air Combat Command's Operational Utility Evaluation (OUE) on an F-15C aircraft.

This contract provided research and development to support the VCATS program. This support was in the form of general support, hardware, software and analysis. During some portions of the effort, this effort supported two aircraft. During the program one of the aircraft was being used for other training that did not involve the VCATS equipment. While on that training, the aircraft was lost in a mid air collision. The collision was not influenced in any way by the VCATS equipment or its installation. Never the less that aircraft was lost to any further support of the VCATS flights, and the VCATS equipment was surrendered from availability to support VCATS operations on the single remaining VCATS aircraft.

2.0 Tasking Summary

2.1 -General

Investigations were completed and planning data was determined for the effort needed to program the VCATS system's SDP (signal data processor) to fly an NDFR "odometer" attitude display as a replacement for the "high" and "low" altitude attitude displays which have been used in the VCATS symbology.

2.2 -Hardware

During the program, hardware support included the following:

Tracker sources, #2, #5 and #6 were tested and shipped to Nellis AFB. This included testing at Polhemus, Inc. (a supplier to Boeing) and in the Boeing labs.

Testing IHUD (Improved Head up Display) Display Unit (DU) # 6 from Nellis. It had a bad deflection circuit. The unit was repaired by substituting a deflection card from another unit. This left DU #6 uncalibrated. DU #3 which was calibrated and used as "a lab unit" was sent to Nellis as a spare. DU #6, while uncalibrated, is suitable as a lab unit and has stayed at the Boeing St. Louis Lab. An informal ROM (rough order of magnitude) estimate was made of the effort and tasking needed to calibrate #6.

Polhemus obtained the necessary parts and repaired VCATS DSP tracker card # 3, the I/O tracker card # 3 and Tracker I/O card # 9. DSP card #10, which had been used with the I/O card #9 as a set, was not repaired

because Polhemus could not diagnose the root cause of the problem within the budget constraints given them. They returned the card to Boeing. It is held at Boeing St. Louis pending further direction from the Air Force. All repaired cards were tested in the lab at Boeing, St Louis, and worked ok.

Working BIT (built in test) latch indicators, as replacement parts, were sent to Nellis AFB to support maintenance actions on an SDP (Signal Data Processor) by another Air Force contractor.

2.3 -Software

The AF reported three software errors with respect to the Suite 4M OFP (operational flight program) flying on non-VCATS aircraft. Boeing analyzed the source of 3 s/w errors. Two were caused by minor s/w problems. One was due to elimination of a function from the baseline Suite 4M OFP.

The three software errors were fixed. A configuration memo was delivered to document the aircraft configuration that uses the new software OFP.

An investigation was made of the relationship of the VCATS OFP with operation and use of AARI (Air Air Range Infrastructure) pods on VCATS aircraft.

An additional set of five software "problems" were found with the VCATS Suite 4M OFP. The Air Force provided problem descriptions and details. An investigation resulted in the following: Problem #1 was fixed. Problems #2 and #3 were later identified as not actually being problems but were simply a misunderstanding. Problem #4 was abandoned by the Nellis personnel as not worth pursuing. And, problem #5 was caused by using an old OFP, i.e., it was not actually a problem. A new OFP release, with "a fix" for Problem #1, was developed and sent to Nellis AFB.

2.4 -Performance Analysis

Boeing provided analysis of how the VCATS helmet tracker works to support diagnosis of helmets malfunctioning at Nellis AFB, NV. Boeing supplied wiring and signal data for the SDP (Signal Data Processor) to Nellis AFB.

Boeing analyzed which signals are needed from the "helmet" so that the VCATS system can operate in the "IPNVG mode."

A partial analysis was made of the "fine bore sight" function and its potential impact on tracking errors that had been reported for aircraft 0030 at Nellis AFB, NV. The analysis concluded that the fine bore sight function is not responsible for tracking errors that were reported for aircraft 0030 at Nellis AFB, NV.

2.5 -Other Activities

Testing was done with an AMOLED (the same type to be used for the Strike Helmet Program) to determine if it is compatible with being driven by RS 170 video from the SDP. The initial test indicated no problems, but further testing was recommended which would use a VCATS PNVG helmet to insure that the sync generator in the SDP graphics processor is compatible with the Strike Helmet 21 AMOLED display device. This test, using a VCATS IPNVG helmet, was run. The AMOLED was successfully driven by RS 170 video from the SDP (Signal Data Processor). This insured that the sync generator in the SDP graphics processor is compatible with the Strike Helmet 21 AMOLED display device.

The Insight Corp investigated reports from Nellis AFB of a "double image" / "ghost displays" when using a particular IPNVG and viewing the HUD on aircraft at Nellis. Insight did some of their testing at Boeing. Boeing supported the tests and supplied test facilities at Boeing to duplicate and examine this phenomenon as a start to solving it. The support included supplying data on the types of phosphors used and on which serial number HUDs were the phosphors used.