OPEN LOOP SIMULATION

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ABSTRACT

My project is designing a flight control program utilizing "C" language. It consists of paths made up of fixed radius ares and straight lines. Ares will be defined by a center, a radius and turn angle. Straight lines will be defined by an end way point and an inbound course. Way points will be pre-defined such that the location of the end of each leg accurately matches the beginning of the next leg. The simulation paths will closely match paths normally flown by the TSRV, but will not necessarily be defined identically in terms of type and number of way points.

OPEN LOOP AIRCRAFT SIMULATION

My project for this summer was to write software to implement open loop aircraft simulations for onboard testing and troubleshooting purposes. This program, written in C language, calculates way points for an inbound course using a list of given data such as pitch, roll, indicated airspeed, magnetic heading, latitude, longitude, etc. This data is then used to calculated successive points on a three dimensional coordinate plane. These points ultimately result to a flight path. I was also given other tasks working with a High-Speed Research (HSR).

The approach used for this project was an analytical process. I had to break my project into component parts or constituent elements. I also learned to utilize the "C" computer language to complete this project.

NASA's Boeing 737 Transport Systems Research Vehicle (TSRV) was acquired by the Langley Research Center in 1974 to conduct research into advance transport aircraft technologies. TSRV has played a critical role in developing and gaining acceptance for numerous significant transport technologies, including "glass cockpits," airborne windshear detection systems, data link for air traffic control communications, the microwave landing system, and the satellite-based global positioning system.

Thorough preflight testing of Transport Systems Research and Vehicle flight controls requires that the system be exercised through an approach and automatic landing. At present, there is a limited capability to accomplish the usage of Microwave Landing System (MLS) signals simulated onboard. The increasing use of Global Positioning System (GPS) and inevitable demise of MLS require that this capability be provided for GPS as well. The availability of smaller and more sophisticated computers provides an opportunity to improve simulation fidelity.

The hardware equipment used is a VME chassis containing a 68010 processor card with Random Access Memory (RAM), Read Only Memory (ROM), RS-232 serial port, an ARINC 429 interface card and other interface cards as required. The software equipment is pSOS real-time kernal in ROM. This program will eventually be used on the 737 airplane during preflight.

In addition to my project, I was able to work with the High-Speed Research Program (HSR). High-Speed Program is the cornerstone of NASA Aeronautics for the 1990s. It addresses the challenges of emissions effects on the atmosphere, airport noise and sonic boom. If solved it could support and industry decision to build a supersonic transport. A supersonic transport flying through the atmosphere at more than twice the speed of sound is extremely sensitive to aerodynamic "drag" generated by air friction. One way to reduce drag and increase an aircraft's fuel

efficiency is to reduce turbulent airflow over the wings, leaving smooth or "laminar" flow. The most important technology work in HSR program focuses on advanced combustor (combustion chamber) concepts that could significantly cut NOx emissions.

The Flight Deck Systems (FDS) technology area is conducting the first in a series of flight tests designed to develop and flight validate a cockpit display system that will eliminate the necessity of a droop-nose configuration for a High Speed Civil Transport (HSCT). the lack of a nose droop capability on the HSCT will require that the pilot's forward visibility be functionally replaced by an External Visibility System(XVS). Additionally, the XVS will enable all-weather, suitable-site operations.

I enjoyed working with HSR. I was able to attend weekly meetings and write work orders for the hardware pertaining to HSR. This part of my intern gave me an opportunity to interact with the employees in a business manner.