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**The Effect of Different Materials on the Accuracy of the  
HYDRA Optical - Fiber - Coupled Coherent Range/Pressure  
Measurement System  
and  
The development of the Health Care Database System  
at Old Dominion University**

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### **Abstract**

The objective of the first project involving the HYDRA laser system was to determine what effects, if any, could be seen in the system's measurements when testing was done with objects composed of different materials. Ideally we would like to have seen that the range of measurements were all within the accepted 0.4 millimeter accuracy of the system. Unfortunately our results were not as we had hoped, and there did appear to be some significant difference in the measurements made on objects composed of different materials.

The second project is a continuing project at Old Dominion University. The ultimate goal is to develop a medical database that allows a doctor or hospital to keep medical records on line. The current data of the system consisted of one patient whose medical data had been hard coded to allow for a demonstration of the potentials of the system. The short term goal for this summer was to add additional patients to the system for testing, and to eliminate the hard coding of data by creating a database where data could be stored and queried to produce the results seen in the current state.

## Project A

### I. Introduction/Background Information

The Hydra Optical - Fiber - Coupled Coherent Range/Pressure Measurement System was developed by the Coleman Research Corporation. (Hereafter referred to as HYDRA laser system) The Hydra laser system is able to measure both range and force. We were only concerned with range measurements. According to the operations handbook, this information is derived from a "coherent laser radar (CLR) utilizing linear frequency modulation of a laser diode source." The laser is constantly emitting a beam which is reflected back from the surface of the object being measured. When the laser picks up the frequency of the signal which has bounced back, the distance can be determined.

The Hydra Laser System has three (3) local oscillators each of which is used for a different range. The system will first focus on the object that is to be measured. This initial focus is a "guess" by the system of the distance of the object. When this is done, the initial distance is used to determine which local oscillator is appropriate, and the appropriate mixing frequency of the signal. The first local oscillator is used for short range distances from 1.8 meters to 5 meters. The second local oscillator is used for medium range distances from 5 meters to 10 meters. The third local oscillator is used for long range distances from 10 meters to 15 meters. It is harder for the system to focus at shorter distances, but there is also a smaller potential area for the target to be in. Although it is easiest to focus at long range distances, there is a greater potential for error since it is harder to find the exact target.

This Laser system was originally designed to be used in the robotics program. Potentially, a system of this type could be used in a robotic arm to assist in locating a specific target for the arm. It would be ideal for the system to target objects of different materials, and still maintain accurate range measurements. This was the motivation behind this particular experiment.

### II. Project Summary

#### A. Approach

We chose five (5) different materials to test. These were : Aluminum, Paper, Plastic, Scotch-Lite ( the reflective material used for highway signs), and Shuttle Tile. Each of the materials were tested at six (6) discrete points within the range of each of the three (3) local oscillators. A range was chosen well within the boundaries of each of the three local oscillators, i.e. the system did not have to attempt to change oscillators for a measurement on the boundary such as 5 meters. For each of the five materials at each of the six measurement points a total of 30 measurements were taken, and the average of these 30 measurements was used for comparison. This allowed us to compensate for the fact that one of the measurements may be poor due to poor focusing or some other problem. The range of measurements also allowed us to compare the standard deviation for each material within each range. The large amount of data would allow us to search for some patterns across materials and across local oscillators.

## B. Equipment and Facilities

The testing was done with the HYDRA Optical - Fiber - Coupled Coherent Range/Pressure Measurement System located in building 1220. This system allows the user to save the data generated by the laser onto disk. This data was then analyzed using Microsoft Excel and NCSS.

## C. Results and Conclusions

The data analysis showed that there were differences in the range measurements for different materials at the same point. Although these differences were generally less than one millimeter, they were considered to be significantly different. Our preliminary conclusion is that the type of material does have some effect on the accuracy of the range measurement. At this point, my mentor left for a four week vacation, and work on the project stopped. I had reached the limit of my usefulness for this project, and the final results and conclusions will be developed by Sixto Vazquez upon his return.

## Project B

### I. Introduction/ Background Information

This project is an ongoing research area at Old Dominion University. The current prototype was developed by Carl Jolly as a master's project. The ultimate goal is to provide a database system with a user friendly interface that will allow physicians to maintain medical files for patients on line. There are different levels of access into the system, doctor, nurse, receptionist, and patient. Patients would be able to view their own medical records. Scheduling would be done through this system. The nurse would record initial patient information such as temperature, height, weight, etc. on line. The doctor would be able to record progress note information for each visit on line as well by pulling up the appropriate window for data entry. The system would keep track of information such as patient allergies and medications. The goal is to allow medical personal more effective and efficient access to pertinent medical information about a specific patient.

The prototype was designed to show what could be expected from a system of this type. Carl Jolly designed windows and screens for data entry and data presentation. The medical records for one patient were hard coded into the system. The current goal is to remove the need for hard links, and to design a database to hold the information for many patients.

Currently three (3) students at Old Dominion University are working on creating and implementing a database for this purpose. There was a need for more medical files. My primary purpose this summer was to transcribe six patient files obtained from Academic Physicians & Surgeons at EVMS in such a way as to facilitate the transfer of this information into the database.

### II. Project Summary

#### A. Approach

Since the database had not yet been completely created, and implementation had not yet begun, it was not possible to directly enter the information into the database. It was necessary for me to enter the data into files that could easily be converted later with a simple C program. Some information required scanning, and these are files that can be directly used by the database at a later point.

## **B. Equipment and Facilities**

The medical files were transcribed at Old Dominion University and scanned at NASA Langley using the Hewlett Packard scanner at the Systems Integration Branch.

## **C. Results/Conclusion**

At this point, all of the data has been entered into files which are ready for conversion. The database development is in progress and implementation has not yet been completed. The goal is to have the database fully implemented by the end of the summer, and then to determine what changes, if any, need to be made.