Improving Data Collection Processes for F-16 Test Units

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Abstract

Test units of the F-16 fighter jet collect significant amounts of data. It is important that this data gets processed, analyzed, and archived properly. This project focused in improving data collection processes with non-material solutions. There were three different processes analyzed. The baseline, a modification to the baseline, and the third process included a software that significantly expedited the data collection process. The software reduced data collection for more than 50% and is the optimal non-materiel solution that can be achieved.

Introduction

Gathering data is different for every test unit in the Department of Defense. Test units, usually face problems gathering and analyzing data due to the big amounts of data transfer within a jet. Also, data collection can be difficult if proper maintenance is not performed on the regular basis. The amount of data collected in day can cost thousands of dollars and flying hours. Having a data process that secures the data collection can potentially save millions of dollars a year and allows to analyze the data efficiently.

Background

The F-16 known as Fighting Falcon or Viper was made by General Dynamics (now known as Lockheed Martin) in 1974 for the United States Air Force (USAF). This is a single engine, fly by wire fighter aircraft designed for an all-weather multirole scenario. Due to its maneuverability, this jet has proven its performance in air-to-air and air-to-ground missions. Compared to other fighter jets, the operation costs of an F-16 are lower by the hour and subsequently overall.

Problem

The problem this project is addresing is the optimization of data collection process with non-materiel solutions. Hundrends of gigabites are collected in the daily basis, and there is not a standard process amongst test units.

Objectives

The objective of these project is to optimize the data collection process and to reduce data collection time. The scope of the project was to find a series of solutions to archive data in a reliable way and that improves data collection storage.

Methodology

This project is based on the change of the process to collect data. F-16 can collect hundreds of gigabytes worth of data per sortie. On ongoing data collection, the process will change for option the team thought it was best.

Process I (Baseline)

This baseline is how data has been collected for the past months. Is necessary to clarify that this process works with for our systems but is not optimal. It takes a significant amount of time to collect data, data is archived in multiple computers, and is cumbersome to retrieved data for future analysis. For this process, pilots take the RMM and RMC to collect data while flying. When the mission is completed, the pilots come back to office and archived data in a computer that's available for them. Downloading data can take up to 30 minutes per pilot. After downloading data, the pilots start debriefing. Debriefings can take up to a one hour depending on mission complexity. And after debriefing is when data can be transferred and analyzed.

Process II (Modification 1)

Process II is slightly modification of the baseline. For this process, pilots take the RMM and RMC to collect data while flying. When the mission is completed, the pilots come back to office and hand the RMM to the flight test engineer or the data transfer authority. They, download the data from the RMMs in the fastest computer. This process will resolve the objective of archiving data and having an easy access for later review.

Process III (New Software)

This process was not foreseen by the test team. Counterparts from another test units use a software called DACS Akers to download RMM data. For this process, pilots take the RMM and RMC to collect data while flying. When the mission is completed, the pilots come back to the office and hand the RMM to the flight test engineer or the data transfer authority. They, download the data from the RMMs in the fastest computer with the new software installed.

Results and Discussion

The average time per computer and the average time per RMM were calculated. This baseline process is how the team is gathered data from the past few years. Table 1 contains the raw data for time collecting data and the averages per computer. Across all three computers downloading data can take up 23 minutes and 45 seconds while other computers can download data faster with a minimum of 15 minutes and 45 seconds. Thus, average for computer number 1 is 17 minutes and 01 seconds, for computer number 2 is 20 minutes and 04 seconds, and for computer 3, 21 minutes and 47 seconds.

Table 1

Time for data transfer for each computer for baseline

	Computers			
Day	1	2	3	Avg time
Day 1	18:34	20:32	21:33	20:13
Day 2	16:12	20:14	19:33	18:39
Day 3	16:43	19:23	21:22	19:09
Day 4	17:43	20:20	21:37	19:53
Day 5	15:45	20:14	22:54	19:37
Day 6	16:54	19:34	--	18:14
Day 7	17:19	20:12	23:45	20:25
Average	17:01	20:04	21:47	19:37

Since computer number 1 was the fastest computer archiving data, Table 1, the team used this to solve archiving problems. Every RMM was downloaded, and data was saved in computer number 1. Although it was faster, it this process does not give a solution to the problem of expediting the process, but just provides a solution for retrieval data. Table 2 summarizes the data points collected when downloading data in computer number 1.

Table 2

Time for data transfer for computer 1

Day	RMM 1	RMM 2	RMM 3
Day 1	17:05	15:01	16:37
Day 2	17:28	17:10	17:15
Day 3	16:42	15:43	17:23
Day 4	17:22	17:31	17:40
Average	17:09	16:21	17:13

Process number three involves a software called DACS Akers. This process expedited data download and data transferred. It decreased downloading time by more than 50 percent when compared to other processes. Table 3 summarizes the data collection point and time for computer with the software installed.

Table 3

Time for data transfer with new software

Day	RMM 1	RMM 2	RMM3
Day 1	7:02	8:32	6:45
Day 2	6:55	7:33	7:17
Day 3	5:59	8:13	7:27
Day 4	7:34	7:08	7:56
Average	6:52	7:51	7:21

Conclusions

After comparing all three process and analyzing the data, the third process significantly improves the data collection process time better than the others. Although, this process is not optimal, since there are some risks involve with it, it can be an alternate solution until new equipment can be purchased to optimize the process. Is clearly to the team that if the process needs to be fully optimized, equipment such as new computers, external hard drives, internal hard drives must be purchase. Other recommendations to improve this process, is that computers should be network within each other, for everyone to see the same data from different computers and not a specific one.

Future Work

The scope of work for the future is purchased equipment that speed up the process in every computer. Also, was recommended to network every computer to reflect the data in all of them.

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