AIRCRAFT MAINTENANCE NETWORKING SYSTEM

by

Flt.Lt. Poonlarp Nimpoonyagampong

A Final Report of the Three-Credit Course
CE 6998 Project

Submitted in Partial Fulfillment
of the Requirements for the Degree of
Master of Science
in Computer and Engineering Management
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Project Title	Aircraft Maintenance Networking System
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Project Advisor	Rear Admiral Prasart Sribhadung
Academic Year	March 2002

The Graduate School of Assumption University has approved this final report of the three-credit course, CE 6998 PROJECT, submitted in partial fulfillment of the requirements for the degree of Master of Science in Computer and Engineering Management.

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ABSTRACT

The project presents the proposed aircraft maintenance networking system, whose operation is applied to Local Area Network (LAN) technology. It is designed to support among Aircraft Maintenance Operation Center and between each aircraft hangar in Flying Training School, RTAF.

The study started form gathering information from the existing aircraft maintenance processes that are manually operated. Then, the existing system is studied and analyzed. The study suggests that a computerized process should replace the manual operation. The analysis tools such as data flow diagram, logical record structure, and entity-relationship diagram, used to develop the behavioral model and data model.

The process in the existing system are manual, problems arise in many ways, for example, the information isn't update, retrieval of information is difficult and work is duplicated.

The proposed system is designed to solve the problem of the existing system and meet user requirements. The solution of the proposed system is effective communication and sharing of aircraft maintenance information among Aircraft Maintenance Operation Center and between each aircraft hangar.

ACKNOWLEDGEMENTS

I am indebted to many people. Without them, this project would not have been possible.

I wish to express my sincere gratitude to my advisor, Rear Admiral Prasart Sribhadung, for his advice, suggestions and recommendations about the concept of computer networking design throughout this project. His patient assistance, guidance, and constant encouragement has helped me from research inception to completion. I also would like to express my gratitude to the members of the examination committee for their valuable comments and suggestions.

I am grateful to all faculty members from whom I received a wealth of knowledge, kindness and guidance during my studies at ABAC.

Special appreciation is due to my family members, who have been behind all my achievements in life. I also want to thank them for their fervent and continuous encouragement.

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I. INTRODUCTION

1.1 Background of the Project

Nowadays, aircraft was created by high technology and is composed of a great deal of special materials components. Therefore, aircraft maintenance must be done carefully and needs high accuracy in operation. Aircraft maintenance is a systematic integrated operation among technicians, engineers and specialists. The error means harm to staff and the aircraft.

In additional to the aircraft maintenance, aircraft manufacturing company has the responsibility to determine the details of individual aircraft maintenance. However, an ordinary aircraft maintenance can be divided into three levels depending on the complexity and details of the maintenance. There are organization maintenance level, intermediate maintenance level and depot maintenance level.

Royal Thai Air Force Flying Training School (RFTS) has the training aircraft composed of CT4, PC9 and BELL206B3. CT4 for the primary pilot student. PC9 and BELL206B3 for the secondary pilot student. Each aircraft has different maintenance which determined by Directorate of Aeronautical Engineering (DAE).

Aircraft Maintenance Operation Center (AMOC) of RFTS's responsibility is to maintain all aircraft for completing the pilot's missions. The level of maintenance in AMOC has two levels. They are organization maintenance level and intermediate maintenance level.

There are three hangars for aircraft maintenance, as follows:

(1) Hangar 1 responsible for maintenance aircraft CT4.

(2) Hangar 2 responsible for maintenance aircraft PC9.

(3) Hangar 3 responsible for maintenance aircraft BELL206B3.

After the aircraft accomplished the mission, Flight Line Officer receives the aircraft status data such as flight hours, engine hours, landing, number of start, and operation error. Flight Line Officer must take the aircraft status data to AMOC to record the aircraft status data. If some aircraft has time for maintenance, AMOC will contact and make orders to each hangar to operate.

For the communication method inside AMOC, between AMOC and each hangar is a manual procedure which made maintenance delay and not accurate or error to the operation because of the confused communication. Some officers may collect the records in error and the aircraft records are not updated instantly.

The computer networking refers to linking individual Local Area Networks (LAN) together. It is designed to support operations of general organizations. It offers much more speed and accuracy and convenience to the organization than a manual operation. It relates to some technology issues such as server, client, communication, media, protocol, technology and software issue. It interconnects all of the computer networks throughout the organization. Workgroup LANs, on different floors of a building or in separate building can be linked together.

This project will propose an Aircraft Maintenance Networking System. It will support the communications between each hangar and AMOC for accurate and high performance operation.

1.2 Objectives of the Project

(1) To propose an Aircraft Maintenance Networking System by using system analysis and design technique.

(2) To design hardware, software specification and network configuration.

(3) To replace the existing aircraft maintenance system based manual procedure by a computer networking system.

1.3 Scope of the Project

(1) The scope is limited to the design of the Aircraft Maintenance Networking System only, not including the implementation of the system.

(2) A recommendation of computer networking structure.

(3) A recommendation of security system.

(4) A recommendation of hardware and software requirement.

(5) A recommendation of interface and report design.

II. LITERATURE REVIEW

2.1 Local Area Network

Local Area Network, commonly know as LAN, is a high-speed communications system designed to link computers and the other data processing devices together within a small building. A communications network connecting a group of computers, printers, and other devices located within a relatively limited area (for example, a building). A allows any connected device to interact with any other on the network.

A computer network that spans a relatively small area. Most LANs are confined to a single building or group of buildings. However, one LAN can be connected to other LANs over any distance via telephone lines and radio waves. A system of LANs connected in this way is called a wide-area network (WAN).

Most LANs connect workstations and personal computers. Each node (individual computer) in a LAN has its own CPU with which it executes programs, but it also is able to access data and devices anywhere on the LAN. This means that many users can share expensive devices, such as laser printers, as well as data. Users can also use the LAN to communicate with each other, by sending e-mail or engaging in chat sessions.

There are many essential elements of computer networking and three major types of devices used for internetworking: bridges, routers, and switches. Today the most commonly used internetworking devices are high-speed routers, especially in local area network linking geographically remote sites. But routers are also heavily used in building and campus internetworks. Bridges have also been popular even though they offer less functionality than because they are less expensive to purchase, implement and maintain.

(1) Hubs/Repeaters

Hubs/repeaters are used to connect together two or more Ethernet segments of any media type. In larger designs, signal quality begins to deteriorate as segments exceed their maximum length. Hubs provide the signal amplification required to allow a segment to be extended a greater distance. A hub takes any incoming signal and repeats it out all ports.

Ethernet hubs are necessary in star topologies such as 10BASE-T. A multi-port twisted pair hub allows several point-to-point segments to be joined into one network. One end of the point-to-point link is attached to the hub and the other is attached to the computer. If the hub is attached to a backbone, then all computers at the end of the twisted pair segments can communicate with all the hosts on the backbone. The number and type of hubs in any one-collision domain is limited by the Ethernet rules. These repeater rules are discussed in more detail later.

A very important fact to note about hubs is that they only allow users to share Ethernet. A network of hubs/repeaters is termed a "shared Ethernet," meaning that all members of the network are contending for transmission of data onto a single network (collision domain). This means that individual members of a shared network will only get a percentage of the available network bandwidth. The number and type of hubs in any one collision domain for 10Mbps Ethernet is limited by the following rules:

Table 2.1. Network Limit.

Network Type	Max Nodes Per Segment	Max Distance Per Segment
10BASE-T	2	100m
10BASE2	30	185m
10BASE5	100	500m
10BASE-FL	2	2000m

While repeaters allow LANs to extend beyond normal distance limitations, they still limit the number of nodes that can be supported. Bridges and switches, however, allow LANs to grow significantly larger by virtue of their ability to support full Ethernet segments on each port. Additionally, bridges and switches selectively filter network traffic to only those packets needed on each segment this significantly increases throughput on each segment and on the overall network. By providing better performance and more flexibility for network topologies, bridges and switches will continue to gain popularity among network managers.

(2) Bridge

Bridge are the simple, and often less expensive, type of device. Bridge filter packets between LANs by making a simple forward/don't forward decision on each packet that they receive from any of the networks to which they are connected. Filtering is done based on the destination address of the packet. If a packet destination is a station on the segment where it originated, it is not forwarded. If it is destined for a station on another LAN, it is connected to a different bridge port and forwarded to that

port. Many bridges today filter and forward packets with very little delay, making them good for large traffic volumes.

(3) Router

Router are more complex internetworking devices and are also typically more expensive than bridges. They use Network Layer Protocol Information within each packet to route it from one LAN to another. This means that a router must be able to recognize all of the different Network Layer Protocols that may be used on the networks it is linking together. This is where the term multiprotocol router comes from, a device that can route using many different protocols. Routers communicate with each other and share information that allows them to determine the best route through a complex internetwork that links many LANs.

(4) Switch

Switches are another type of device used to link several separate LANs and provide packet filtering between them. A LAN switch is a device with multiple ports, each of which can support a single end station or an entire Ethernet or Token Ring LAN. With a different LAN connected to each of the switch's ports, it can switch packets between LANs as needed. In effect, it acts like the switch based on the destination address and filters a very fast multiport bridge packet.

Switches are used to increase performance on an organization network by segmenting large networks into many smaller, less congested LANs, while still providing necessary interconnectivity between them. Switches increase network performance by providing each port with dedicated bandwidth, without requiring users to change any existing equipment, such

as NICs, hubs, wriing, or any routers or bridges that are currently in place. Switches can also support numerous transmissions simultaneously. Deploying technology called dedicated LANs is another advantage of using switches.

(5) Gateway

A gateway is a network point that acts as an entrance to another network. On the Internet, in terms of routing, the network consists of gateway nodes and host nodes. The computers of network users and the computers that serve content are host nodes. The computers that control traffic within your company's network or at your Local Internet service provider (ISP) are gateway nodes.

2.2 LAN Architecture

A design. The term architecture can refer to either hardware or software, or to a combination of hardware and software. The architecture of a system always defines its broad outlines, and may define precise mechanisms as well.

An open architecture allows the system to be connected easily to devices and programs made by other manufacturers. Open architectures use off-the-shelf components and conform to approved standards. There are 2 types in LAN architecture.

(1) Client/server architecture

A network architecture in which each computer or process on the network is either a client or a server. Servers are powerful computers or processes dedicated to managing disk drives (file servers), printers (print servers), or network traffic (network servers). Clients are PCs or workstations on which users run applications. Clients rely on servers for resources, such as files, devices, and even processing power.

Another type of network architecture is known as a peer-to-peer architecture because each node has equivalent responsibilities. Both client/server and peer-to-peer architectures are widely used, and each has unique advantages and disadvantages. Client-server architectures are sometimes called two-tier architectures.

(2) Peer-to-peer architecture

A type of network in which each workstation has equivalent capabilities and responsibilities. This differs from client/server architectures, in which some computers are dedicated to serving the others. Peer-to-peer networks are generally simpler, but they usually do not offer the same performance under heavy loads.

2.3 LAN Topology

There are four principal topologies used in LANs.

(1) Bus topology

All devices are connected to a central cable, called the bus or backbone, see in Figure 2.1. Bus networks are relatively inexpensive and easy to install for small networks. Ethernet systems use a bus topology. A network in which all nodes are connected to a single wire (the bus) that has two endpoints. Ethernet 10Base-2 and 10Base-5 networks, for example, are bus networks. Other common network types include star networks and ring networks. Bus requires fewer cables; may be disable if cable is cut.

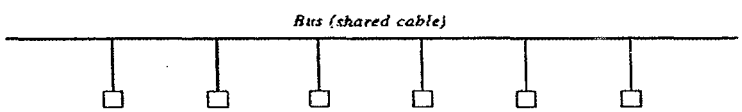

Figure 2.1. Bus Topology.

(2) Ring topology

All devices are connected to one another in the shape of a closed loop, so that each device is connected directly to two other devices, one on either side of it. Ring topologies can see in Figure 2.2 are relatively expensive and difficult to install, but they offer high bandwidth and can span large distances. A local area network (LAN) whose topology is a ring. That is, all of the nodes are connected in a closed loop. Messages travel around the ring, with each node reading those messages addressed to it. One of the advantages of ring networks is that they can span larger distances than other types of networks, such as bus networks, because each node regenerates messages as they pass through it. Ring ease synchronization; may be disabled if any cable is cut.

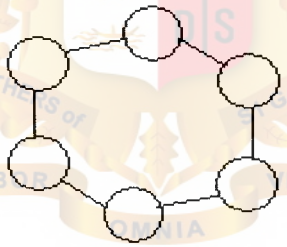

Figure 2.2. Ring Topology.

(3) Star Topology

All devices are connected to a central hub. See Figure 2.3. Star networks are relatively easy to install and manage, but bottlenecks can occur because all data must pass through the hub. A local-area network (LAN) that uses a star topology in which all nodes are connected to a central computer. The main advantages of a star network is that one malfunctioning

node doesn't affect the rest of the network, and it's easy to add and remove nodes. The main disadvantage of star networks is that they require more cabling than other topologies, such as a bus or ring networks. In addition, if the central computer fails, the entire network becomes unusable. Standard twisted-pair Ethernet uses a star topology. Star easier to manage and more robust; requires more cables.

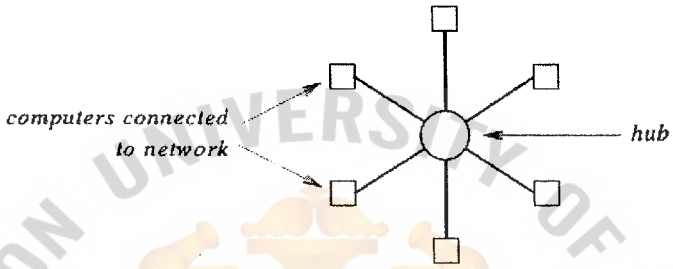

Figure 2.3. Star Topology.

(4) Tree topology

A hybrid topology. Groups of star-configured networks are connected to a linear bus backbone. A tree topology combines characteristics of linear bus and star topologies. It consists of groups of star-configured workstations connected to a linear bus backbone cable.

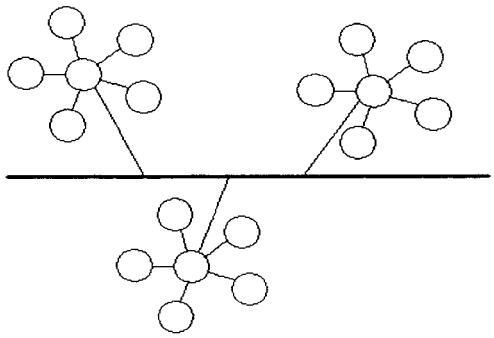

Figure 2.4. Tree Topology.

These topologies can also be mixed. For example, a bus-star network consists of a high-bandwidth bus, called the backbone, which connects a collections of slower-bandwidth star segments.

2.4 LAN Technology

(1) Ethernet

A local-area network (LAN) architecture developed by Xerox Corporation in cooperation with DEC and Intel in 1976. Ethernet uses a bus or star topology and supports data transfer rates of 10 Mbps. The Ethernet specification served as the basis for the IEEE 802.3 standard, which specifies the physical and lower software layers. Ethernet uses the CSMA/CD access method to handle simultaneous demands. It is one of the most widely implemented LAN standards. Ethernet is the most popular physical layer LAN technology in use today. Other LAN types include Token Ring, Fast Ethernet, Fiber Distributed Data Interface (FDDI), Asynchronous Transfer Mode (ATM) and LocalTalk. Ethernet is popular because it strikes a good balance between speed, cost and ease of installation. These benefits, combined with wide acceptance in the computer marketplace and the ability to support virtually all popular network protocols, make Ethernet an ideal networking technology for most computer users today. The Institute for Electrical and Electronic Engineers (IEEE) defines the Ethernet standard as IEEE Standard 802.3. This standard defines rules for configuring an Ethernet network as well as specifying how elements in an Ethernet network interact with one another. By adhering to the IEEE standard, network equipment and network protocols can communicate efficiently.

A newer version of Ethernet, called 100Base-T (or Fast Ethernet), supports data transfer rates of 100 Mbps. And the newest version, Gigabit Ethernet supports data rates of 1 gigabit (1,000 megabits) per second.

(2) Token Ring

Token Ring is another form of network configuration which differs from Ethernet in that all messages are transferred in a unidirectional manner along the ring at all times. Data is transmitted in tokens, which are passed along the ring and viewed by each device. When a device sees a message addressed to it, that device copies the message and then marks that message as being read. As the message makes its way along the ring, it eventually gets back to the sender who now notes that the message was received by the intended device. The sender can then remove the message and free that token for use by others.

Various PC vendors have been proponents of Token Ring networks at different times and thus these types of networks have been implemented in many organizations.

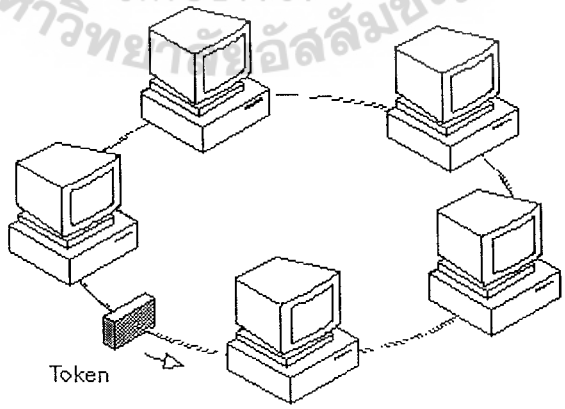

Figure 2.5. Token Ring.

A type of computer network in which all the computers are arranged (schematically) in a circle. A token, which is a special bit pattern, travels around the circle. To send a message, a computer catches the token, attaches a message to it, and then lets it continue to travel around the network. When capitalized, Token Ring refers to the PC network architecture developed by IBM. The IBM Token-Ring specification has been standardized by the IEEE as the IEEE 802.5 standard.

(3) Fiber Distributed Data Interface (FDDI)

Abbreviation of **F**iber **D**istributed **D**ata **I**nterface, a set of ANSI protocols for sending digital data over fiber optic cable. FDDI networks are token-passing networks, and support data rates of up to 100 Mbps (100 million bits) per second. FDDI networks are typically used as backbones for wide-area networks.

An extension to FDDI, called FDDI-2, supports the transmission of voice and video information as well as data. Another variation of FDDI, called FDDI Full Duplex Technology (FFDT) uses the same network infrastructure but can potentially support data rates up to 200 Mbps.

FDDI uses a dual ring topology, which is to say that it is comprised of two counter-rotating rings. A dual-attached rooted station on the network is attached to both of these rings.

A dual-attached station on the ring has at least two ports - an A port, where the primary ring comes in and the secondary ring goes out, and a B port where the secondary ring comes in, and the primary goes out. A station may also have a number of M ports, which are attachments for single-attached stations. Stations with at least one M port are called concentrators.

The sequence in which stations gain access to the medium is predetermined. A station generates a special signaling sequence called a Token that controls the right to transmit. This Token is continually passed around the network from one node to the next. When a station has something to send, it captures the Token, sends the information in well formatted FDDI frames, then releases the token. The header of these frames includes the address of the station(s) that will copy the frame. All nodes read the frame as it is passed around the ring to determine if they are the recipient of the frame. If they are, they extract the data, retransmitting the frame to the next station on the ring. When the frame returns to the originating station, the originating station strips the frame. The token-access control scheme thus allows all stations to share the network bandwidth in an orderly and efficient manner.

(4) Asynchronous Transfer Mode (ATM)

Short for **A**synchronous **T**ransfer **M**ode, a network technology based on transferring data in cells or packets of a fixed size. The cell used with ATM is relatively small compared to units used with older technologies. The small, constant cell size allows ATM equipment to transmit video, audio, and computer data over the same network, and assure that no single type of data hogs the line.

Some people think that ATM holds the answer to the Internet bandwidth problem, but others are skeptical. ATM creates a fixed channel, or route, between two points whenever data transfer begins. This differs from TCP/IP, in which messages are divided into packets and each packet can take a different route from source to destination. This difference makes

it easier to track and bill data usage across an ATM network, but it makes it less adaptable to sudden surges in network traffic.

(5) Local Talk

Local Talk, a network technology is developed by Apple Computer Corporation. Designed for networks are based on Apple's AppleTalk network system, which is built into Macintosh computers using Bus topology. This LAN technology use CSMA/CA (Carrier Sense Multiple Access With Collision Avoildance) to approach the signal.

2.5 Server

A computer or device on a network that manages network resources. For example, a file server is a computer and storage device dedicated to storing files. Any user on the network can store files on the server. A print server is a computer that manages one or more printers, and a network server is a computer that manages network traffic. A database server is a computer system that processes database queries.

Servers are often dedicated, meaning that they perform no other tasks besides their server tasks. On multiprocessing operating systems, however, a single computer can execute several programs at once. A server in this case could refer to the program that is managing resources rather than the entire computer.

(1) File Server

A file server acts as a librarian, storing various programs and data for network users. The server determines who gets access to what and in what sequence. Servers may be powerful microcomputers with larger hard disk capacity, workstation, minicomputer, or mainframes, although specialized computers are now available for this purpose. The server typically contains

the LAN's network operating system, which manages the server and routes and manages communications on the network.

(2) Application Server

An application server is a server program in a computer in a distributed network that provides the business logic for an application program. The application consisting of a graphical user interface (GUI) server, and application (business logic) server, and a database and transaction server.

(3) Print Servers

Print servers allow printers to be shared by other users on the network. Supporting either parallel and/or serial interfaces, a print server accepts print jobs from any person on the network using supported protocols and manages those jobs on each appropriate printer.

The earliest print servers were external devices, which supported printing via parallel or serial ports on the device. Typically, only one or two protocols were supported. The latest generation of print servers support multiple protocols, have multiple parallel and serial connection options and, in some cases, are small enough to fit directly on the parallel port of the printer itself. Some printers have embedded or internal print servers. This design has an integral communication benefit between printer and print server, but lacks flexibility if the printer has physical problems.

Print servers generally do not contain a large amount of memory; printers simply store information in a queue. When the desired printer becomes available, they allow the host to transmit the data to the appropriate printer port on the server. The print server can then simply queue and print

each job in the order in which print requests are received, regardless of protocol used or the size of the job.

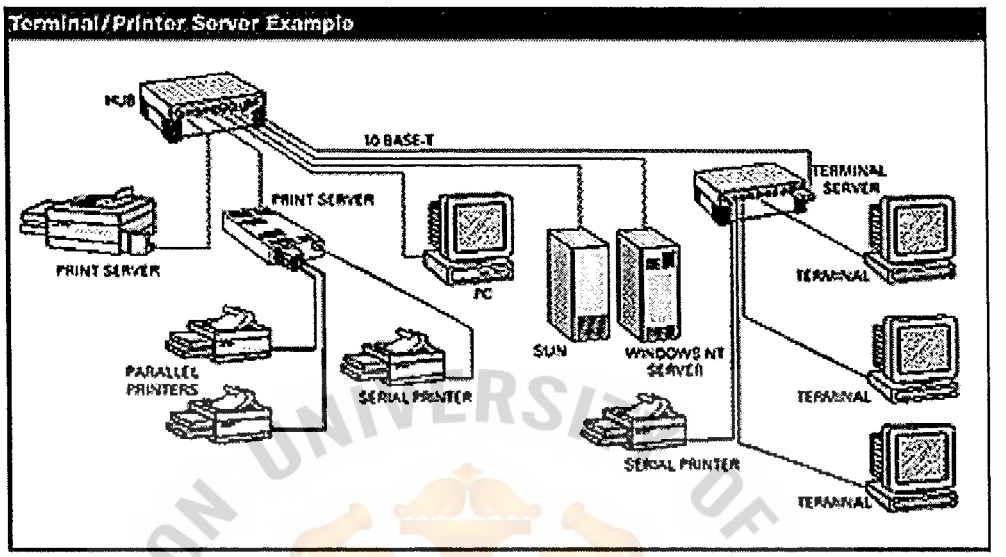

Figure 2.6. Terminal / Printer Example.

2.6 Advantages of LAN

Local area network offer several advantages over single-processor systems.

(1) Resource sharing. Users of network can access a variety of resources through the network. Sharing data based, data and program files, and other resources reduces maintenance and storage cost while providing each user with improve access. Usage, may be too low for a single individual to justify buying a specialized or expensive device. However, being able to share the device with many network users may justify its purchase.

(2) Distributing the workload. The use of a single system varies as users join and leave a system. The degree of fluctuation or workload for a single system can be moderated in a network, so the workload can be shifted from a heavily loaded system to an underused one.

(3) Increased reliability. Because a local area network consists of more than one computing system. The failure of one system or of just one component need not necessarily block users from continuing to compute. If similar systems exist, users can move their computing tasks to other systems when one system fails.

(4) Expandability. Network systems can be expanded easily by adding new nodes. This expansion of the user base can occur without the manager of any single system having to task special action.

III. ANALYSIS OF THE EXISTING SYSTEM

3.1 Background of the General Aircraft Maintenance System

Aircraft was created by high technology and is composed of a great deal of special materials components. Therefore, aircraft maintenance must be done carefully and needs high accuracy in operation. Aircraft maintenance is a systematic integrated operation among technicians, engineers and specialists. The error means harm to staff and to the aircraft.

In additional to aircraft maintenance, aircraft manufacturing company has responsibility to determine the details of individual aircraft maintenance. However, an ordinary aircraft maintenance can be divided into three levels depending on the complexity and details of the maintenance. There are organization maintenance level, intermediate maintenance level and depot maintenance level.

The flight hours of an aircraft means the hours of operation that the aircraft was operating on the ground or in the air. They can be divided into the flight hour of aircraft (structure), engine, and spare parts. They are significant indicators for taking aircraft, engine, and spare parts to maintenance shops. In other words, the spare parts order and maintenance plan of organization can be made up from the flight hours evaluation.

3.2 Background of the Aircraft maintenance System of Royal Thai Airforce

Royal Thai Airforce (RTAF) is a military department, supervised by the Ministry of Defense. It is assigned to:

(1) Prepare the combat forces.

(2) Protect the welfare of Thailand.

(3) Protect the sovereignty beyond the horizon of Thailand.

In order to complete these missions. RTAF is organized into 3 Commands, as shown in Figure 3.1. It is composed of the Air Combat Command, the Air Support

Command, and the Air Education and Training Command. The Air Combat Command is responsible for preparing air combat forces and protecting the sovereignty beyond the horizon of Thailand.

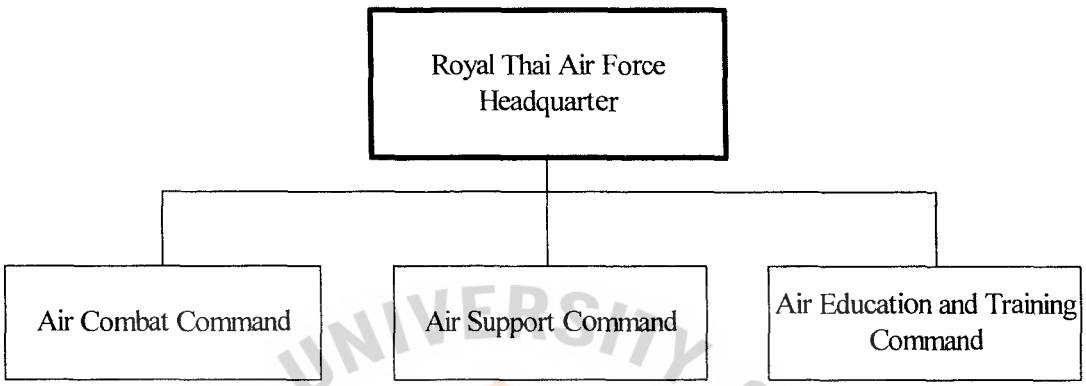

Figure 3.1. Organization Chart of Royal Thai Air Force Headquarter.

The Air Support Command is responsible for supporting the mission of the Air Combat Command.

The Air Education and Training Command is responsible for offering training to all of the RTAF staff.

In this project, the researcher intends to study aircraft maintenance. The Air Education and Training Command is not concerned with that topic directly. Thus, the researcher will omit the details.

The Air Support Command is responsible for supporting the mission of the Air Combat Command. It is organized into several directorates. Each directorate has a unique responsibility. The Directorate of Aeronautical Engineering (DAE) is responsible for supporting all Wings and Flying Training School in aircraft maintenance. The organization of Air Support Command is shown in Figure 3.2.

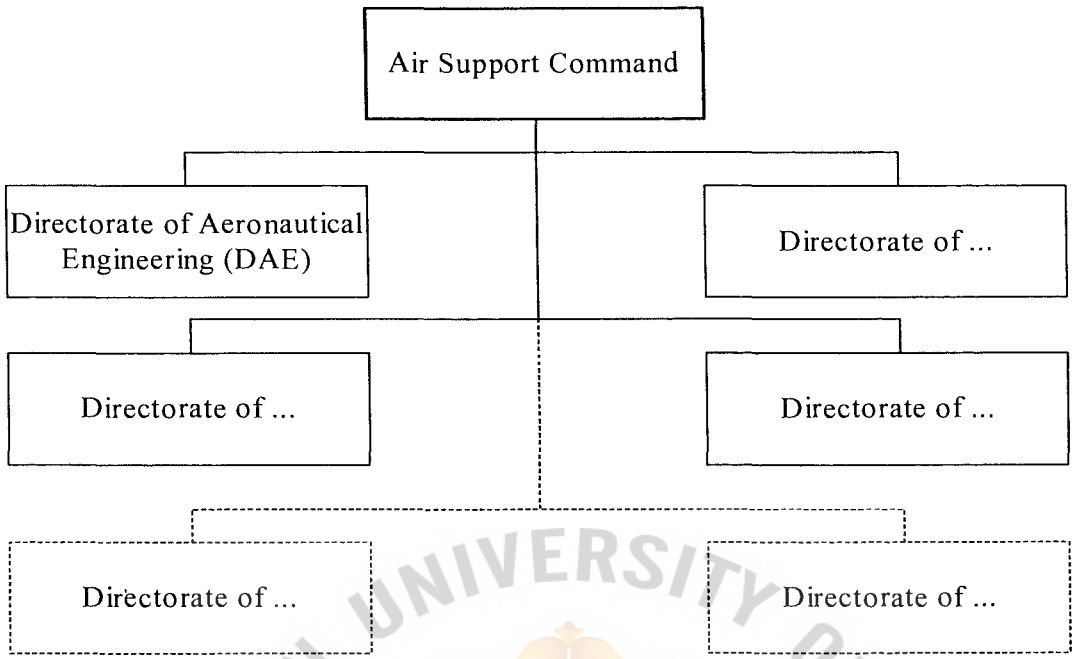

Figure 3.2. Organization Chart of Air Support Command.

The Air Combat Command is organized into four Air Divisions (the 1st Air Division, the 2nd Air Division, the 3rd Air Division, and the 4th Air Division) and Flying Training School, as shown in Figure 3.3.

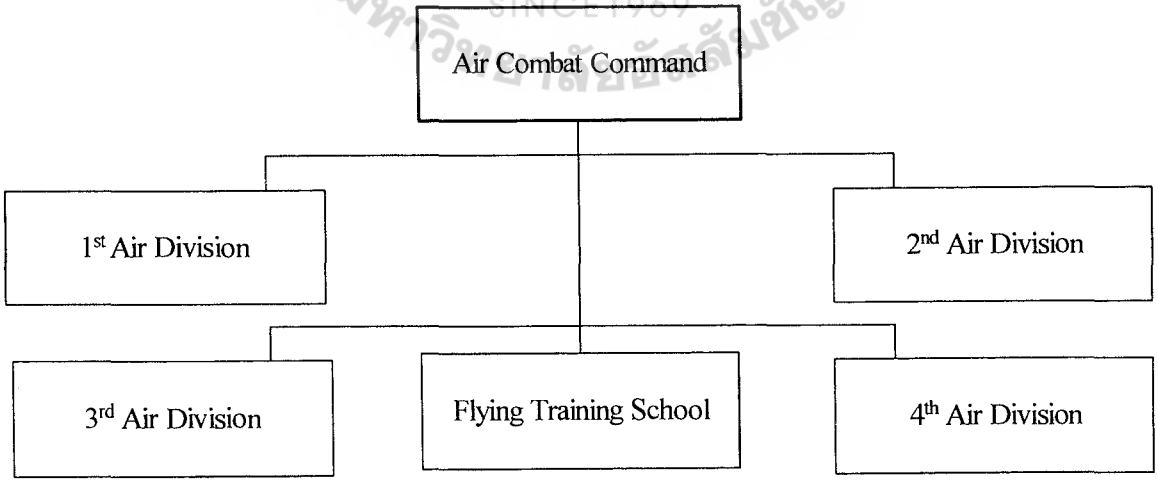

Figure 3.3. Organization Chart of Air Combat Command.

Flying Training School, RTAF has stationed aircraft consist of CT4, PC9 and BELL206B3. Flying Training School is assigned for training the student pilots and operates the air mission. Flying Training School is organized into seven divisions as shown in Figure 3.4.

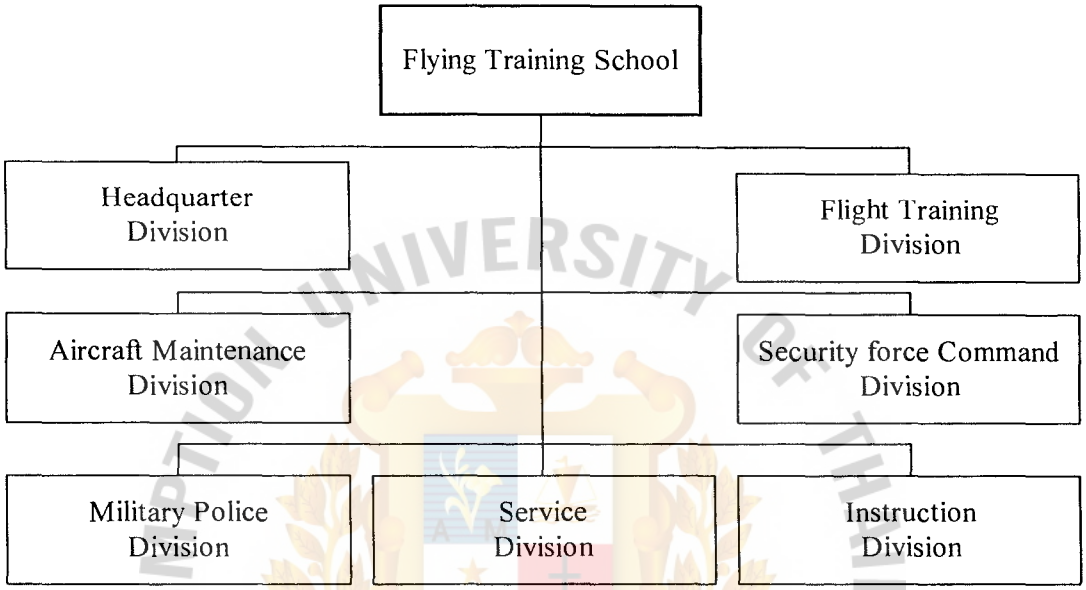

Figure 3.4. Organization Chart of Flying Training School, RTAF.

Aircraft Maintenance Division is responsible for maintenance of the training aircraft which consist of CT4, PC9 and BELL206B3 in organization and intermediate maintenance level. Also follow the technical order of DAE. Aircraft Maintenance Division is organized into six sections as shown in Figure 3.5.

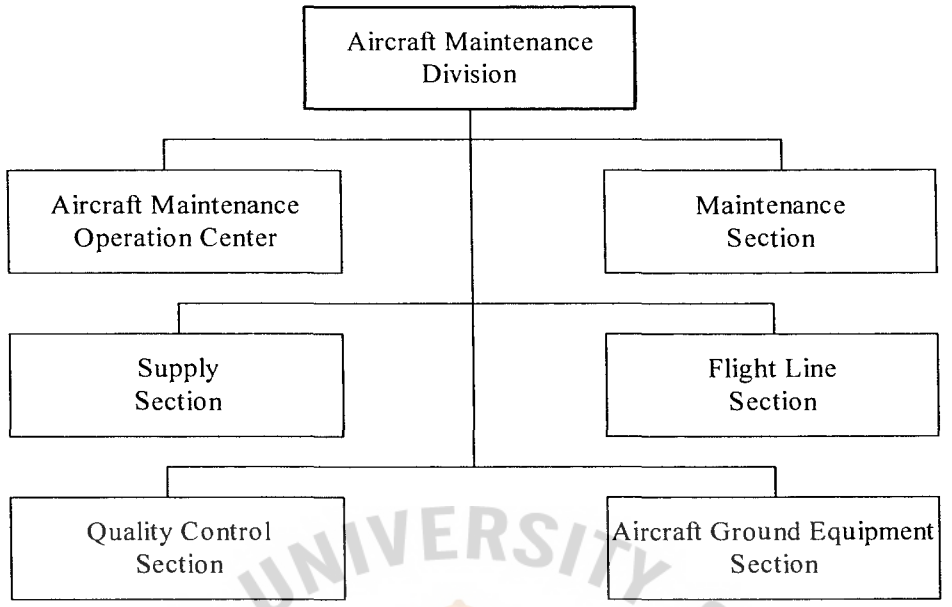

Figure 3.5. Organization Chart of Aircraft Maintenance Division, FTS.

(1) Aircraft Maintenance Operation Center

Aircraft Maintenance Operation Center is in charge of and to control and make order to maintain the aircraft and make the aircraft status report.

(2) Flight Line Section

Flight Line Section is in charge of preparing the aircraft for the pilot to the mission.

(3) Maintenance Section

Maintenance Section is responsible for maintenance of the aircraft which received the maintenance order from Aircraft Maintenance Operation Center. Maintenance Section is divided into three hangars.

(a) Hangar 1 responsible for maintenance aircraft CT4.

(b) Hangar 2 responsible for maintenance aircraft PC9.

(c) Hangar 3 responsible for maintenance aircraft BELL206B3.

(4) Quality Control Section

Quality Control Section is responsible for controlling all operation in Aircraft Maintenance Division following the RTAF order, Technical Order from DAE and Service Bulletin from the aircraft manufacturing.

(5) Supply Section

Supply Section is in charge of procurement, storing, distributing, accounting and statistics recording of the aircraft supplies and determining supply requirement.

(6) Aircraft Ground Equipment Section

Aircraft Ground Equipment Section is in charge of servicing all the aircraft ground equipment.

Their tasks are unique. But when they operate their own tasks, they have to communicate and monitor the others, since their tasks are related to the others and they have to use integrative information that they retrieved from AMOC.

The communication methods are manually operated among Aircraft Maintenance Operation Center and all sections, and between AMOC and DAE. The methods are supported by a government document transaction system.

3.3 Area under Study

(1) Process1: Sending the Aircraft Status

This process is related to Flight Line Section, Maintenance Section and Aircraft Maintenance Operation Center. Flight Line is responsible for sending Aircraft Status to Aircraft Maintenance Operation Center everyday when finishing the missions. Maintenance Section sending maintenance data to Aircraft Maintenance Operation Center everyday. The details are about

aircraft model, aircraft number, aircraft hour, aircraft operation error and aircraft maintenance data.

(2) Process 2: Translate the Information

This process is related to the Aircraft Maintenance Operation Center. It translates data, which is obtained from process 1, The Daily Aircraft Status Report and Maintenance Report.

The Daily Aircraft Status Report comes from the summary of aircraft status from Flight Line and maintenance data all day. It is done everyday at 15.30 and send to DAE.

The Maintenance Report will be created after each hangar sends maintenance data.

(3) Process 3: Requesting for spare parts

This process is related to the Supply Section and DAE. They request the spare parts from DAE by sending the spare parts form.

(4) Process 4: Picking and delivering the release spare part

This process is related to the Supply Section and each hangar. The required spare part with its receipt will be sent to requesting unit. Then the status of the spare parts will be updated.

3.4 Current Problems of the Existing System

The operation of the existing system is done manually; some jobs are unnecessary and this induces many problems that can be listed as follows:

(1) The information is not up to date

The total of each aircraft status data is sent to the Aircraft Maintenance Operation Center everyday at about 16.00 or after mission is finished. A maintenance order is done when the aircraft status is received

too long for determining the maintenance order. A Daily aircraft status report is done on 15.30. Thus the information in the existing system is not up to date.

(2) The information is not reliable

The Aircraft status report is done manually. An error may occur during the transferring of the information from the Aircraft status report and Maintenance order.

(3) Information is difficult to retrieve

It is hard for users for retrieve the required information. It takes a long time. It leads to problems as follows:

(a) A great deal of paper is used

All information is recorded in hard copies. It has to use paper every time. Thus, there is a great deal of hard copies.

(b) A large space is needed

It has to take a large space to keep the hard copies.

(4) Work is duplicated

The government document transaction system takes a long time. The Aircraft Maintenance Operation Center always received status reports at a later time. Thus, the staff has to call the Wings for the information. This operation induces duplication of work.

(5) The system is time consuming

The existing transaction system always takes a long time. It leads to problems as follows:

(a) The document transaction system takes a long time

The government document transaction system has to be supported by messengers with this method, document movement from one point to another always takes a long time.

(b) Writing a report by hand consumes a lot of time

All the reports are made slowly because all of the information is manually written.

IV. REQUIREDMENTS AND FUNCTIONS

4.1 Requirements of the Proposed System

The proposed system listed a set of requirements to solve the problems of the existing system, which are mentioned in item 3.4. After analyzing the existing system, the following are required of the users.

(1) The time used in updating and retrieving all the information should be reduced.

(2) The Daily Aircraft Status from Flight Line and Aircraft Maintenance data from all of the hangars should be updated every day.

(3) The Daily Aircraft Status Report should be done every time when receiving the daily aircraft status from Flight Line. Its details should cover the crucial item on spare part inventory. It can be monitored any time a user needs to.

(4) The Maintenance order must be updated any time.

(5) The procedures in updating and retrieving all the reports should not be complicated.

(6) The duplicated work must be deleted.

(7) The information work must be deleted.

(8) The information must be accurate.

(9) There must be a security method applicable to all the information.

4.2 Functions of the Proposed System

The proposed system is designed in order to maintain the existing system and support the requirements. It introduces a computerized system and database management technique. The proposed system is divided into four main functions as follows:

(1) Providing Maintenance Information

All the hangars have to update maintenance information about their aircrafts, engines, and spare parts every day. The maintenance information includes Aircraft Number (A/C No.), Aircraft Hour (A/C Hrs.), Time Since New (TSN), Time Since Overhaul (TSO), operation error, last maintenance date, last maintenance level, engine and spare parts can be added. Additionally, this piece of information can be monitored, updated, searched, and deleted any time the user needs to.

(2) Providing a Spare Part Information

The spare parts can be requested from the Supply Section. The spare part requested can be added, monitored, updated, searched, and deleted every time a user needs it.

(3) Creating Daily Aircraft Status Report

The proposed system can extract maintenance status information, then create a daily aircraft status report, which is presented to the DAE.

(4) Creating a Maintenance Report

The proposed system can extract maintenance information, then create the Maintenance Report.

V. DATA FLOW DIAGRAM

5.1 Data Flow Diagram of the Proposed System

The data flow diagram is a process model that graphically represents the functions of the system. It can be used as a tool for representing the process of the proposed system. The context diagram is shown in Figure 5.1.

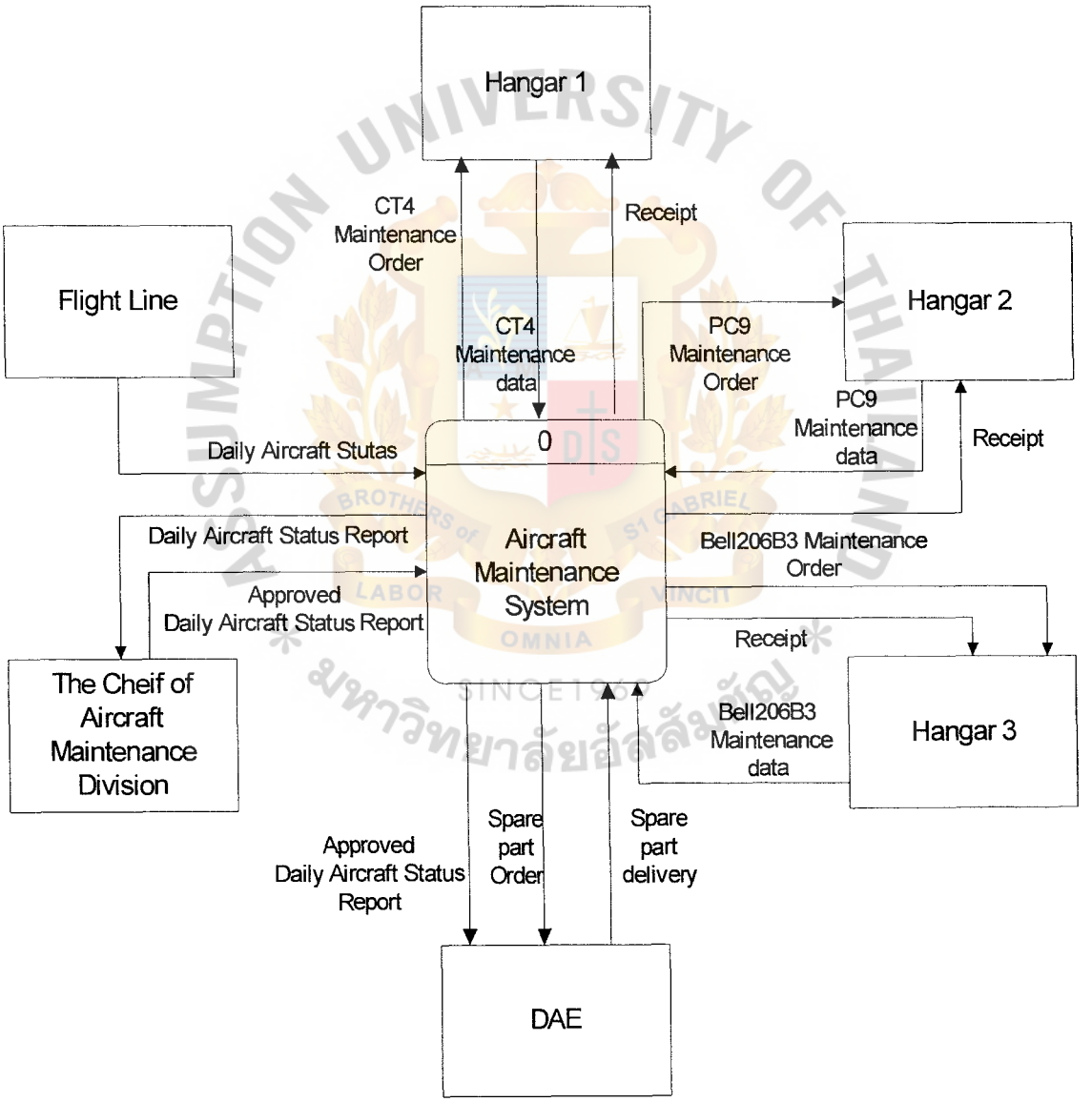

Figure 5.1. Context Diagram.

(1) Context Diagram

There are 6 external entities that communicate to the Aircraft Maintenance System as Shown in Figure 5.1.

(a) Flight Line

Flight Line will provide daily aircraft status to an aircraft maintenance system. Its details cover the daily data about aircraft model, aircraft number, aircraft hour, operation error. The system is responsible for developing these data to daily aircraft status report and maintenance order everyday.

Only maintenance order will be sent to each hangar. Hangar will use it as a guideline for maintenance. In order to complete this task, hangar will request for spare part by sending maintenance data of each hangar to the system. Then the requested spare part will be obtained with a receipt.

(b) Hangar 1

Hangar 1 will send the maintenance data of aircraft CT4 to the system. Then the system will update the maintenance data and will check the spare parts which are ordered to DAE.

(c) Hangar 2

Hangar 2 will send the maintenance data of aircraft PC9 to the system. Then the system will update the maintenance data and will check the spare parts which are ordered to DAE.

(d) Hangar 3

Hangar 3 will send the maintenance data of aircraft BELL 206B3 to the system. Then the system will update the maintenance data and will check the spare parts which are ordered to DAE.

(e) The Chief of the Aircraft Maintenance Division, FTS

After the Daily Aircraft Status Report is drawn, it will be sent to Chief of the Aircraft Maintenance Division, FTS. For examination and approval. Then it will be send to DAE.

(f) Directorate of Aeronautical Engineering (DAE)

DAE will deliver all spare parts to the system after receiving the approved report from the system.

(2) level 0: Aircraft Maintenance System

This level shows the main process that the aircraft maintenance system will do. It is shown in Figure 5.2.

(a) Process 1: Update Aircraft Data

Flight Line provide daily aircraft status data to the system. These data will be entered in the aircraft file, engine file, operation error file and maintenance file.

(b) Process 2: Produce Maintenance Order

This process uses Operation error file and Maintenance file to produce maintenance order for each hangar.

(c) Process 3: Prepare Maintenance Report

Each hangar provides the maintenance data to the system, and create the Maintenance Report and send to Process 1, The information includes last maintenance date, last maintenance level, aircraft hour,

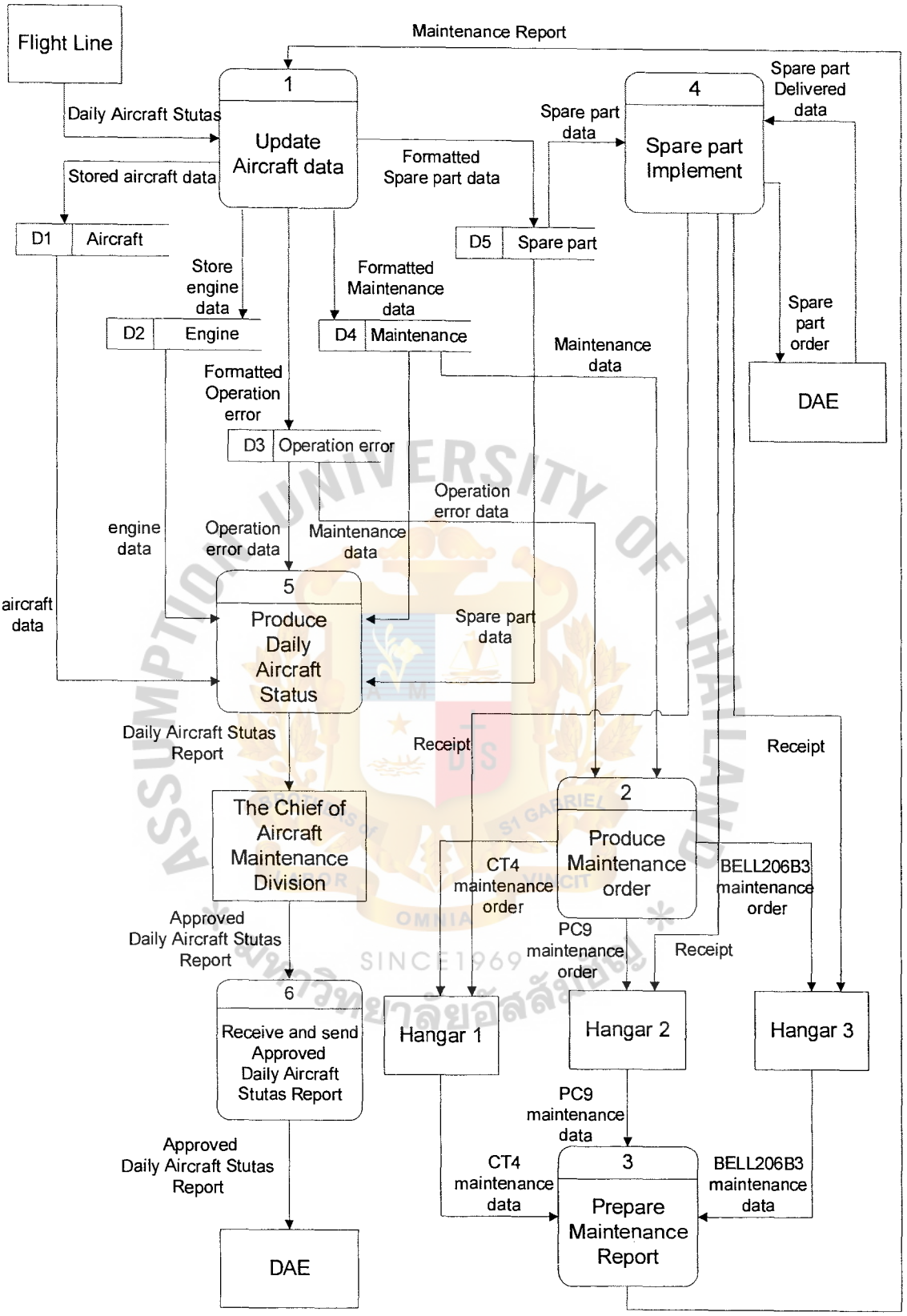

Figure 5.2. Level 0.

engine hour and spare part order. These data will be updated and recorded in Maintenance file. The system utilized this data to cerate spare part file.

(d) Process 4: Spare part Implement

Spare part file provides aircraft status, spare part status and spare part order to the system. Spare part order will be sent to DAE. Then receive the spare part from DAE and provides the spare parts to each hangar.

(e) Process 5: Produce Daily Aircraft Status

Aircraft file, engine file, operation error, Maintenance file and spare part file provide the data about aircraft, engine operation error, maintenance and spare part to the system. These data will be utilized for the Daily Aircraft Status Report, which will be sent to the Chief of the Aircraft Maintenance Division for examination and approval.

(f) Process 6: Receive and send Approved Daily Aircraft Status Report

After the Daily Aircraft Status Report is approved by the Chief of the Aircraft Maintenance Division, it will be sent to DAE.

(3) Level 1 of Process 1

This level shows the processes of updating the maintenance status data. It is shown in Figure 5.3.

(a) Process 1.1: Receive Aircraft Status Data

The Flight Line provides daily aircraft status data to the system. These data will be divided into aircraft, engine, operation error and maintenance data.

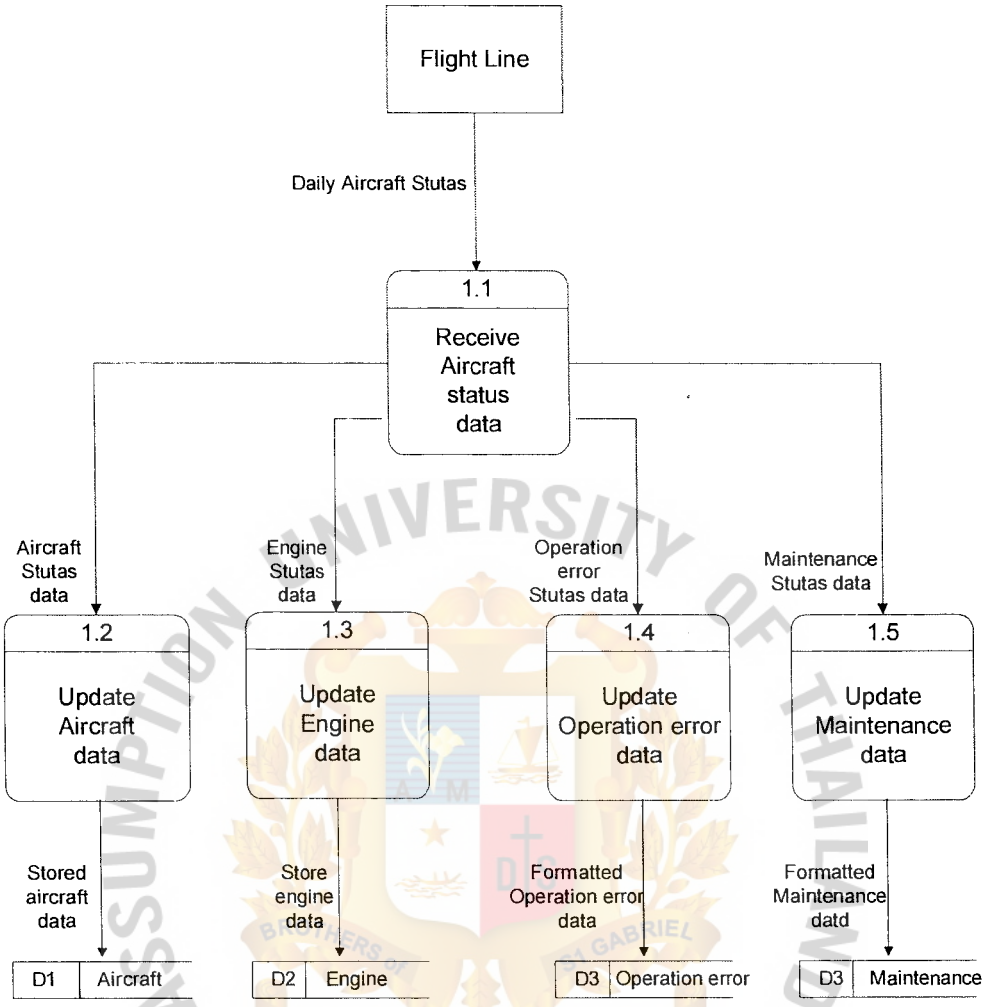

Figure 5.3. Level 1 of Process 1.

(b) Process 1.2: Update Aircraft Data

The aircraft status data will be formatted and installed to the aircraft file for continuous update.

(c) Process 1.3: Update Engine Data

The engine status data will be formatted and installed to the engine file in order to always update it.

(d) Process 1.4: Update Operation Error Data

The operation error data will be formatted and installed to the operation error file in order to always up date it.

(e) Process 1.5: Update Maintenance Data

The maintenance data will be formatted and installed to the maintenance file in order to always update it.

(4) Level 2 of Process 1.2

This level shows the processes of updating the aircraft data. It is shown in Figure 5.4.

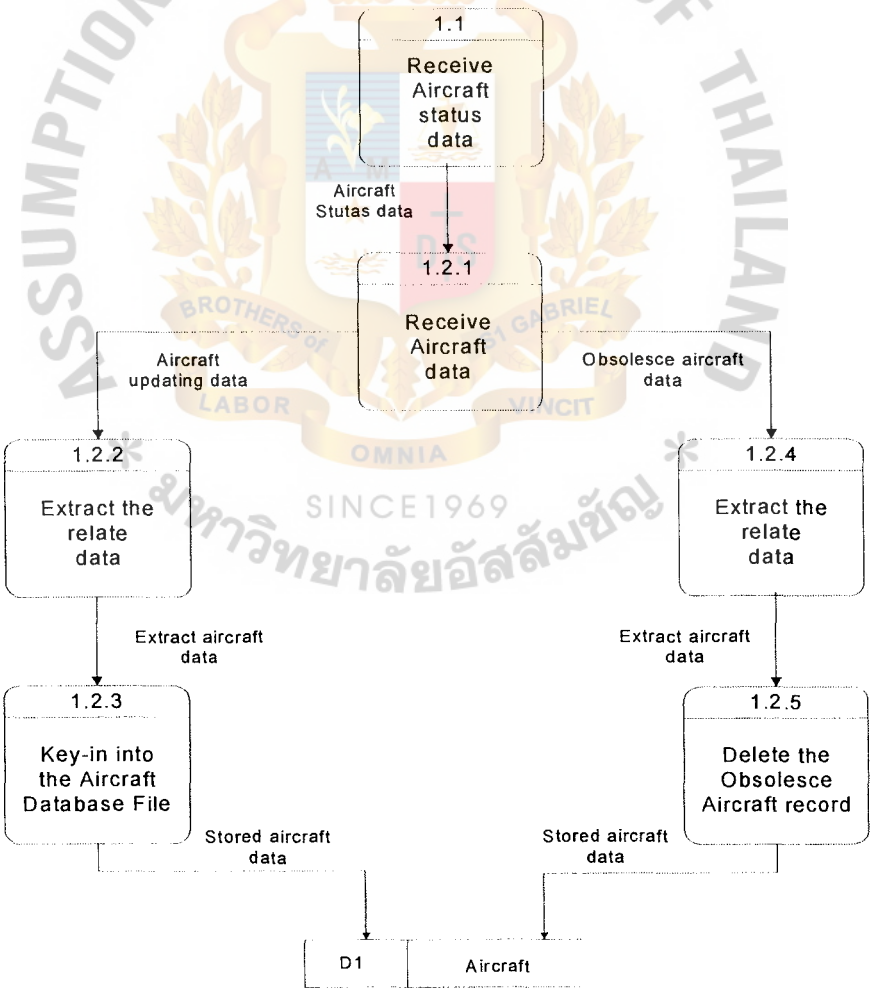

Figure 5.4. Level 2 of Process 1.2.

(a) Aircraft Updating Data

Staff extracts the updated data of daily aircraft status and then stores it in the aircraft file.

(b) Obsolesce Aircraft Data

When an aircraft is not on duty, the staff will delete that aircraft record in the aircraft file.

(5) Level 2 of Process 1.3

This level shows the processes of updating the engine data. It is similar to the level 2 of process 1.2 as shown in Figure 5.5.

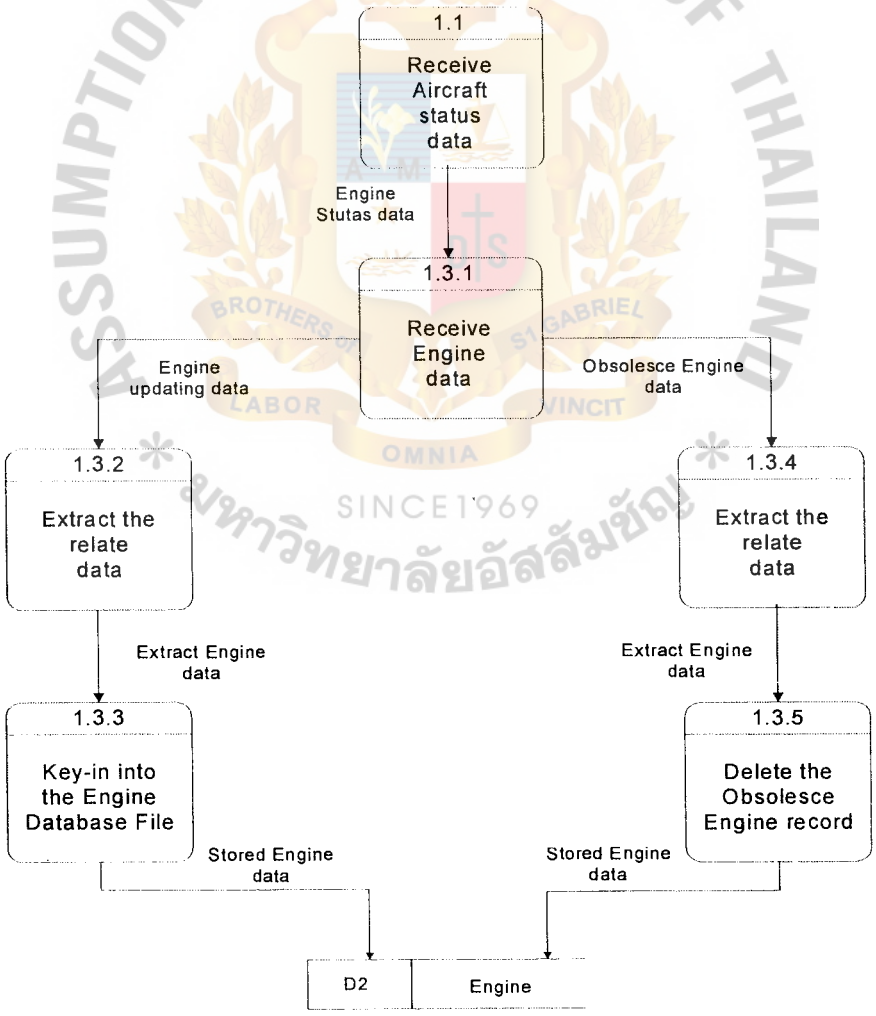

Figure 5.5. Level 2 of Process 1.3.

(6) Level 2 of Process 1.4

This level shows the processes of updating the operation error data. It is similar to the level 2 of process 1.2 as shown in Figure 5.6.

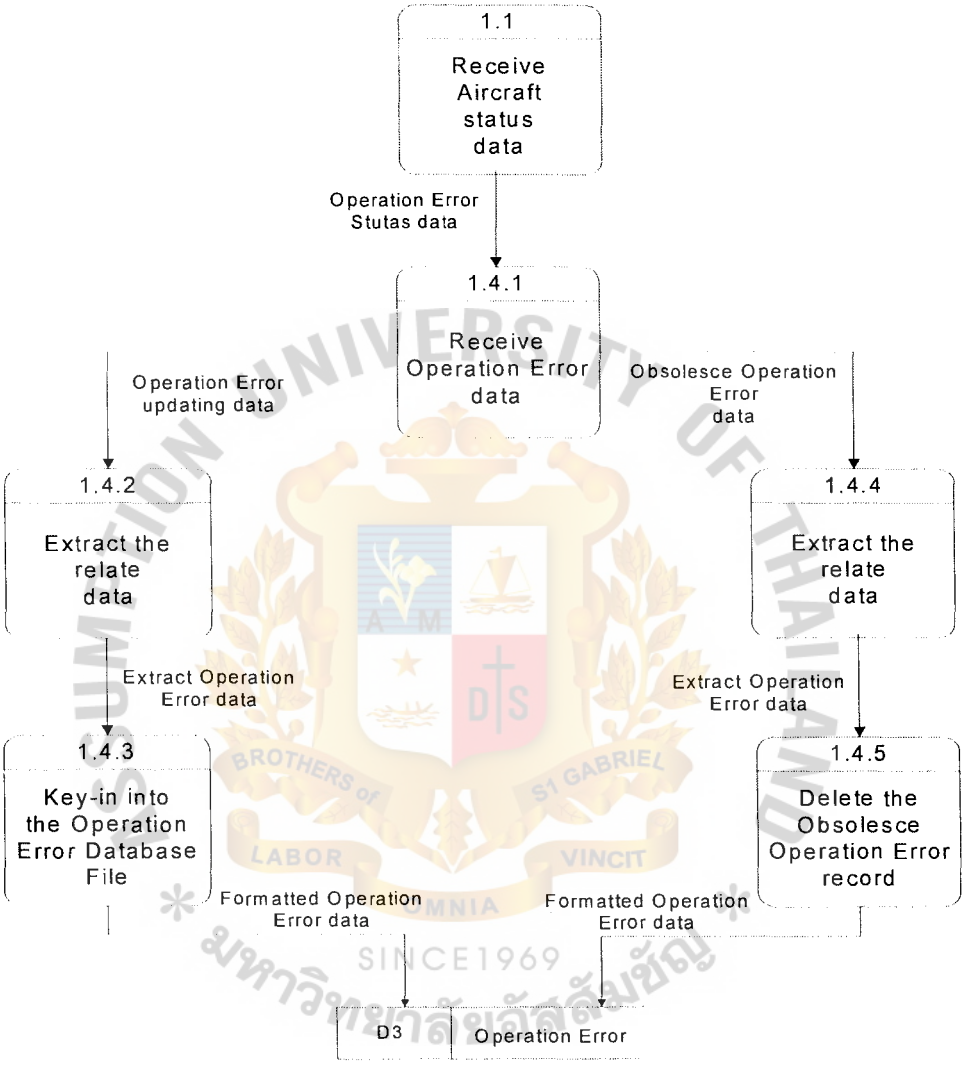

Figure 5.6. Level 2 of Process 1.4.

(7) Level 2 of Process 1.5

This level shows the processes of updating the maintenance data and spare part data. Maintenance Report is provided in the system, These information include spare part status. Staff will store data in maintenance file and spare part file as shown in Figure 5.7.

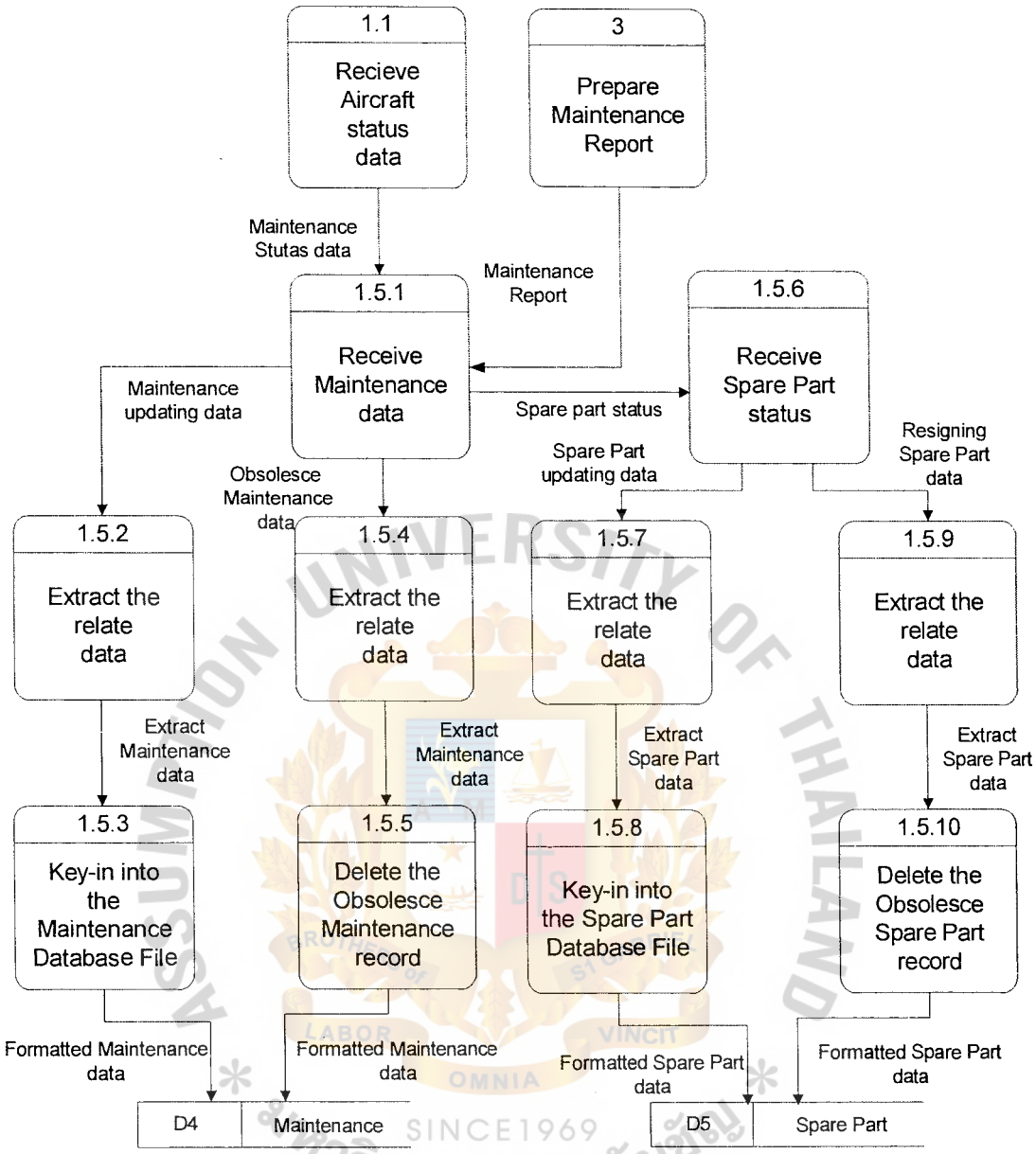

Figure 5.7. Level 2 of Process 1.5.

(8) Level 1 of Process 2

This level shows the processes of creating maintenance order and send to each hangar as shown in Figure 5.8.

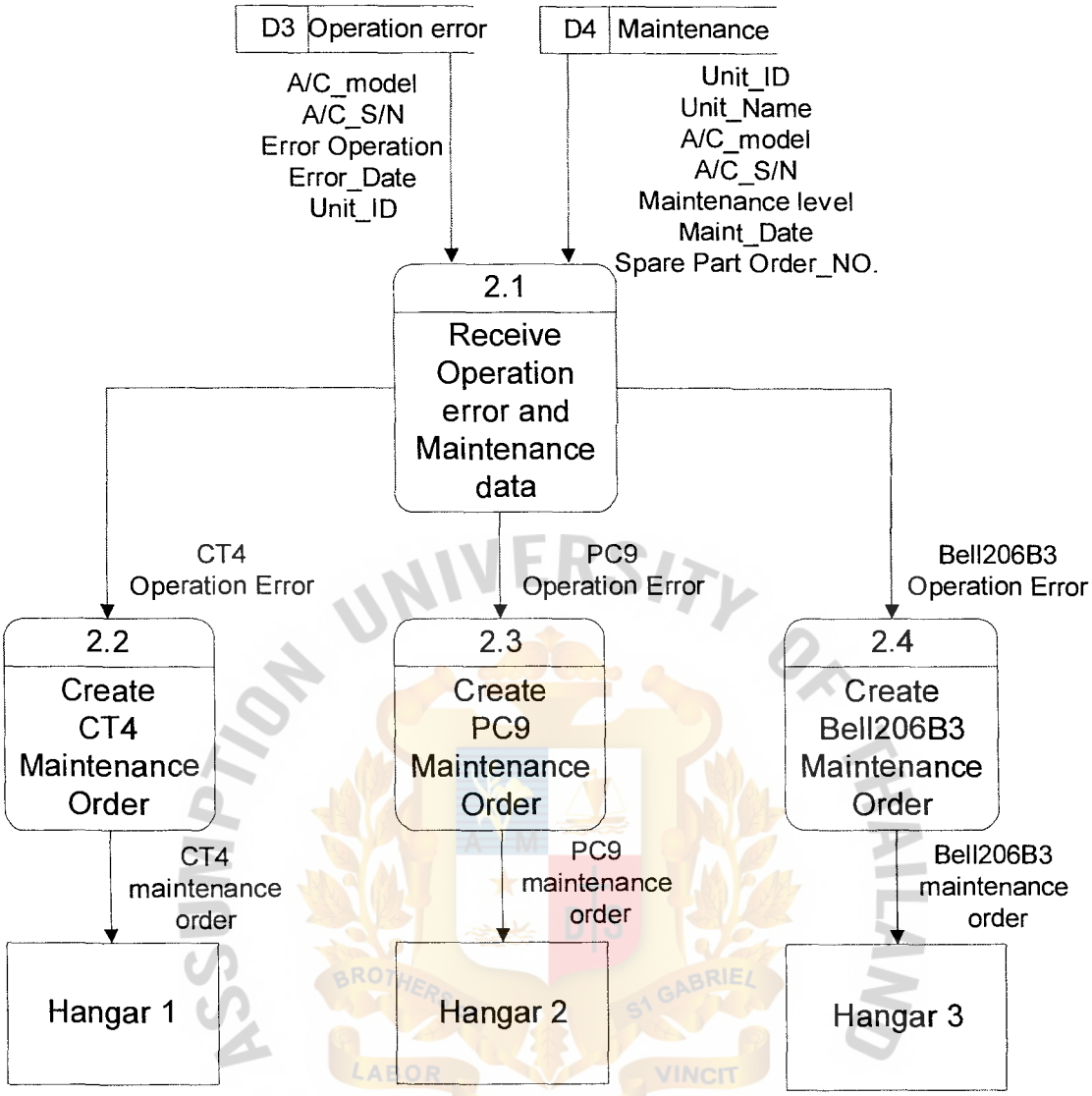

Figure 5.8. Level 1 of Process 2.

(a) Receiving Operation error and Maintenance Data

Staff will use Operation error and Maintenance Data to create maintenance order.

(b) Sending the maintenance order

The maintenance order will be sent to each hangar.

(9) Level 1 of Process 3

This level shows the process of the Prepare Maintenance Report, as shown in Figure 5.9.

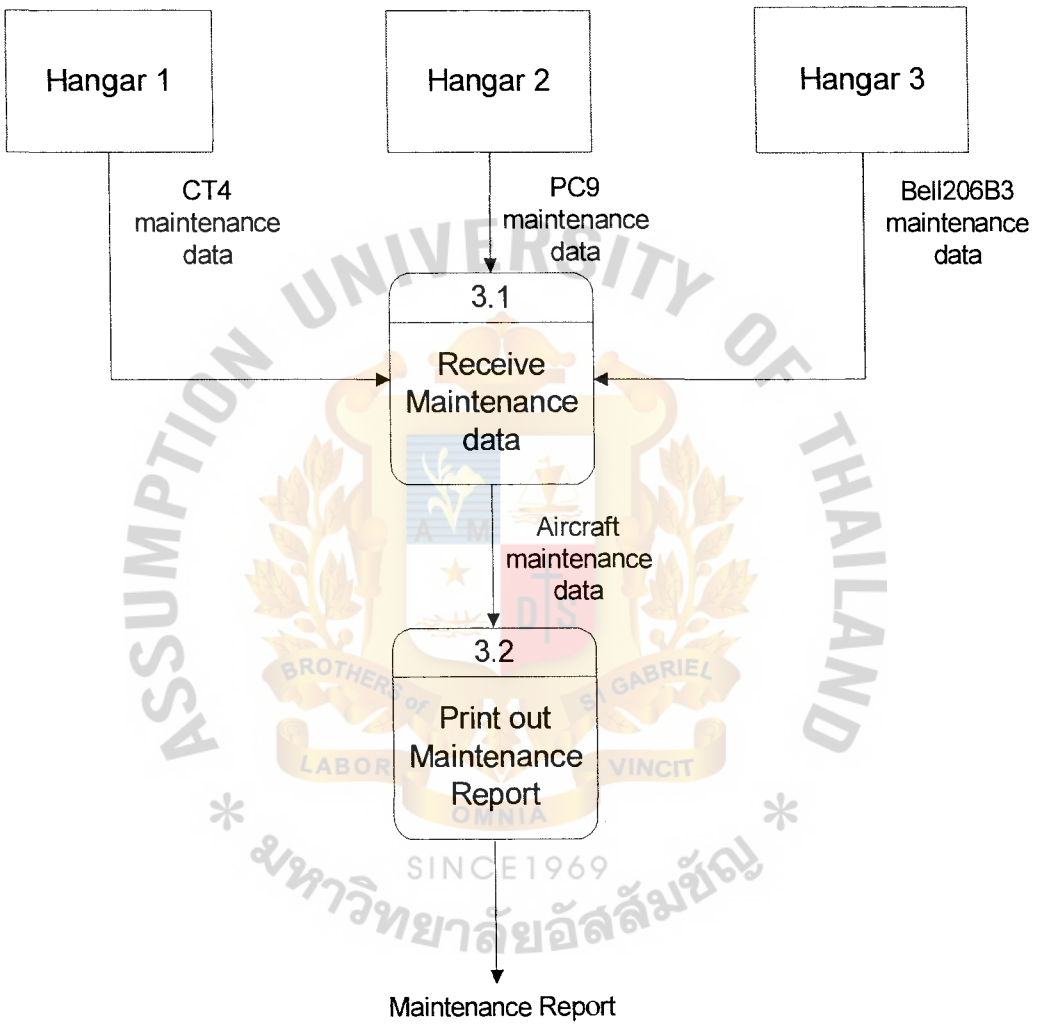

Figure 5.9. Level 1 of Process 3.

(10) Level 1 of Process 4

This level shows the process of receiving and transforming order, as shown in Figure 5.10.

(11) Level 1 of Process 5

This level shows the process of Produce the Daily Aircraft Status Report, as shown in Figure 5.11.

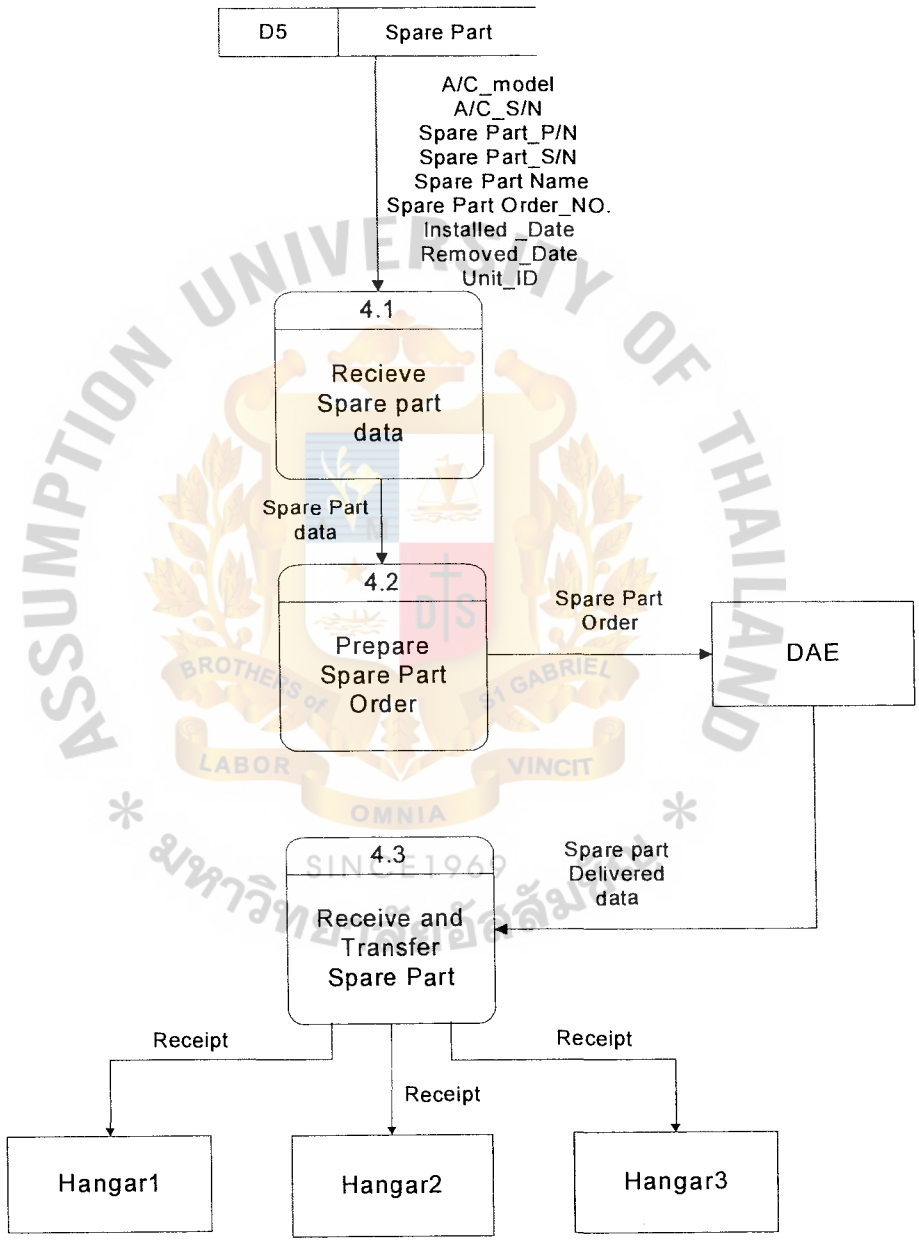

Figure 5.10. Level 1 of Process 4.

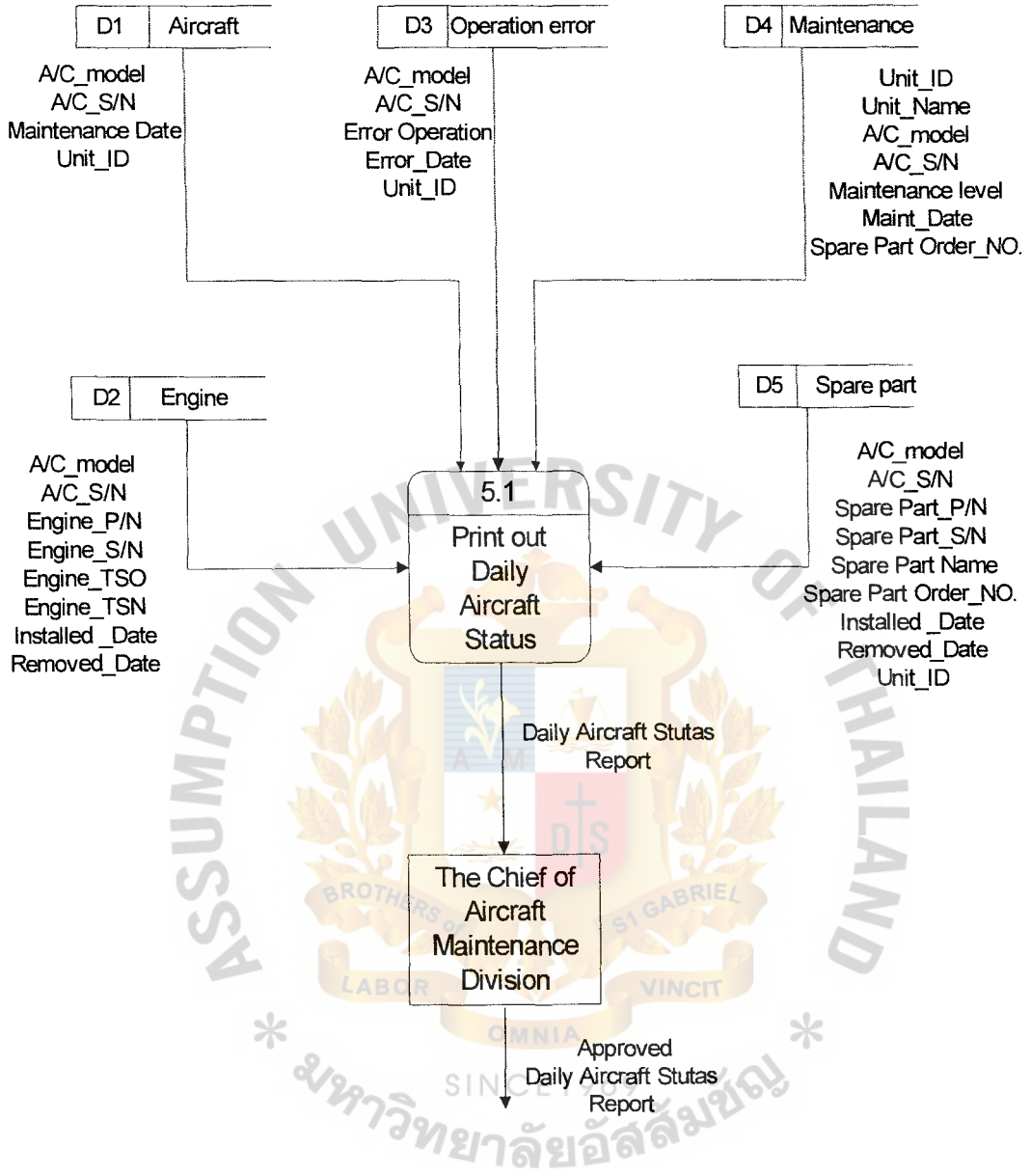

Figure 5.11. Level 1 of Process 5.

VI. DATABASE DESIGN AND COMPUTER NETWORKING STRUCTURE

6.1 Entity Relation Diagram

The Entity Relation Diagram (ERD) is a tool that is used to show the data modeling of the proposed system, as shown in Figure 6.1. There are 6 entities. Each entity has its own attributes that are related to others.

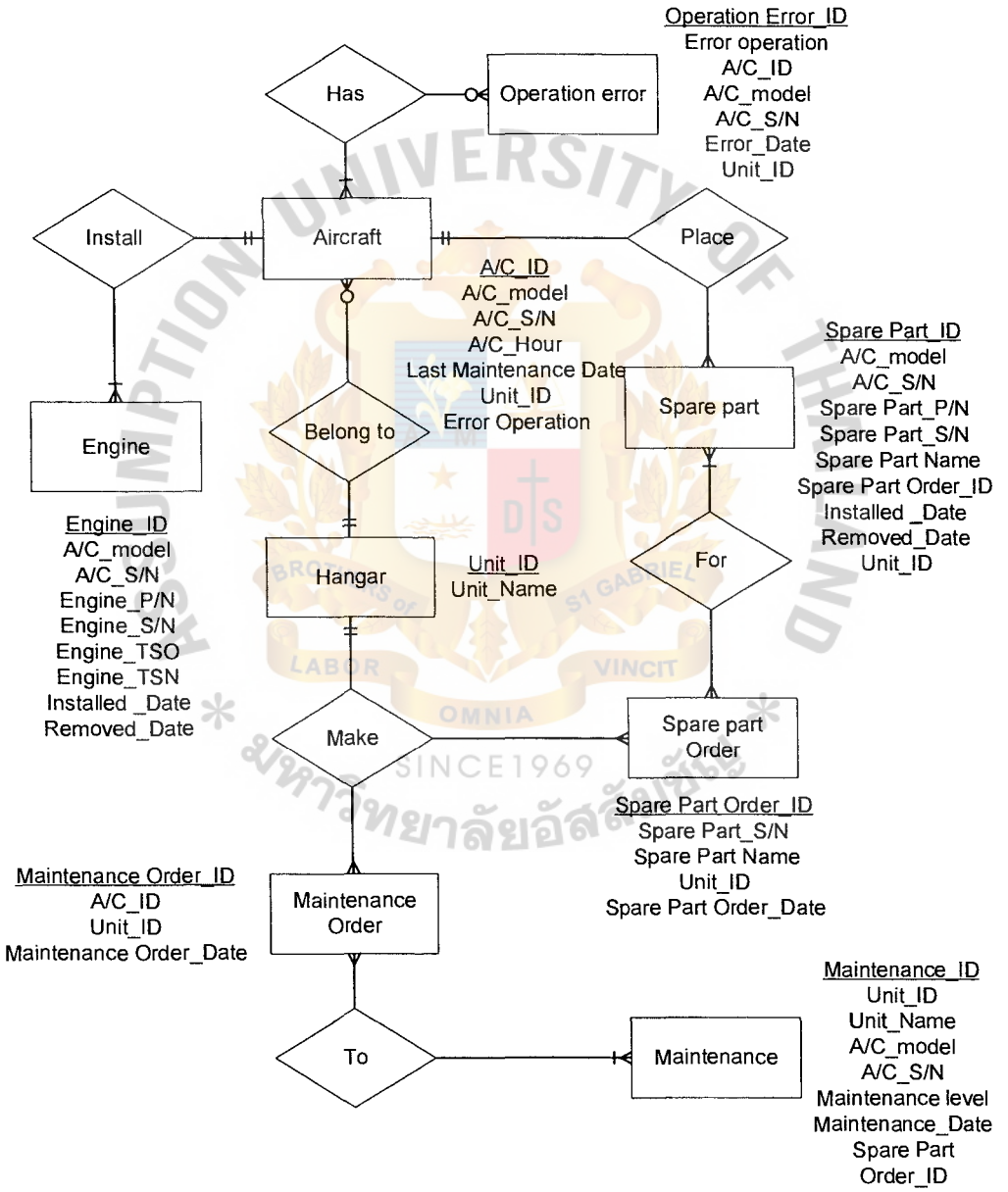

Figure 6.1. The Entity Relation Diagram (ERD).

(1) Entity and its attributes

(a) Aircraft Entity has Aircraft _ID to be its key attribute.

(b) Spare Part Entity has Spare Part_ID to be its key attribute.

(c) Engine Entity has Engine_ID to be its key attribute.

(d) Hangar Entity has Unit_ID to be its key attribute.

(e) Spare Part Order Entity has Spare Part Order_ID to be its key attribute.

(f) Maintenance Order Entity has Maintenance Order_ID to be its key attribute.

(g) Maintenance Entity has Miantenance_ID to be its key attribute.

(h) Operation Error Entity has Operation Error_ID to be its key attribute.

(2) Relationship between Entities.

(a) Each aircraft is installed with one or more engines.

(b) Each aircraft has to be installed with many spare parts.

(c) None or many aircrafts may belong to hangar.

(d) Each spare part order is for one or more spare parts.

(e) Each maintenance order is for one or more aircrafts.

(f) Each aircraft has none or more operation errors.

6.2 Logical Record Structure

The Logical Record Structure is mapped from the ERD. It is a primary tool to design a database. It is shown in Figure 6.2.

6.3 Database Design

The original table of database is mapped from the Logical Record Structure, as shown in Figure 6.3. It is not in normalization form. In order to design an efficient

database, the normalized table is developed from the original table by using normalization method, as shown in Figure 6.4. It is the last figure of database design.

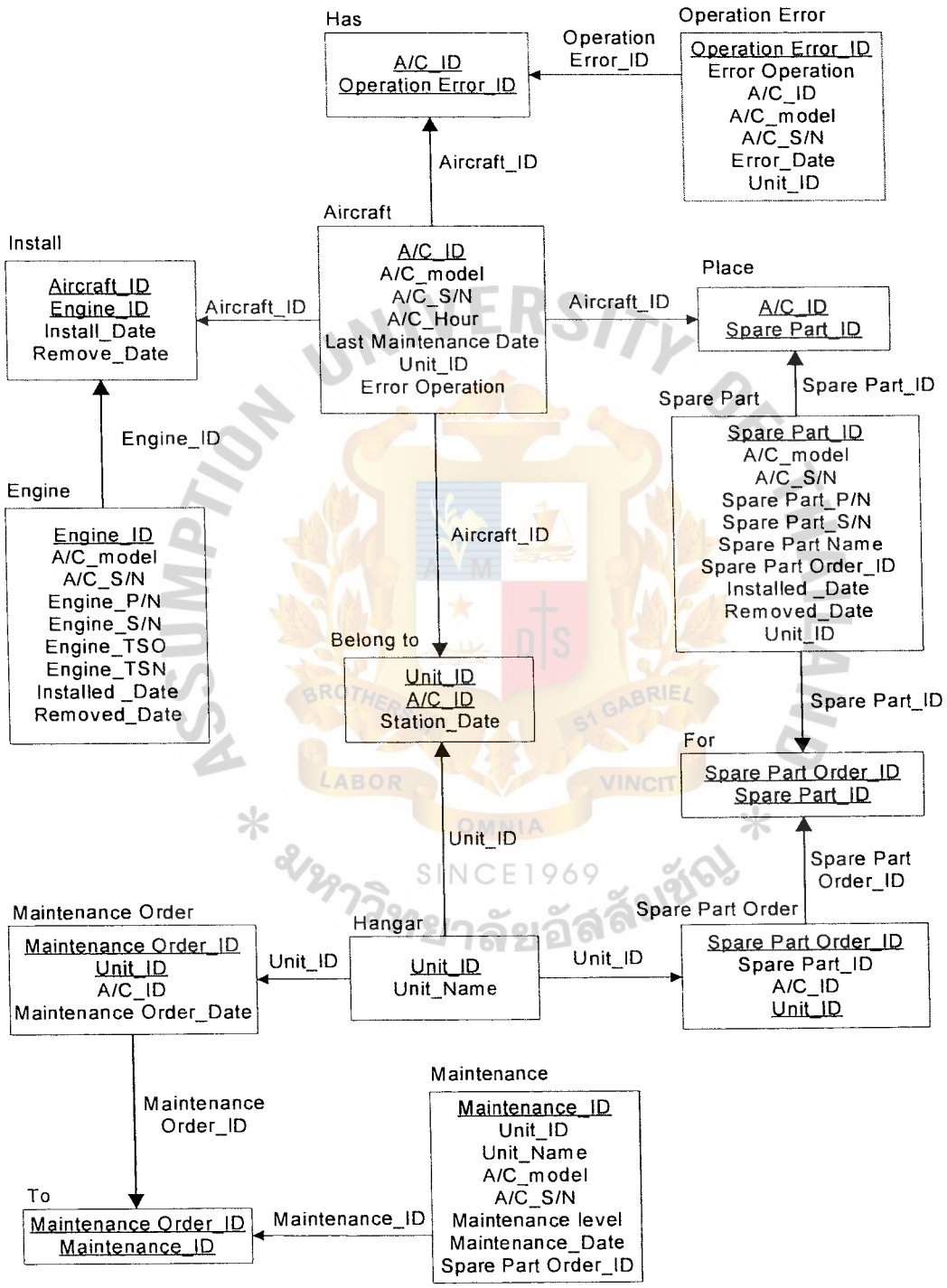

Figure 6.2. Logical Record Structure.

Table 6.1. Original Table.

Aircraft

Aircraft ID	Aircraft Model	Aircraft S/N	Aircraft Hour	Last Maint. Date	Unit ID	Operation Error

Install

Aircraft ID	Engine ID	Installed Date	Removed Date

Engine

Engine ID	Aircraft Model	Aircraft S/N	Engine P/N	Engine S/N	Engine TSO	Engine TSN	Installed Date	Removed Date

Belong to

Aircraft ID	Unit ID	Station Date

Maintenance Order

Maintenance Order ID	Aircraft ID	Unit ID	Maint. Order Date

Maintenance

Maintenance ID	Unit ID	Unit Name	Aircraft Model	Aircraft S/N	Maint Date	Maint level	Spare Order ID

Spare Part

Spare ID	Aircraft Model	Aircraft S/N	Spare P/N	Spare S/N	Spare Name	Installed Date	Removed Date	Unit ID	Spare Order ID

For

Spare Order ID	Spare ID

Has

Aircraft ID	Operation Error ID

Place

Aircraft ID	Spare ID

Hangar

Unit ID	Unit Name

Operation Error

Operation Error ID	Aircraft ID	Aircraft Model	Aircraft S/N	Error Date	Unit ID	Operation Error

Spare Part Order

Spare Order ID	Spare ID	Aircraft ID	Unit ID

To

Maintenance Order ID	Maintenance ID

Table 6.2. Normalized Table.

Aircraft

Aircraft ID	Aircraft Model	Aircraft S/N

Aircraft ID	Unit ID

Aircraft ID	Aircraft Hour	Last Maint. Date	Operation Error

Install

Aircraft ID	Engine ID	Installed Date	Removed Date

Engine

Engine ID	Engine P/N	Engine S/N

Engine ID	Aircraft Model	Aircraft S/N

Engine ID	Engine TSO	Engine TSN

Engine ID	Installed Date	Remove Date

Belong to

Aircraft ID	Unit ID	Station Date

Has

Aircraft ID	Operation Error ID

Hangar

Unit ID	Unit Name

For

Spare Order ID	Spare ID

To

Maintenance Order ID	Maintenance ID

Place

Aircraft ID	Spare ID

Maintenance Order

Maintenance Order ID	Aircraft ID	Unit ID	Maint. Order Date

Maintenance

Maintenance ID	Maint Date	Maint level

Maintenance ID	Aircraft Model	Aircraft S/N

Maintenance ID	Unit ID	Spare Order ID

Spare Part

Spare ID	Spare P/N	Spare S/N	Spare Name

Spare ID	Aircraft Model	Aircraft S/N	Unit ID

Spare ID	Installed Date	Removed Date

Spare ID	Spare Order ID

Operation Error

Operation Error ID	Aircraft ID	Unit ID

Operation Error ID	Operation Error	Error Date

Spare Part Order

Spare Order ID	Spare ID	Aircraft ID	Unit ID

6.4 The Existing Computer System

(1) Each Hangar (Hangar1, 2 and 3) has:

(a) 2 Personal Computers. All of them are stand-alone.

(b) 1 Printer

(2) The Supply Section has:

(a) 2 Personal Computers. All of them are stand-alone.

(b) 1 Printer.

(3) The Flight Line Section has:

(a) 2 Personal Computers. All of them are stand-alone.

(b) 1 Printer.

(4) The Aircraft Maintenance Operation Center has:

(a) 2 Personal Computers. All of them are stand – alone.

(b) 2 Printers.

6.5 The Purposed Computer Networking Structure

The purposed Computer Networking Structure is supporting by the Local Area Network (LAN) technology. The details of this technology and the essential components of computer networking are explained in Chapter 2. Aircraft Maintenance Operation Center, hangars, Flight Line and Supply Section are in the same area. Thus the main server of this proposed system will be at Aircraft Maintenance Operation Center. The proposed Computer Networking Structure is shown in Figures 6.5 and 6.6.

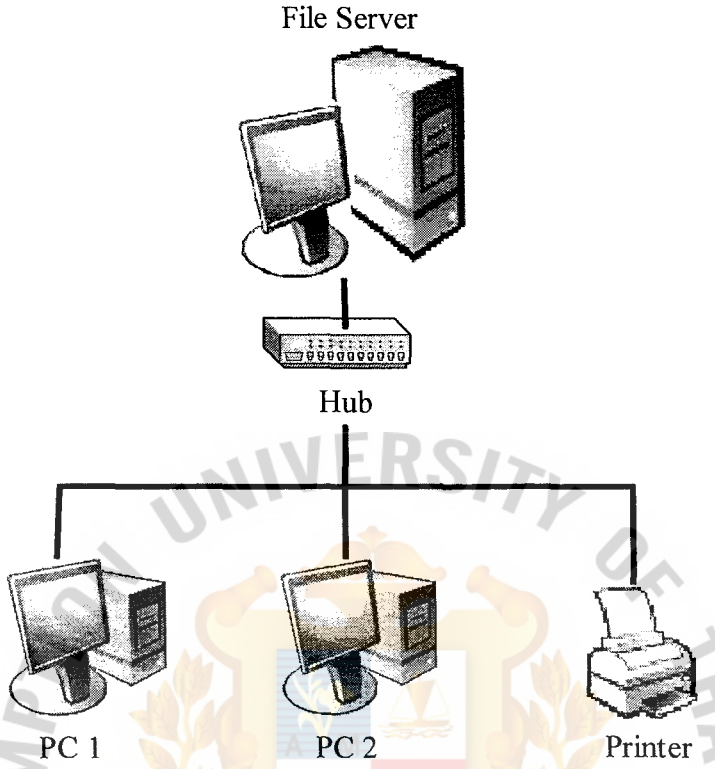

Figure 6.3. The LAN of Each Section in Aircraft Maintenance Division, FTS.

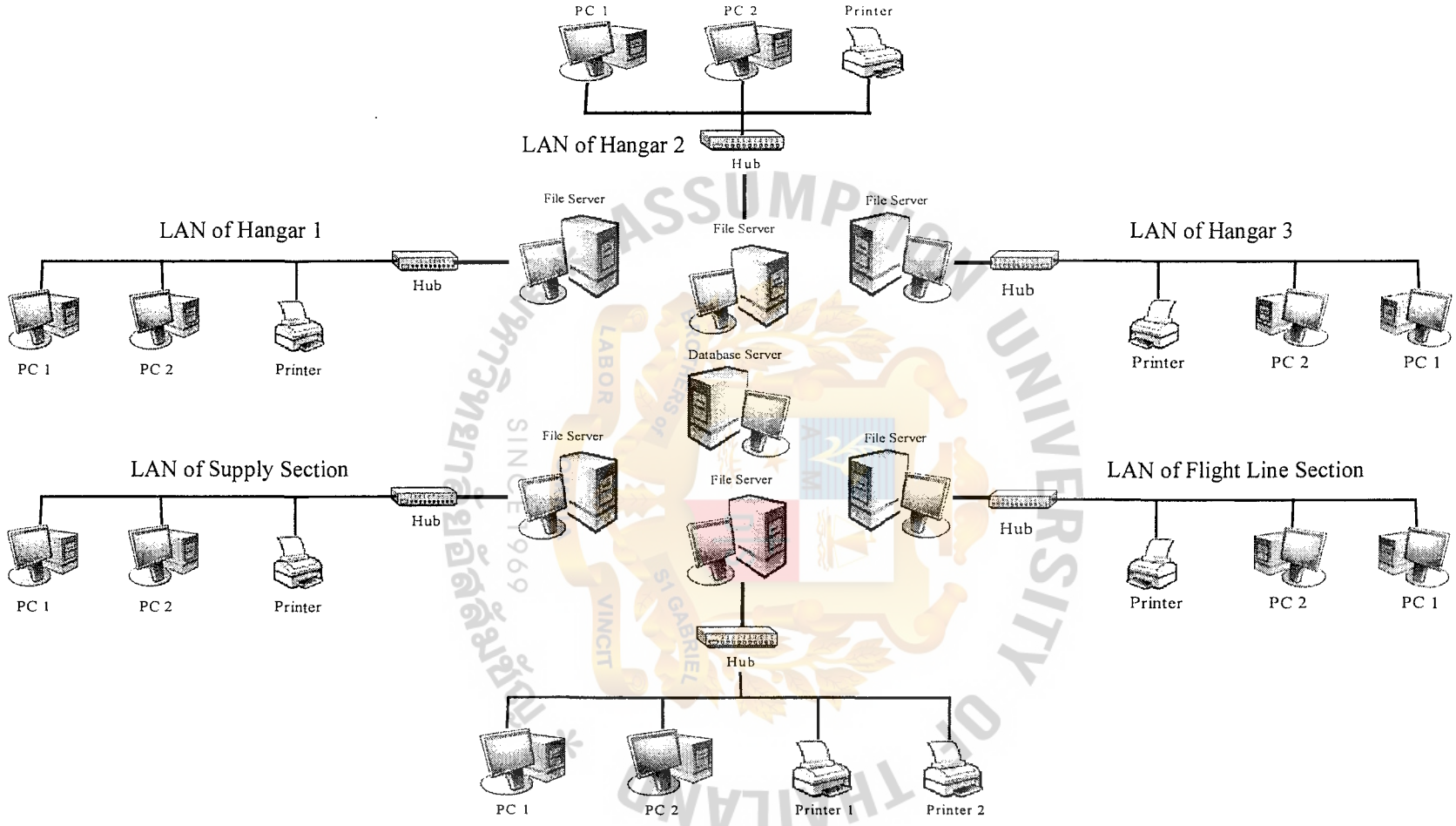

Figure 6.4. Large Picture of the Proposed System.

VII. SECURITY OF THE PROPOSED SYSTEM

7.1 Concept of Database

A database is a collection of data and a set of rules that organize the data by specifying certain relationships among the data. Through these rules, the user describes a logical format for the data. The data items are stored in a file, but the precise physical format of the file is of no concern to the user. A data base administrator is a person who defines the rules that organize the data and controls who should have access to what parts of the data. The user interacts with the data through a program called a data base manager or a data base management system (DBMS), informally known as a front end.

The data base file consists of record, each of which contains one related group of data. Each record consist of field or elements, the elementary data items themselves. The logical structure of a data is call schema. A particular user may have access to part of the database, called a subschema.

The advantages of using Data Bases

(1) Shared access, so that many users can use one common, centralized set of data.

(2) Minimal redundancy, so that individual user do not have to collect and maintain their own sets of data.

(3) Data consistency, so that a change to a data value affects all users of the data value.

(4) Data integrity, so that data values are protected against accidental or malicious incorrect changes.

(5) Controlled access, so that only authorized users are allowed to view or to modify data values.

7.2 Security Requirements

(1) Physical data base integrity

Database is immune to physical problems such as power failures and so that someone can reconstruct the data base if it is destroyed through a catastrophe. Using UPS to protect database.

(2) Logical data base integrity

The structure of the database is preserved, a modification to the value of one field does not effect other fields.

Two situations can affect the integrity of a database:

(a) Integrity of the database as a whole is the responsibility of the DBMS, the operating system, and the computing system manager.

(b) One form of protection for the database as a whole is a regular backup copies of all files on the system.

(3) Element Integrity

The integrity of elements of a database is their correctness or accuracy. Ultimately, authorized users are responsible for putting correct data into database. However, users make mistakes collecting data, computing results, and entering values. Therefore, DBMSs sometimes help a user catch errors as they are entered and correct errors after they are inserted.

The DBMS maintains the integrity of each item in the database in three ways. It can apply field checks, which are tests for appropriate values in a position. Integrity is also maintained by access control. A data base may contain data from several sources. However, ownership of a shared central file is a question. Who has authorization to update which elements? The

third to maintain a change log for the database. A change log is a list of every change made to the database; the log contains both original and modified values.

(4) Auditability

In some applications it may be desirable to generate an audit record all access (read or write) to a database. Such a record can help to maintain the integrity of a database or, at least, to discover after the fact who affected what values and when. To be useful for the purposes just described, audit trails for database must include accesses at the record, field and element levels. This level of the detail is prohibitive for most data base applications.

(5) Access Control

Database are often logically separated by user access privileges, all users can be granted access to general data, but the only one personnel department can obtain salary data and only the marketing department can obtain sales data.

The database administrator specifies who should be allowed access to which data, at the field, or record, or even element level. The DBMS must enforce this policy, granting access to all specified data or no access where prohibited. The number of modes of access can be many. A user or program may have the right to read, change, delete, or append to a value, add or delete entire fields or records, or reorganize the entire database.

Access control for a database seems like access control for operating systems or any other component of a computing system. However, the database problem is more complicated. Operating system objects, such as files, are unrelated items, whereas records, field, and elements are related.

Although a user cannot determine the contents of one file by reading others, a user might be able to determine one data element just by reading others. You can access data by interference, without needing to have direct access to the secure object itself. However, restricting access to control interference also limits queries from user who did not intend to access values not authorized. Size or granularity is different between operating system objects. An access control list of several hundred files is much easier to implement than an access control list for a data base with several hundred files of perhaps a hundred fields each.

(6) User Authentication

The DBMS can require rigorous user authentication. For example, a DBMS might require a user to pass both specific password and time-of-day checks. An operating system bases much of its protection on knowing who a user of the system is. People have developed systems of authentication using documents, voice recognition, and other trusted means of identification. The most common authentication mechanism is a **password**, a "word" know to computer and user.

Passwords are manually agreed-upon code words, assumed to be known only to the user and the system. In some cases a user chooses passwords; in other cases they are assigned by the system. The length and format of the password also vary from one system to another. The use of passwords is fairly straightforward. A user enters some piece of identification, such as a name or an assigned user ID; this identification can be available to the public or easy to guess, because it dose not provide the real security of the system. The system then request the password from the

user. If the password matches that on file for the user, the user is authenticated to the system. If the password match fails, the user may have mistyped, in which case the system requests the password again.

(7) Availability

A DBMS has aspects of both a program and system. It is a program that uses other hardware and software resources, yet to many user it is the only application run. Once availability problem stems from arbitrating two users' requests for the same record. A second problem comes from needing to withhold some unprotected data in order to avoid revealing protected data.

7.3 Virus Protection

Techniques for building a reasonably safe database as follows:

(1) Use only commercial software acquired from reliable, well-established vendors. Although we may receive a virus from even a large manufacturer with a name everyone would recognize, these organizations have significant reputations that could be seriously damaged by even one bad incident. Similarly, software distribution companies are careful about products they handle.

(2) Test all new software on an isolated computer. If we must use software from a questionable source, test the software first on a computer with no hard disk, not connected to a network, and with the boot disk removed. Run the software and look for the unexpected behavior, even simple behavior such as unexplained figures on the screen. Test the computer with a copy of virus scanner, created before running the suspect program. Only if the program passes these tests should it be installed on a less isolated machine.

(3) Make a bootable diskette and store it safety. Revise the startup files on the startup files on the diskette so that system files (drivers, memory management software) are loaded from the diskette. If your system does become inflected, this clean diskette will let you reboot securely. Keep the diskette write-protected during reboot. Prepare this diskette now, before inflection; after inflection it is too late. For safety, prepare an extra copy of the safe boot diskette.

(4) Make and retain backup copies of executable system files. This way, in the event of a virus inflection, you can remove inflected files and install from the clean backup copies.

(5) Use virus detectors (often called virus scanners) regularly. Many of the virus detectors available can both detect and eliminate viruses. Several scanners are better than one, because one may detect viruses other miss. Scanners search for virus signatures. They are constantly being revised as new viruses are discovered. New virus signature files, or new versions of scanners, are distributed frequently.

VIII. HARDWARE AND SOFTWARERE REQUIREMENTS

8.1 Introduction

The purpose of this project is to solve problems of the existing system and meet the requirements of the users. After completing the purposed system by applying the existing operation to a Local Area network (LAN) technology, the communication inside AMOC and between AMOC and each hangar and Flight Line will be smoother, faster, and more effective than the existing one. The hardware and software requirements are detailed in the subsequence discussion.

8.2 Aircraft Maintenance Operation Center's Requirements

(1) Hardware Requirements

(a) PC Server

(1) Pentium 4

(2) RAM 2 GB

(3) Hard drive 60 GB

(4) Land Card

(b) Switching Hub

(c) Laser Printer

(d) Dot Printer

(2) Software Requirements

(a) Operating System Program

(1) Windows XP Professional or

(2) Linux

(b) Application Program

8.2 Each Hangar, Flight Line and Supply Section's Requirements

(1) Hardware Requirement

(a) PC with Pentium III or up

(b) Land card

(c) Switching Hub

(d) Inkjet Printer

(e) Dot Printer

(2) Software Requirements

(a) Operating System Program

(1) Windows XP Home Edition or

(2) Linux

(b) Application Program

IX. INTERFACE AND REPORT DESIGN

9.1 Interface Design

The interface design is the method that helps users interact with information system. The interface design of the proposed system can help the development team to understand the same concept of the system interface and simplify the process in the system development phase.

(1) AMOC will correct aircraft data when receiving aircraft status from Flight Line.

(a) CT4 status. (Figure B.1 of Appendix B)

(b) PC9 status. (Figure B.2 of Appendix B)

(c) BELL206B3 status. (Figure B.3 of Appendix B)

(d) CT4 hour. (Figure B.4 of Appendix B)

(e) PC9 hour. (Figure B.5 of Appendix B)

(f) BELL206B3 Hour. (Figure B.6 of Appendix B)

(2) Store the maintenance status data.

(a) CT4 maintenance status. (Figure B.7 of Appendix B)

(b) PC9 maintenance status data. (Figure B.8 of Appendix B)

(c) BELL206B3 maintenance status data. (Figure B.9 of Appendix B)

(3) Stored the spare part data.

(a) CT4 spare part list. (Figure B.10 of Appendix B)

(b) PC9 spare part list. (Figure B.11 of Appendix B)

(c) BELL206B3 spare part list. (Figure B.12 of Appendix B)

(4) Order aircraft spare part.

(a) CT4 spare part order. (Figure B.13 of Appendix B)

(b) PC9 spare part order. (Figure B.14 of Appendix B)

(c) BELL206B3 spare part order. (Figure B.15 of Appendix B)

9.2 Report Design

(1) Maintenance Report. (Figure C.1 of Appendix C)

(2) Spare Part Order Report. (Figure C.2 of Appendix C)

(3) Daily Aircraft status Report. (Figure C.3 of Appendix C)

X. CONCLUSIONS AND RECOMMENDATIONS

10.1 Conclusions

The objective of this project to propose a networking system based Local Area Network (LAN) which supports the aircraft maintenance system of the Aircraft Maintenance Division, Flying Training School. LAN technology supplies network in area and make the operation efficient.

The study of this project started from studying and analyzing the existing system aircraft maintenance process in Flying Training School that are manually operated. The researcher found out that there are many problems. The information is not up to date, the information is not reliable, the details is not enough, the information is difficult to retrieve, work is duplicated, and too much time is consumed. After that, the research plans the proposed system that based LAN. It can replace the existing one and meet the users requirement.

The analysis tool such as data flow diagram, logical diagram, logical record structure and entity-relationship diagram, are used to develop the behavioral model and data model of the proposed system.

In this study, the researcher comments on the hardware and software requirements, and the interface and report design to be the guideline for developing the system. In order to secure the information of the proposed system user authentication and access control methods are applied to the proposed system. It will provide high security in communication and information.

After the proposed system is completed, the problem of the existing one will be solved and it will also provide effective communications system to all the Aircraft Maintenance Division, FTS.

10.2 Recommendations

I recommend that we should apply Aircraft Maintenance Networking System to all Wings over Thailand in the near future. The objective is to replace the existing aircraft maintenance system based manual procedure by a computer networking system. It offers much more speed, accuracy and convenience to the organization than a manual operation. And the next stage, we should develop the Virtual Private Network (VPN) for connect to between all Aircraft bases over Thailand and Directorate of Aeronautical Engineering (DAE). For managing and controlling the aircraft maintenance and spare parts. If it is successful, Royal Thai Air Force (RTAF) will safe in cost and time for maintain the aircraft. And accuracy in maintenance, therefore there are many aircraft which ready for the mission to protecting the sovereignty beyond the horizon of Thailand.

APPENDIX A

GLOSSARY OF TERMS

Glossary of Terms

(1) Flight Hour

The operation hour of aircraft (structure), engine, and spare part. It can be divided into Time Since new and Time Since Overhaul. They can be used to determine the maintenance schedule of aircraft, engine, and spare part.

(2) Time Since New

It commonly known as TSN, is the operation hour that start to count since manufacture.

(3) Time Since Overhaul

It commonly known as TSO, is the operation hour that start to count since the last depot maintenance.

(4) Part Number

It commonly known as P/N, is the identify number of spare part that determine by manufacture company.

(5) Serial Number

It commonly known as S/N, is the identify number of spare part that determine by sup-manufacture company.

(6) Aircraft Maintenance Level

It can be divided into 3 level, There are Organization Maintenance, Intermediate Maintenance, and Depot Maintenance. Aircraft maintenance level depends on the complexity and the interval of maintenance. The Organization maintenance is the most often and the less complexity, but the Depot Maintenance is rarely often and the most complexity.

(7) FCF

It is stand for Function Check Flight, The pilot will take the aircraft after finished in maintenance for check the aircraft's functions and performance.

(8) FMC

It is stand for Full Mission Capable, the percentage of the aircraft ready for the mission.

(9) NMCS

It is stand for Not Mission Capable Supply, the status of the aircraft when waiting the spare parts for maintenance.

(10) Asynchronous Transfer Mode (ATM)

A type of switching technology in which the switches are small, fixed – length cells containing data.

(11) AppleTalk

A communications protocol developed by Apple Computer to allow networking between Macintoshes. All Macintosh computers have a LocalTalk port, running AppleTalk over a 230K bps serial line. AppleTalk also runs over Ethernet (EtherTalk) and Token Ring (TokenTalk) network media.

(12) Backbone

The main cable in a network. A segment of network that links several individual workgroup department LANs together in a single building. It is also used to link several building LANs together in a campus environment.

(13) Bit

The smallest unit of data processing information. A bit (or binary digit) assumes the value of either 1 or 0.

(14) Bridge

A networking device that connects two LANs and forwards or filters data packets between them, based on their destination addresses. Bridges filter packets between LANs by making simple forward/don't forward decision on each packet they receive form any of the networks to which they are connected.

(15) Bus

A LAN topology in which all the nodes are connected to a single cable. All nodes are considered equal and receive all transmissions on the medium.

(16) Coaxial Cable

An electrical cable with a solid wire conductor at its center surrounded by insulating materials and an outer metal screen conductor with an axis of curvature coinciding with the inner conductor - hence "coaxial." Examples are standard Ethernet cable and Thinwire Ethernet cable.

(17) Collision

The result of two network nodes transmitting on the same channel at the same time. The transmitted data is not usable. When two stations try to send packets at the same time. In Ethernet networks collisions are consider normal events and the CSMA/CD access method is designed to quickly restore the network to normal activity after a collision occurs.

(18) Collision Detect

A signal indicating that one or more stations are contending with the local station's transmission. The signal is sent by the Physical layer to the Data Link layer on an Ethernet/IEEE 802.3 node.

(19) Communication Server

A dedicated, standalone system that manages communications activities for other computers.

(20) CSMA/CD

Carrier Sense Multiple Access with Collision Detection is the Ethernet media access method. All network devices contend equally for access to transmit. If a device detects another device's signal while it is transmitting, it aborts transmission and retries after a brief pause. An element defined by 802.3 specification. It is access method which is used by stations connected to an Ethernet LAN. In this method each station contends for access to the shared medium.

(21) Domain Name

A domain name is a text name appended to a host name to form a unique host name across internets.

(22) Download

The transfer of a file or information from one network node to another. Generally refers to transferring a file from a "big" node, such as a computer, to a "small" node, such as a terminal server or printer.

(23) Ethernet

The most popular LAN technology in use today. The IEEE standard 802.3 defines the rules for configuring an Ethernet network. It is a 10 Mbps,

CSMA/CD baseband network that runs over thin coax, thick coax, twisted pair or fiber optic cable.

(24) EtherTalk

Apple Computer's protocol for Ethernet transmissions.

(25) FDDI

Fiberoptic Data Distribution Interface. A cable interface capable of transmitting data at 100 Mbps. Originally specified for fiber lines, FDDI can also operate over twisted-pair cable for short distances.

(26) Fiber-Optic Cable

A transmission medium composed of a central glass optical fiber cable surrounded by cladding and an outer protective sheath. It transmits digital signals in the form of modulated light from a laser or LED (light-emitting diode).

(27) File Server

A computer that stores data for network users and provides network access to that data.

(28) Filtering

Process whereby an Ethernet switch or bridge reads the contents of a packet and then finds that the packet does not need to be forwarded, drops it. a filtering rate is the rate at which a device can receive packets and drop them without any loss of incoming packets or delay in processing.

(29) FTP

File Transfer Protocol, a TCP/IP protocol for file transfer.

(30) Full-Duplex

Independent, simultaneous two-way transmission in both directions, as opposed to half-duplex transmission.

(31) Gateway

A device for interconnecting two or more dissimilar networks. It can translate all protocol levels from the Physical layer up through the Applications layer of the OSI model, and can therefore interconnect entities that differ in all details.

(32) Hertz (Hz)

A frequency unit equal to one cycle per second.

(33) IEEE 802.3

The IEEE (Institute of Electrical and Electronic Engineers) standard that defines the CSMA/CD media-access method and the physical and data link layer specifications of a local area network. Among others, it includes 10BASE2, 10BASE5, 10BASE-FL and 10BASE-T Ethernet implementations.

(34) Internet

A series of interconnected local, regional, national and international networks, linked using TCP/IP. Internet links many government, university and research sites. It provides E-mail, remote login and file transfer services.

(35) ISDN

(Integrated Services Digital Network): All digital service provided by telephone companies. Provides 144K bps over a single phone line (divided in two 64K bps "B" channels and one 16K bps "D" channel).

(36) Kbps

Kilobits per second.

(37) LAN

Local Area Network, a data communications system consisting of a group of interconnected computers, sharing applications, data and peripherals. The geographical area is usually a building or group of buildings. LAN is a high – speed communications system designed to link computers and other data processing devices together within a small geographic area such as a workgroup, department, or a single floor of a multi – story building.

(38) Layer

In networks, layers refer to software protocol levels comprising the architecture, with each layer performing functions for the layers above it.

(39) LocalTalk

Apple Computer's proprietary 230 Kbps baseband network protocol. It uses the CSMA/CD access method over unshielded twisted pair wire.

(40) Mbps

Megabits per second.

(41) Modem

A modulator-demodulator device for changing transmission signals from digital to analog for transmission over phone lines. Used in pairs, one is required at each end of the line.

(42) Multiport Repeater

A repeater, either standalone or connected to standard Ethernet cable, for interconnecting up to eight Thinwire Ethernet segments.

(43) Name Server

Software that runs on network hosts charged with translating (or resolving) text-style names into numeric IP addresses.

(44) NCP

Network Control Program, a program run on VMS machines to configure local network hardware and remote network devices.

(45) NetWare

A Novell developed Network Operating System (NOS). Provides file and printer sharing among networks of Personal Computers (PCs). Each NetWare network must have at least one file server, and access to other resources is dependent on connecting to and logging into the file server. The file server controls user logins and access to other network clients, such as user PCs, print servers, modem/fax servers, disk/file servers, etc.

(46) NetBIOS/NetBEUI

Microsoft's networking protocols for it's LAN Manager and Windows NT products.

(47) Network

An interconnected system of computers that can communicate with each other and share files, data and resources.

(48) Network Address

Every node on a network has one or more addresses associated with it, including at least one fixed hardware address such as "ae-34-2c-1d-69-f1" assigned by the device's manufacturer. Most nodes also have protocol specific addresses assigned by a network manager.

(49) Network Management

Administrative services for managing a network, including configuring and tuning, maintaining network operation, monitoring network performance, and diagnosing network problems.

(50) Network Operating Systems

Ethernet and Token Ring technologies are just one part of a complete LAN. They provide the services specified in the Physical and Data Link Layers of the OSI model, but several other services must be added on top of the connectivity of Ethernet or Token Ring. Network operating systems (NOSs) are most often used to provide the additional communications services. A NOS defines client and sever systems. Clients are individual user workstations attached to the network where application programs are run and data is generated. Servers are shared network resources that provide hard disk space for user to store files, print services, and a number of other network services. The network operating system provides a set of protocols in software that run on the both servers and client systems and allow them to communicate with each other, share files, printers and other network resource.

(51) NIC

Network Interface Card, an adapter card that is inserted into a computer, and contains the necessary software and electronics to enable the station to communicate over the network.

(52) Node

Any intelligent device connected to the network. This includes terminal servers, host computers, and any other devices (such as printers and

terminals) that are directly connected to the network. A node can be thought of as any device that has a "hardware address."

(53) NOS

Network Operating System, the software for a network that runs in a file server and controls access to files and other resources from multiple users. It provides security and administrative tools. Novell's NetWare, Banyan's VINES and IBM's LAN Server are NOS examples.

(54) Packet

A series of bits containing data and control information, including source and destination node addresses, formatted for transmission from one node to another.

(55) PAP

(Password Authentication Protocol) Authentication scheme for PPP links. A password can be specified for both devices on a remote link. Failure to authenticate will result in a dropped connection prior to start of data transmission.

(56) Physical Address

An address identifying a single node.

(57) Point-to-Point

A circuit connecting two nodes only, or a configuration requiring a separate physical connection between each pair of nodes.

(58) Port

The physical connector on a device enabling the connection to be made.

(59) Port Multiplier

A concentrator providing connection to a network for multiple devices.

(60) PostScript

A printer/display protocol developed by Adobe Corp. PostScript is an actual printing and programming language to display text and graphics. Unlike line/ASCII printers, which print character input verbatim, PostScript printers accept and interpret an entire PostScript page before printing it.

(61) PPP

Point-to-Point Protocol. The successor to SLIP, PPP provides router-to-router and host-to-network connections over both synchronous and asynchronous circuits.

(62) Print Server

A dedicated computer that manages printers and print requests from other nodes on the network.

(63) Protocol

Any standard method of communicating over a network.

(64) Remote Access

Access to network resources not located on the same physical Ethernet. (Physical Ethernet here refers to an entire site network topology.)

(65) Remote Control

Form of remote access where a device dialing in assumes control of another network node - all keystrokes on the remote are translated into keystrokes on the network node. Used primarily with IPX protocol.

(66) Remote Node

Form of remote access where the device dialing in acts as a peer on the target network. Used with both IP and IPX protocols.

(67) Repeater

A repeater is a network device that repeats signals from one cable onto one or more other cables, while restoring signal timing and waveforms.

(68) Ring

A network topology in which the nodes are connected in a closed loop. Data is transmitted from node to node around the loop, always in the same direction.

(69) ROM

Read-Only Memory, a memory device that retains its information even when power to it is removed. A ROM version of a network device does not need to download, since the ROM contains the entire executable code and thus never needs to reload it. Frequently the ROM is provided as "flash ROM", which can be reprogrammed by downloading if the user chooses.

(70) Router

Device capable of filtering/forwarding packets based upon data link layer information. Whereas a bridge or switch may only read MAC layer addresses to filter, routers are able to read data such as IP addresses and route accordingly.

(71) Server

A computer that provides resources to be shared on the network, such as files (file server) or terminals (terminal server).

(72) Shared Access

Shared media technology means that all of the devices attached to the LAN share a single communications medium, usually a coaxial, twisted pair, or fiber optic cable.

(73) Shared Ethernet

Ethernet configuration in which a number of segments are bound together in a single collision domain. Hubs produce this type of configuration where only one node can transmit at a time.

(74) Store and Forward

Technique for examining incoming packets on an Ethernet switch or bridge whereby the whole packet is read before forwarding or filtering takes place. Store and forward is a slightly slower process than cut-through, but it does ensure that all bad or misaligned packets are eliminated from the network by the switching device.

(75) Switch

Multiport Ethernet device designed to increase network performance by allowing only essential traffic on the attached individual Ethernet segments. Packets are filtered or forwarded based upon their source and destination addresses.

(76) T-Connector

A T-shaped device with two female and one male BNC connectors.

(77) TCP/IP

Transmission Control Protocol (TCP) and Internet Protocol (IP) are the standard network protocols in UNIX environments. They are almost always implemented and used together and called TCP/IP.

(78) Telnet

Telnet is an application that provides a terminal interface between hosts using the TCP/IP network protocol. It has been standardized so that "telnetting" to any host should give one an interactive terminal session, regardless of the remote host type or operating system. Note that this is very different from the LAT software, which allows only local network access to LAT hosts only.

(79) 10BASE2

Ethernet running on thin coax network cable.

(80) 10BASE5

Ethernet running on Thickwire network cable.

(81) 10BASE-T

Ethernet running on unshielded twisted pair (UTP) cable. Note that 10BASE-T is a point-to-point network media, with one end of the cable typically going to a repeater/hub and the other to the network device.

(82) Terminal Server

A concentrator that facilitates communication between hosts and terminals.

(83) Terminator

Used on both ends of a standard Ethernet or Thinwire Ethernet segment, this special connector provides the 50 ohm termination resistance needed for the cable.

(84) TFTP

Trivial File Transfer Protocol. On computers that run the TCP/IP networking software, TFTP is used to quickly send files across the network with fewer security features than FTP.

(85) Token

The character sequence or frame, passed in sequence from node to node, to indicate that the node controlling it has the right to transmit for a given amount of time.

(86) Token Ring

Developed by IBM, this 4 or 16 Mbps network uses a ring topology and a token-passing access method.

(87) Topology

The arrangement of the nodes and connecting hardware that comprises the network. Types include ring, bus, star and tree.

(88) Twisted-Pair Cable

Inexpensive, multiple-conductor cable comprised of one or more pairs of 18 to 24 gauge copper strands. The strands are twisted to improve protection against electromagnetic and radio frequency interference. The cable, which may be either shielded or unshielded, is used in low-speed communications, as telephone cable. It is used only in baseband networks because of its narrow bandwidth.

(89) Unix

A multitasking, multiuser computer operating system developed by AT&T. Several versions exist, e.g., the Berkeley version.

(90) Wide Area Network (WAN)

A network using common carrier transmission services for transmission of data over a large geographical area.

APPENDIX B

SCREEN LAYOUT

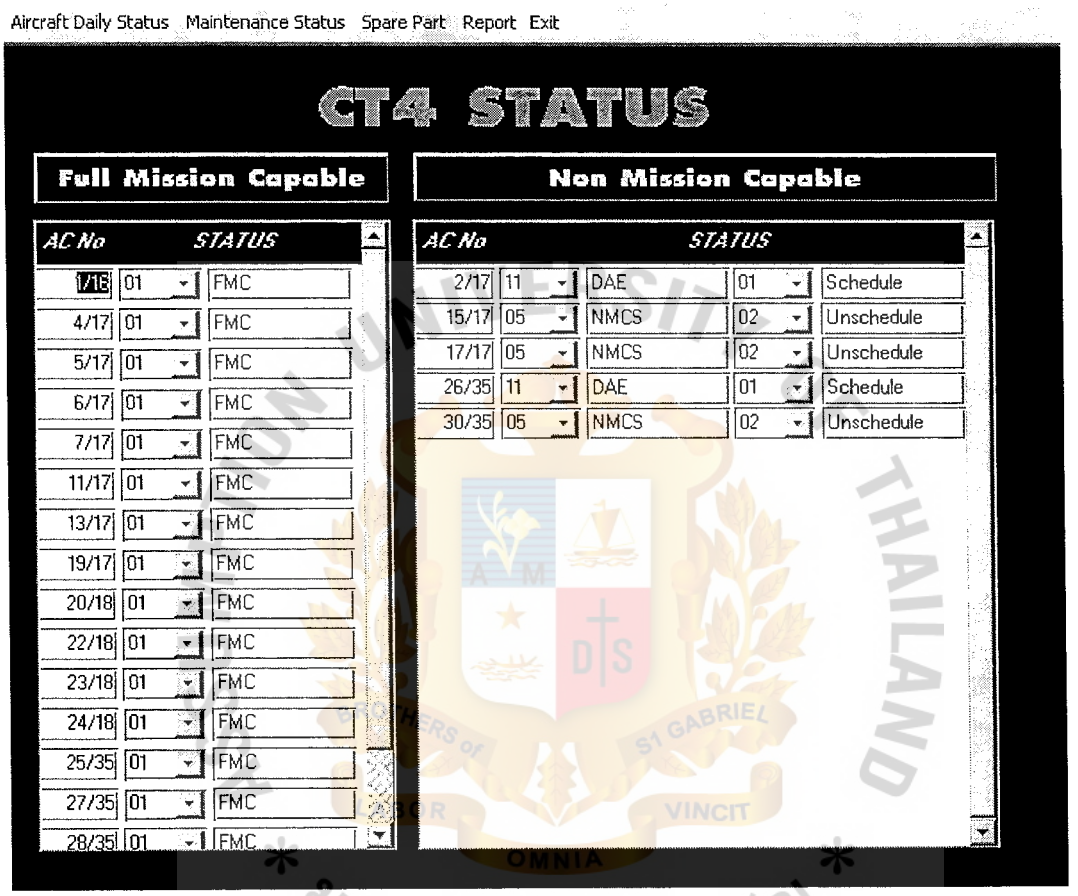

Figure B.1. CT4 Status Screen.

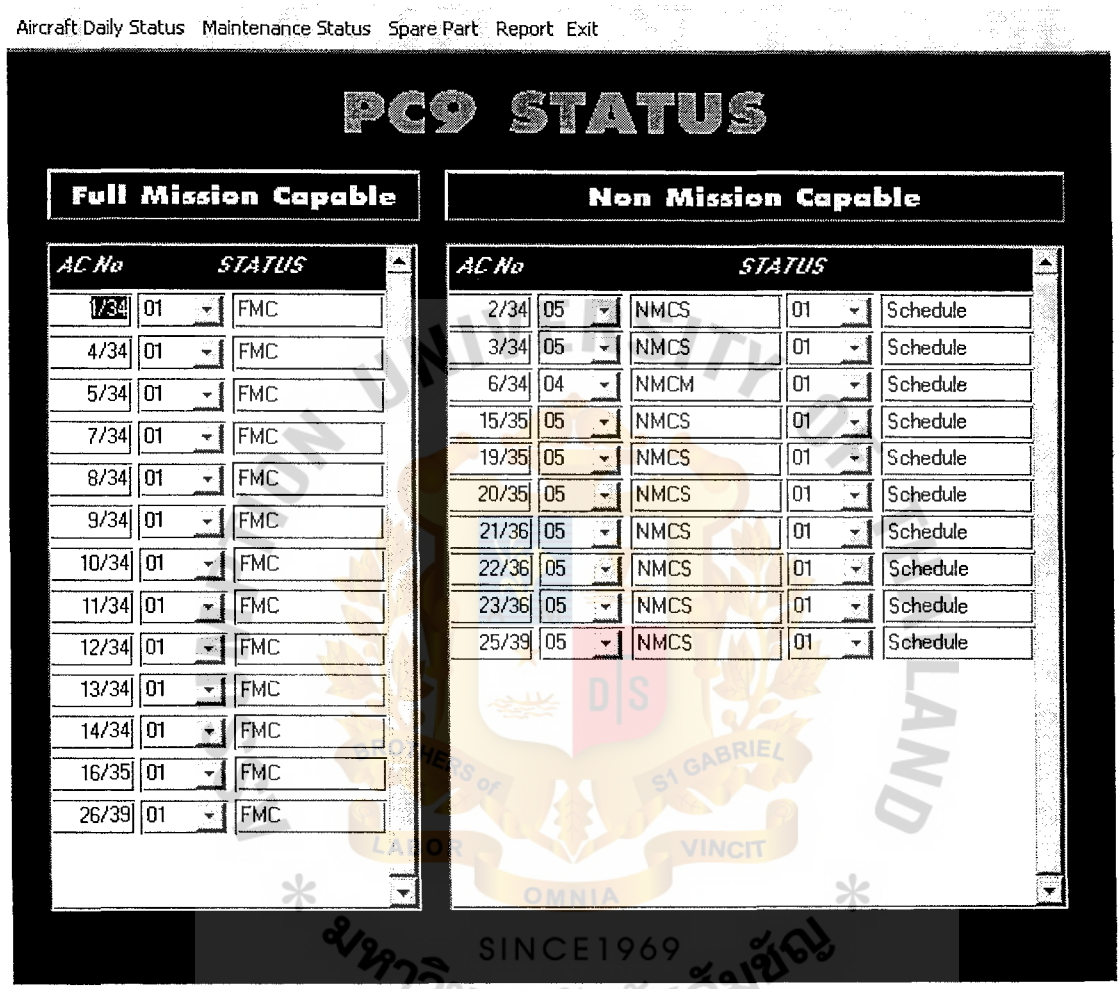

Figure B.2. PC9 Status Screen.

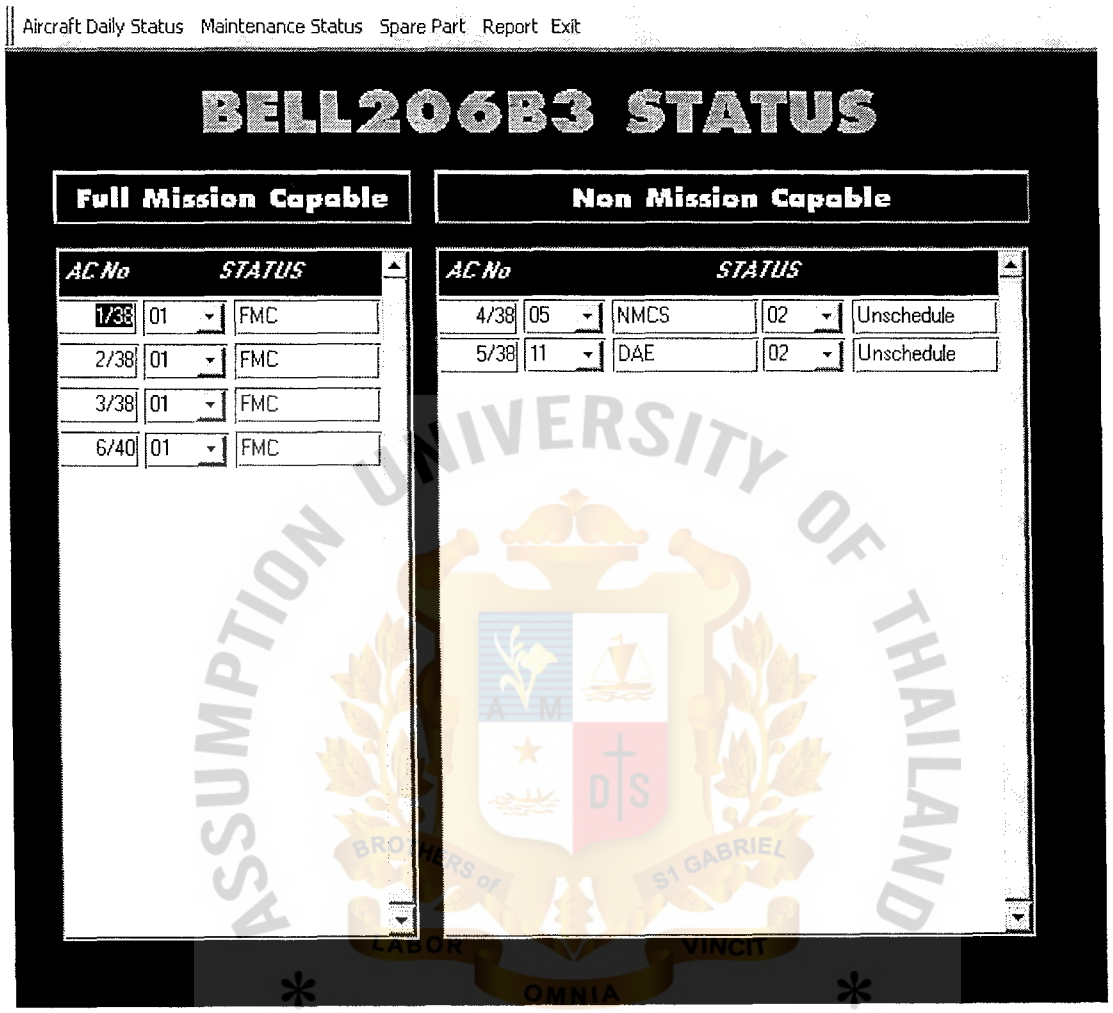

Figure B.3. BELL206B3 Status Screen.

AIRCRAFT		ENGINE		Operation Error
S/N	Hour	S/N	Hour	
1/16	9976.9	358010-HB3B	8477.4	
2/17	11363.2	226510-H	11351.8	PDM Inspection
4/17	11756.9	50R008-H3B	10466.0	
5/17	10888.5	358006-HB3	10468.0	
6/17	12005.0	358007-HB3	11081.6	
7/17	10563.8	353369-H3B	10415.3	
11/17	11643.2	50R005-H	10886.9	
13/17	11251.3	353074-H3B	11249.3	
15/17	11235.6	353386-HB3B	9866.6	Master Switch Off fail
17/17	11784.2	353340-HB3	10800.6	Oil Leak
19/17	9725.4	353367-HB	9419.3	
20/18	12310.7	353365-HB3	11847.8	
22/18	11367.1	358014-HB3	10076.4	
23/18	10813.8	358013-H3B	10511.0	
24/18	11099.7	358004-HB3B	10449.3	
25/35	3586.0	358003	3099.7	
26/35	3695.0	358017	2273.5	PDM Inspection
27/35	3690.8	358012	3099.1	
28/35	3450.2	358023	3257.5	
29/35	2969.5	353399	2334.8	
30/35	3594.2	358021	3444.4	Rudder Operate Failure
*				

Figure B.4. CT4 Hour Screen.

AIRCRAFT		ENGINE		OPERATION ERROR
S/N	Hour	S/N	Hour	
1/34	3642.0	PCE 103118	642.0	
2/34	4003.6	PCE 103175	2004.6	Waiting spare part
3/34	3592.7	PCE 103213	1957.3	Waiting spare part
4/34	3669.6	PCE 103190	2970.3	
5/34	3508.1	PCE 103178	3500.2	
6/34	3900.0	PCE 103196	3499.6	After FCF.ECS. ON LOW P/W MCP. ELU. SHOW when RESET ELU. Tq
7/34	3608.0	PCE 103210	2566.0	
8/34	4313.2	PCE PL0002	1921.2	
9/34	3760.8	PCE 103183	3499.2	
10/34	3499.1	PCE 103180	3499.1	
11/34	4200.6	PCE 103116	4200.6	
12/34	3601.5	PCE 103193	3601.5	
13/34	3499.2	PCE 103179	3499.2	
14/34	3354.5	PCE 103181	3354.5	
15/35	3821.7	PCE PL0016	3821.7	Waiting spare part
16/35	3073.0	PCE 103173	3073.0	
19/35	4421.4	PCE PL0003	4421.4	Waiting spare part
20/35	3818.2	PCE 103248	3818.2	Waiting spare part
21/36	3520.3	PCE 103174	3520.3	Waiting spare part
22/36	3153.8	PCE 103198	3153.8	Waiting spare part
23/36	3003.8	PCE 103201	3003.8	Waiting spare part
25/39	2400.0	PCE 103245	2400.0	Waiting spare part
26/39	2045.4	PCE 103121	2045.4	

Figure B.5. PC9 Hour Screen.

	AIRCRAFT		ENGINE		OPERATION ERROR
	S/N	Hour	S/N	Hour	
▶	1/38	1763.8	CAE-270724	1492.0	
	2/38	1554.4	CAE-835593	1442.0	
	3/38	1628.9	CAE-270729	1573.0	
	4/38	1747.0	None	0.0	ENGINE CHIP SHOW
	5/38	1692.4	CAE-270734	1692.4	Lose of Control on 6 April 01
	6/40	1074.6	CAE-270733	708.1	
*					

Figure B.6. BELL206B3 Hour Screen.

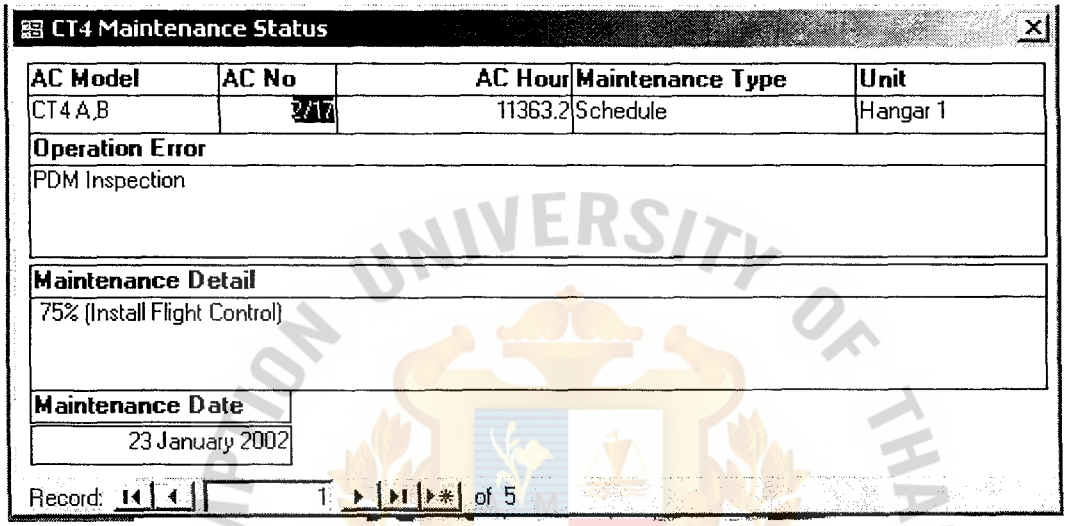

Figure B.7. CT4 Maintenance Status Screen.

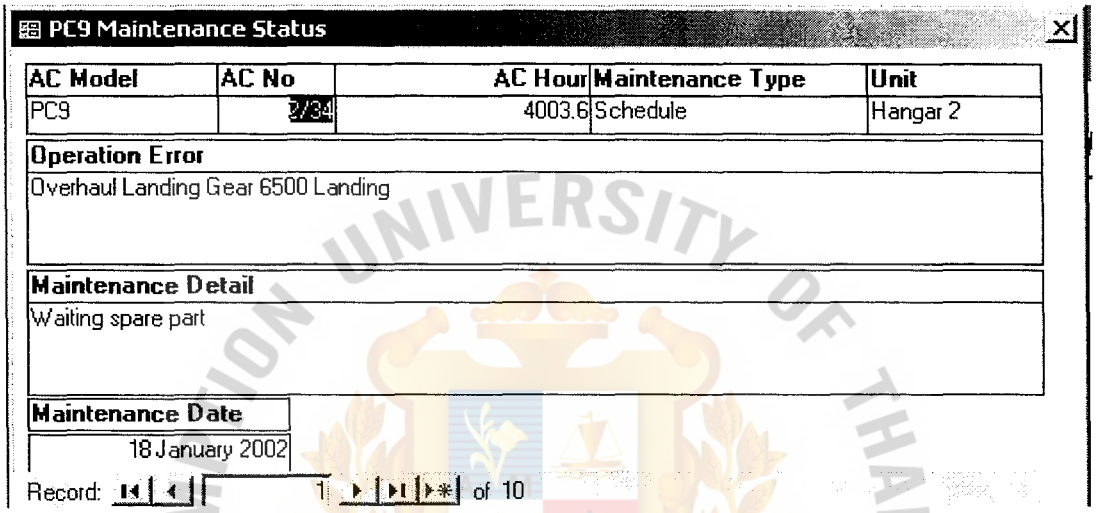

Figure B.8. PC9 Maintenance Status Screen.

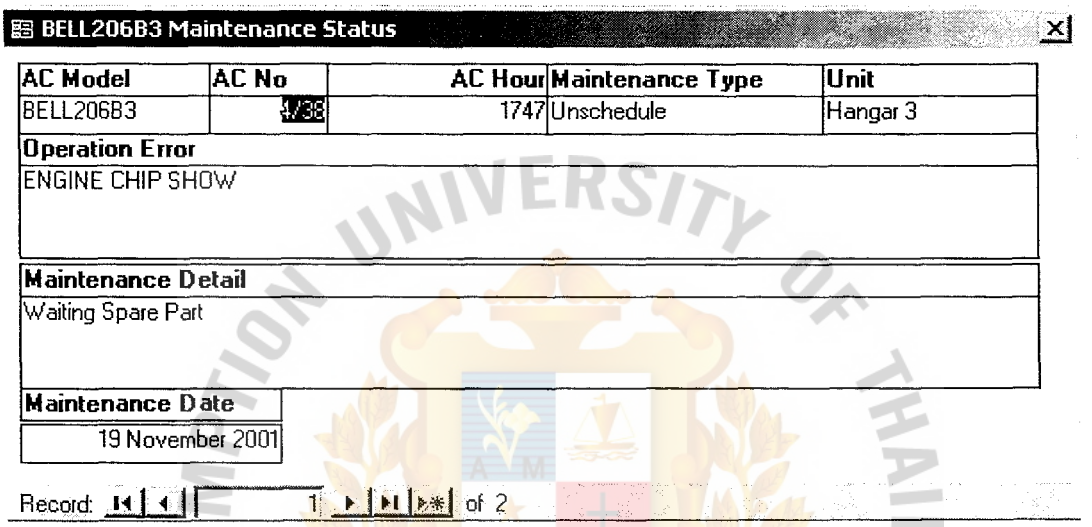

Figure B.9. BELL206B3 Maintenance Status Screen.

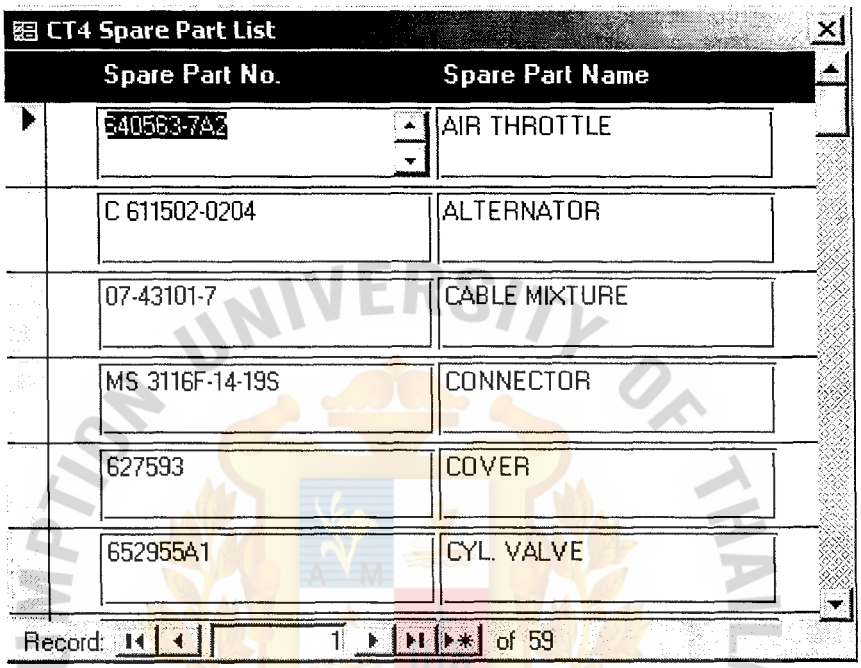

Figure B.10. CT4 Spare Part List Screen.

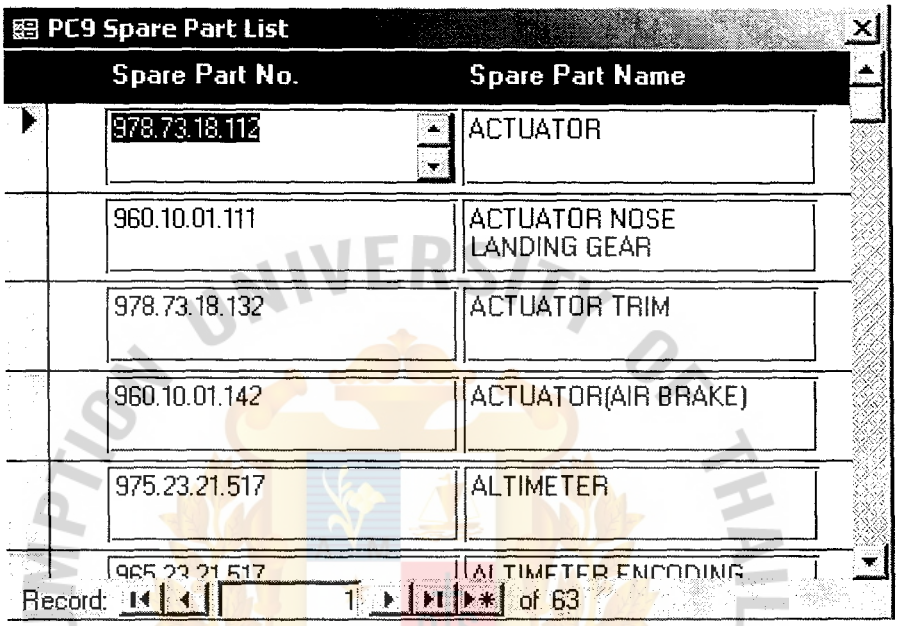

Figure B.11. PC9 Spare Part List Screen.

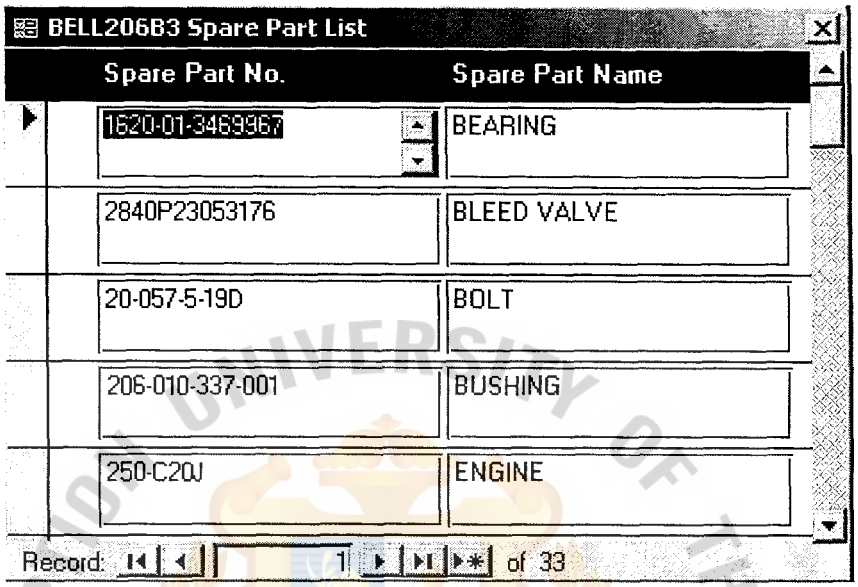

Figure B.12. BELL206B3 Spare Part List Screen.

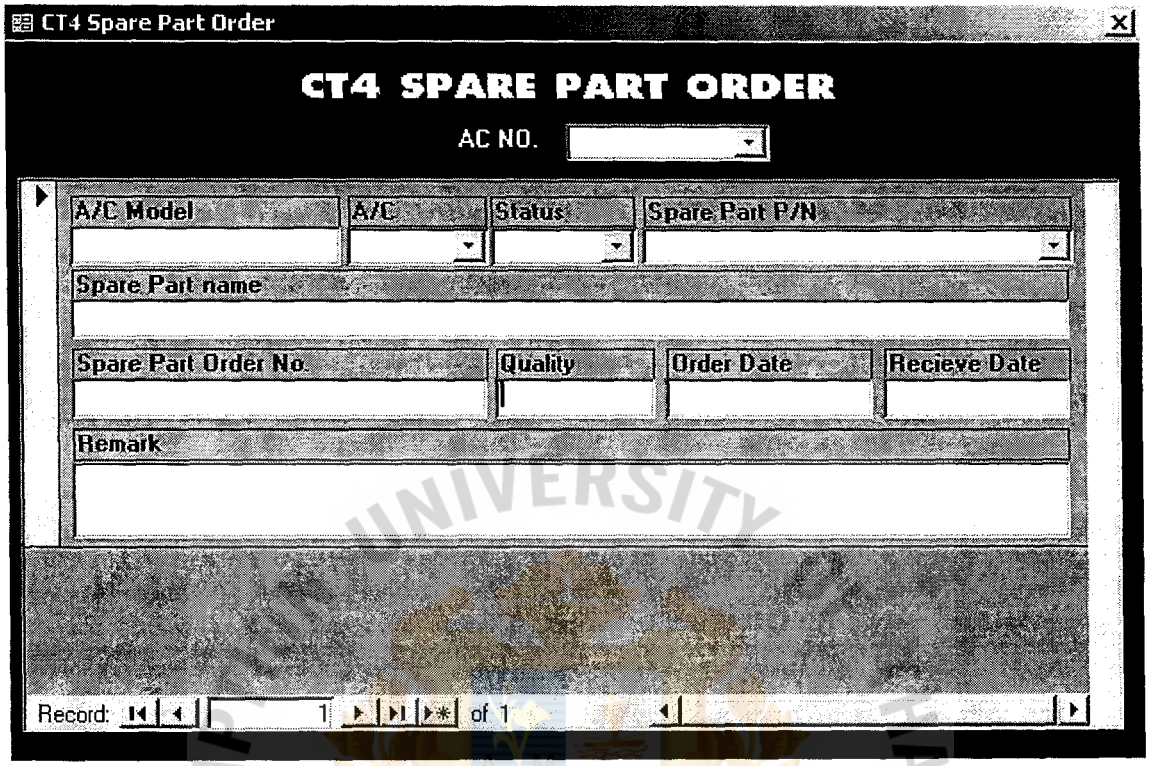

Figure B.13. CT4 Spare Part Order Screen.

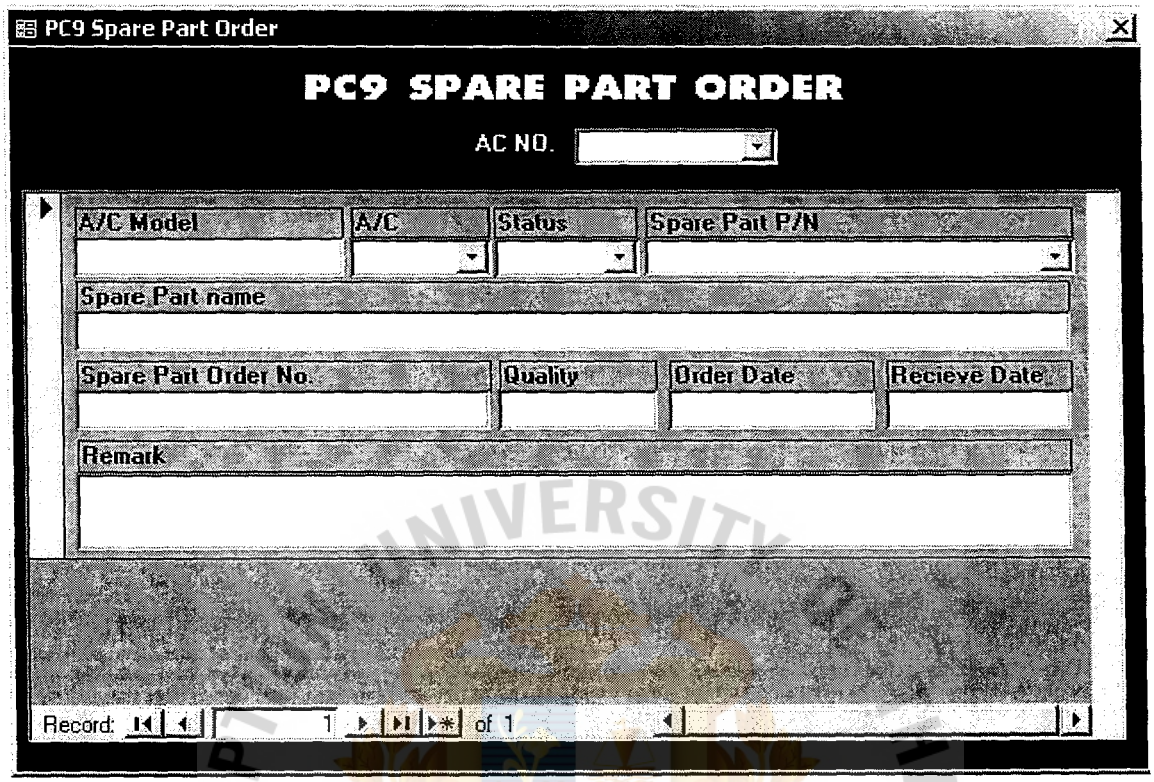

Figure B.14. PC9 Spare Part Order Screen.

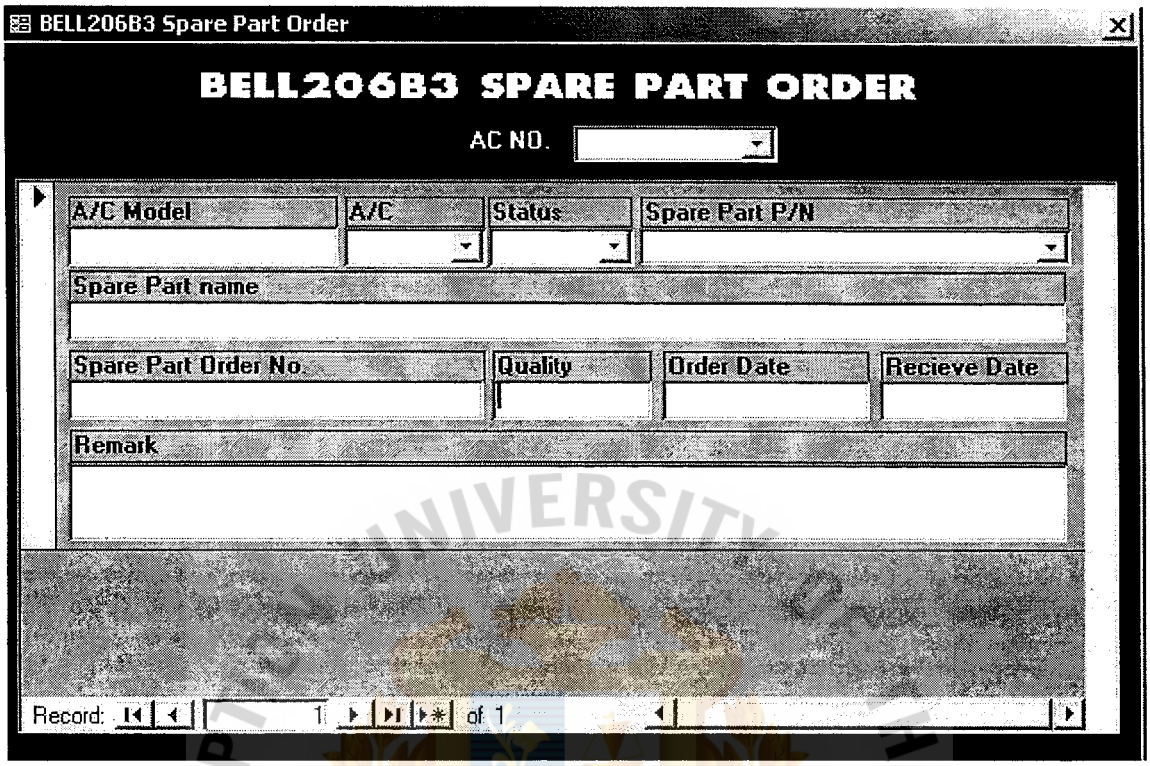

Figure B.15. BELL206B3 Spare Part Order Screen.

APPENDIX C

REPORT DESIGN

Aircraft Maintenance Report

21 March 2002 18:13:48

AC Model	AC NO.	Maintenance Type	Operation Error	Maintenance Detail	Maintenance Date
CT4 A,B	15/17	Unschedule	Master Switch Off fail	Waiting Spare Part	8 November 2001
CT4 A,B	17/17	Unschedule	Oil Leak	Waiting Spare Part	7 January 2002
CT4 A,B	30/35	Unschedule	Rudder Operate Failure	Waiting Spare Part	13 March 2002
PC9	2/34	Schedule	Overhaul Landing Gear 6500 Landing	Waiting spare part	18 January 2002
PC9	3/34	Schedule	Overhaul Engine 3500 hour	Waiting spare part	14 February 2002
PC9	6/34	Schedule	D-INSPECTION	After FCF.ECS. ON LOW P/W MCP. ELU. SHOW when RESET ELU. Tq,Ng.,Np.,ITT unstable.	1 March 2002
PC9	15/35	Schedule	D-INSPECTION	Waiting spare part	26 November 2001
PC9	19/35	Schedule	Overhaul Landing Gear 6500 Landing	Waiting spare part	25 February 2002
PC9	20/35	Schedule	Overhaul Engine	Waiting spare part	1 June 2001
PC9	21/36	Schedule	Overhaul Engine	Waiting spare part	16 July 2001
PC9	22/36	Schedule	Overhaul Engine	Waiting spare part	6 November 2001
PC9	23/36	Schedule	D-INSPECTION	Waiting spare part	20 February 2002
PC9	25/39	Schedule	Overhaul Engine	Waiting spare part	30 July 2001

Figure C.1. Maintenance Report.

AIRCRAFT SPARE PART ORDER

A/C Model	A/C No.	Spare Part P/N	Spare Part Name	Spare Part Order	Date of Order	DayWaiting
CT4 A,B	15/17	B 210680	GOVERNOR	WG030020290007	30/1/2002	51 days
CT4 A,B	17/17	640563-7A2	AIR THROTTLE	WG030020070003	7/1/2002	74 days
CT4 A,B	17/17	C 611502-0204	ALTERNATOR	501956	11/10/2001	162 days
CT4 A,B	17/17	652955A1	CYL. VALVE	WG030020070004	7/1/2002	74 days
CT4 A,B	30/35	638157-2A1	FUEL PUMP	WG03002066145	6/3/2002	16 days
PC9	2/34	965.23.21.517	ALTIMETER ENCODING	403448	14/6/2001	281 days
PC9	2/34	MS 3116F-14-19S	CONNECTOR	502007	8/11/2001	134 days
PC9	2/34	532.30.09.090	CONTROL GEAR BOX	501543	19/11/2001	123 days
PC9	2/34	968.20.12.017	ELU.	402574	14/2/2001	401 days
PC9	2/34	571.20.09.402	ENGINE SHOCK MOUNT	WG030013520027	18/12/2001	94 days
PC9	2/34	532.10.09.049	MLG. STRUT LH.	WG030020160015	17/1/2002	64 days
PC9	2/34	532.10.09.050	MLG. STRUT RH.	WG030020160017	17/1/2002	64 days
PC9	2/34	532.02.09.089	NLG. STRUT	WG030020160013	17/1/2002	64 days
PC9	3/34	965.23.21.576	ALTIMETER ENCODING	WG030020460003	18/2/2002	32 days
PC9	3/34	975.44.21.312	AOA ELECTRONIC UNIT	WG030020460002	18/2/2002	32 days
PC9	3/34	975.96.13.202	ATTITUDE IND.	WG030020460004	18/2/2002	32 days
PC9	3/34	2915P 968.84.51.106	EMGINE DRIVEN PUMP	WG030020666017	6/3/2002	16 days
PC9	3/34	975.26.10.201	TACHO. GEN.	WG030020700005	7/3/2002	15 days

Date of Print 21 March 2002

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Figure C.2. Spare Part Order Report.

DAILY AIRCRAFT STATUS REPORT

Date 1 - 9 March 2002

		RTAF Base	FTS Base	Maintenance	Mission	Schedule	Waiting Spare Part
CT4 A,B	Total	189	171	124	6	5	36
	Average	21.00	19.00	13.78	0.67	0.56	4.00
	RTAF. FMC	65.61%	FTS. FMC	72.51%	3.51%	2.92%	21.05%
PC9	Total	207	207	105	18	3	81
	Average	23.00	23.00	11.67	2.00	0.33	9.00
	RTAF. FMC	50.72%	FTS. FMC	50.72%	8.70%	1.45%	39.13%
BELL206B3	Total	54	45	31	0	5	9
	Average	6.00	5.00	3.44	0.00	0.56	1.00
	RTAF. FMC	57.41%	FTS. FMC	68.89%	0.00%	11.11%	20.00%

Figure C.3. Daily Aircraft status Report.

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