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AN OVERVIEW OF GARUDA'S CONTROL (EM) CENGKERENG JAKARTA, INDONESIA

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The Airline Operation Control Centre

An Overview of Garuda's Operation Control (EM) at Cengkereng
Jakarta, Indonesia

Final Report to PT Garuda Indonesia

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1.0 Introduction

Airline operations are generally handled in two phases, strategic and tactical. Strategic operations are concerned with schedule planning. Given the desired schedule of services to be offered to passengers (called the Schedule of Services) established by the Commercial/ Marketing department, the Operations group generates the Nominal Operational Schedule (NOS) for the airline's resources such aircraft rotations and crew rotations, and then assigns tail numbers, and individual crew members to a given flight. These activities constitute the schedule generation and resource allocation phases of the scheduling process. They are carried out by various groups which support the development of the planned schedule for all airline resources.

Given these resource schedules, the tactical side of the Operations group is responsible for the final stage of the scheduling process: Execution Scheduling. Execution scheduling is the process of executing the system resource schedules on a daily basis. This involves three main activities: executing the pre-planned schedules, updating the schedules for minor operational deviations, and rerouting for irregular operations. The tactical operations of a regular scheduled air carrier is usually under the 24 hour/day control of a central organization often referred to as the Airline Operational Control Center AOCC.

This chapter presents a summary of a typical AOCC, outlining its organization, primary activities within the airline, and operational facilities. The facilities and personnel of a particular AOCC will vary considerably depending on the type and size of the airline. AOCC centers can range from a single controller/dispatcher on duty to several dispatchers and hundreds of other personnel handling flights throughout the carrier's entire global network. During the process of operation control, the AOCC is supported by the Maintenance Operations Control Center (MOCC) which controls aircraft maintenance activities, and various Station Operations Control Centers (SOCC) which control station resources (gates, refuelers, catering, ramp handling, and passenger handling facilities).

Operations Control Centers are usually linked to the Aeronautical Radio Inc. (ARINC) and the Societe International Telecommunications Aeronautiques (SITA) networks to send and receive teletype/telex messages. Communications with maintenance and engineering,

customer service, and airport services are maintained to facilitate prompt contact with the appropriate personnel. Teletype, telex, facsimile, telephone, leased lines, and public data networks combine to provide an effective medium of collecting information and communicating revised operational plans developed by the AOCC center. In some cases, the AOCC has communications systems connected to VHF, HF and Satcom radio links, air traffic control centers, and other relevant locations, allowing them to effectively gather and disseminate information instantaneously.

2.0 Functional Groups Within AOCC

The AOCC is organized into three functional groups, each with a distinct responsibility within the schedule execution process. The airline Operations Controllers are responsible for maintaining the operational version of all the system resource schedules (crew, aircraft and flight) and the management of irregular operations. The final operational decisions are made by one (or more) Operation Controller(s) who are assisted by a variety of operating personnel. The Flight Dispatch group is responsible for flight planning, flight dispatch and enroute flight following. Crew Operations group is responsible for tracking individual crew members as they move through the airline's route network, for maintaining up to date status for all crew members, and for calling in reserve crews as required. These three groups are usually located together in the AOCC Center.

The AOCC at larger airlines may have a dedicated airline Air Traffic Control ATC coordinator, as well as specific supporting personnel for functions such as dispatch, crew scheduling, aircraft scheduling, and meteorology services within the AOCC center. Ancillary off-line services such as the maintenance of the navigation database, operations engineering (or flight technical services) are usually located nearby and serve to provide supporting resources for AOCC personnel. In addition, the crisis center to manage activities after an accident or incident is often an integrated part of the Airline's Operational Control Center.

2.1 Operations Controllers

The airline Operation Controllers are the center of the airline operation control process. They are the sole operational group within the AOCC with the authority and responsibility to resolve problems that develop during the course of both regular and irregular operations. Airline Operation Controllers receive information from every facet of the airline during operations (see Figure One). From these inputs, the Controllers maintain an updated version of the airline system resource schedules which includes delays, irregular routings for aircraft and crews, and additional flights. These can be called the "Current Operational Schedules " (COS). Other personnel in the AOCC are normally grouped by the geographic areas of the flights they manage and monitor. As the focal point in the AOCC for flight and schedule management, controllers interact with the following key personnel and organizations:

- Flight Dispatchers
- Crew Operations (scheduling, tracking, and rescheduling)
- Station managers and gate coordinators
- Passenger service managers
- Ramp service managers (fuelers, baggage handling, aircraft loading, catering)
- Maintenance and engineering
- Meteorology
- Operations engineering/route planning
- Air traffic control coordinator

During normal operations, Dispatchers are responsible for the successful release of a flight, depending on maintenance issues (deferred maintenance equipment list (MEL) or configuration deviation list (CDL) items), aircraft restrictions (such as noise), the availability of required operational support (fuel, gates, ground power, airport facilities) at the departure, destination and alternate airports. During irregular operations and emergencies, the Dispatcher will inform the Operations Controller of the problem, and their role is to handle the additional coordination that such situations demand. If the airline is experiencing irregularities, the Operation Controllers have to devise modified operational schedules on a very short notice. The Current Operational Schedule is the plan that the airline with follow to order to return to Nominal Schedule of Services. These modified schedules are disseminated to the relevant airline divisions, and airports of the system.

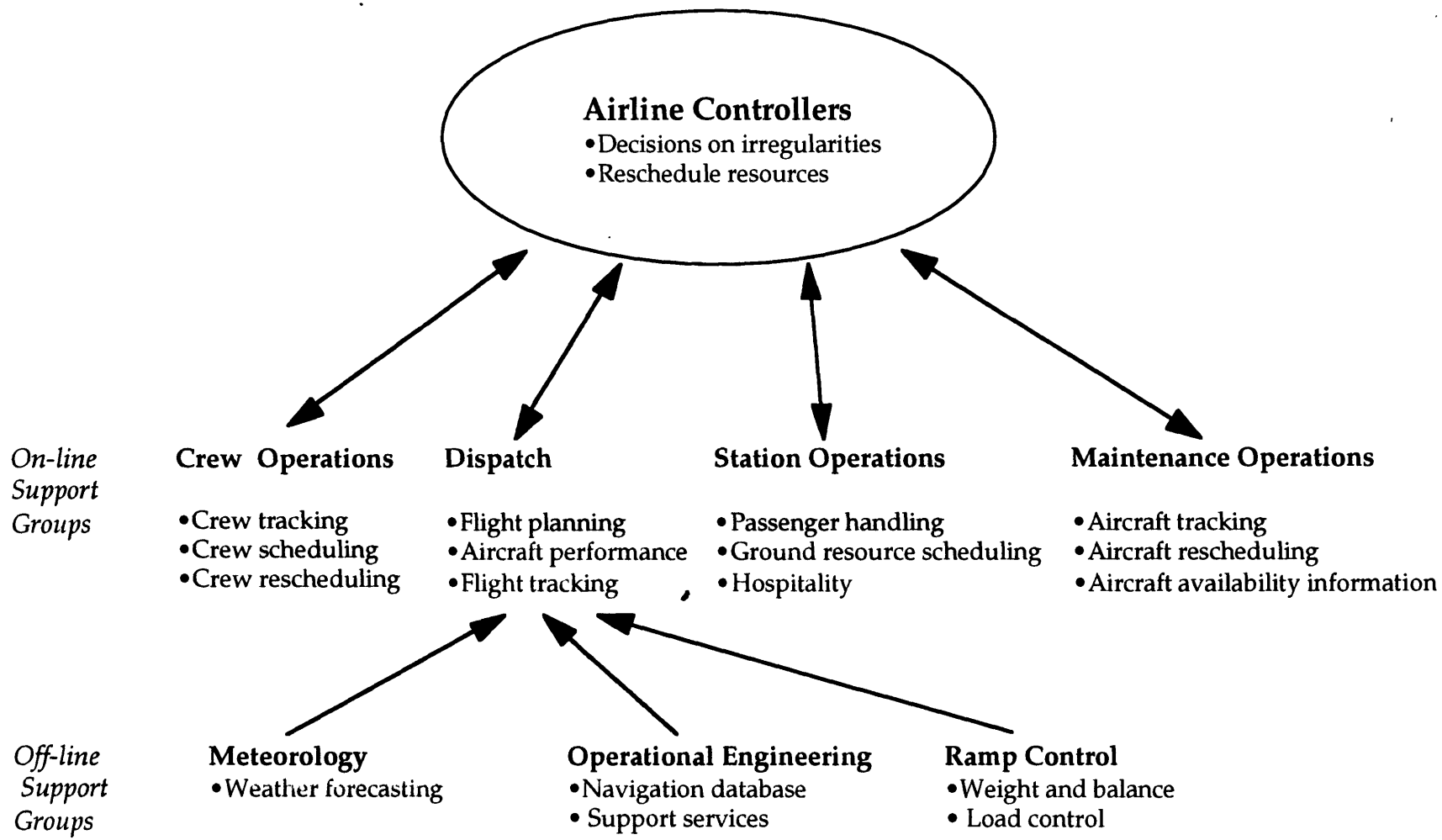

Figure 1 Information Flow Diagram for the Airline Operations Control Center (AOCC)

2.2 Flight Dispatchers

The primary function of the Dispatcher is the preparation of every flight/take-off which involves the creation of a legal flight plan showing the estimated fuel burn and reserves, and declaring alternative and diversion airports, preparation of weight and balance sheets, passenger manifests, and take-off and landing performance analysis. In addition, dispatchers are responsible for the monitoring the weather, operational status of navigation aids, etc. to ensure the safe progress of flights while they are enroute. Dispatching of flights is the key activity at all airline operations control centers. Dispatchers play a central role in coordinating and planning for individual flights and they are jointly responsible with the pilot-in-command for the safe execution of the flight. *Each airline is usually required to have its own organization for conducting dispatch functions and related tasks.*

Dispatchers are the primary contact for pilots and flight crews who receive dispatch releases and weather briefings, coordinate operating plans, and provide feedback on operational status. Communications between Dispatchers and aircraft during flight are often handled by data links to the flight deck, or by radio services through providers such as ARINC, or other VHF and HF radio facilities. The dispatcher interacts with cockpit crews and other airline personnel via telephone, facsimile, radio and through desktop computers which are part of a local area network (LAN) which is connected to the airline's central mainframe and other computer systems within the airline. The desktop computers may provide an electronic mail (e-mail) interface to other divisions. The connection to the mainframe computer usually provides access to many computer databases (such as reservations, flight information, etc.), flight planning and scheduling software tools, and the data link to the flight deck.

The flight planning process at major airlines is normally done by computer. State of the art software enable dispatchers to analyze various routes, altitudes and scenarios prior to finalizing each flight plan. These flight planning computers are linked to other airline databases and computer systems. In addition to pre-flight planning, flights often require re-planning and re-dispatch while en route (due to route deviations, severe weather patterns, etc,). This is also handled by dispatchers in AOCC in conjunction with the cockpit crew of a given flight.

Dispatchers are also responsible for the monitoring of flights while enroute. Often referred to as flight following, it involves monitoring all aspects of flights in progress, ensuring that the flight stays within safe and legal limitations, assessing weather conditions en route, at the destination and alternate airport. At many airlines, much of the monitoring is automated by information sent directly to or from computers on the ground and in the aircraft. At large US carriers (many using ACARS datalink), regular position reports are received two ways. On board ACARS, HF or SATCOM units send reports from the aircraft to the AOCC center via ARINC or SITA as digital messages. These messages are specifically labelled as position reports and are automatically entered into the computer database as they are received. Flight following software use these position reports to record the aircraft's current position and status.

2.2.1 Meteorological Support Services

The primary responsibility of the meteorology division is to create weather forecasts based on data received from external support services (such as the National Weather Service in the USA). Dispatchers rely on the meteorology resources to obtain en route briefings in an effort to avoid areas of turbulence or severe weather, forecast for key destination and alternate airports, and other special weather events such as volcanic ash. Meteorology systems provide access to databases containing surface weather reports, forecasts, Notice to Airmen (NOTAM's), area of turbulence, and upper air winds data. Additionally, weather graphics such as satellite imagery, composite radar, National Weather Service (NWS) analysis charts and graphs may be accessible.

2.2.2 Operations Engineering

Operations Engineering and navigation database personnel support the real-time dispatch process by maintaining and adjusting databases needed to calculate aircraft and airport performance and flight plans. This group is removed from the daily operations of the airline, and its primary functions are that of strategic support, on-going operational support, and emergency services. In the strategic role, Operations Engineering may analyze performance characteristics of new aircraft types and new city-pairs as part of long-term planning at the airline.

On-going support services involve maintaining current operational databases such as runway analysis, and company preferred flight routes between city-pairs. In addition, other support tasks may include collecting and analyzing operational data such as specific aircraft fuel consumption behaviour. At some carriers, the Operations Engineering group may support the Dispatcher in the daily flight planning for long-haul international flights. In the emergency role, Operations Engineering personnel may develop special departure procedures, and analyze the maximum allowable take-off weight for a flight that has been diverted to an emergency airport.

2.3 Crew Operations

Crew Operations is composed of three separate responsibilities: crew scheduling, crew following (tracking) and crew rescheduling. Most airlines use computer based crew scheduling systems to develop the legal sequence of flights to which crews are assigned. These systems may employ optimization models to maximize crew utilization based on civil authority requirements and other operational constraints mandated by the carrier. Crew tracking may be executed using the Crew Management System which is a database for the current status of all individual crew members. Rescheduling functions during irregularities are normally handled by dedicated specialists in the AOCC to ensure that qualified and legal crews are available for each flight. Controllers and Dispatchers coordinate with crew scheduling and tracking specialists to keep crews within duty time and flight time limitations, as well as to obtain additional crews during irregularities.

2.4 Station Operations Control Center (SOCC)

The Station Operations Control group consists of station managers, gate coordinators, ramp and passenger service managers. They are responsible for providing real-time assessments of available manpower and resources such as gates, ground support equipment, and specialized facilities such as de-icing trucks. This on-going flow of information into the AOCC allows Controllers and Dispatchers to formulate realistic operating plans. Dispatchers provide ramp control managers with all the necessary information for planning ramp activities. In the event of schedule irregularities, the SOCC is responsible for the rescheduling of all ground facilities necessary to support the revised flight schedule generated by the AOCC.

2.5 Maintenance Operations Control Center (MOCC)

Maintenance Controllers work closely with personnel from the AOCC center to ensure that each aircraft that is planned to have a check is routed to an appropriate maintenance facility. Liaison with maintenance and engineering provides Operations Controllers information on fleet status. Major carriers use elaborate computer systems to track all maintenance activity for each aircraft. These applications are usually linked to real-time systems used in AOCC and receive updates of operational data as they occur during the course of daily operations. AOCC decisions to delay, divert, or cancel flights are immediately transferred to these maintenance and engineering systems, and can alert Maintenance Controllers of any missed opportunities to complete scheduled maintenance checks. AOCC tries to coordinate specific aircraft routings so that maintenance events occur according to schedule. The maintenance division is responsible for keeping the AOCC informed of the availability of aircraft.

References

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3.0 Summary of Current Systems for Schedule Planning, Operations and Maintenance Control Activities at PT Garuda Indonesia

The primary objective of the MIT/Garuda research program with the Operations division at Garuda is to develop a comprehensive framework for decision making in the event of irregular operations in the airline's network. A project team consisting of personnel from Operations Planning, Maintenance Control, and Operations Control, in conjunction with MIT personnel have surveyed the available data sources and operations information systems currently in use at Garuda, and the major findings of the exploration are presented here. Visits were conducted at several departments within the operations division, and related divisions of Garuda, located primarily in the Operations Center at Cengkereng.

Operational Organization

- Operation Planning (EP)
- Operations Control Center (OCC/Cockpit)
- Maintenance Planning (MP)
- Crew Planning (OB)
- Navigation (ON)
- Airport Operations (KO)
- Information Systems (DX)
- Operations Movement Control (EM)
- Maintenance Control Center (MCC)
- Commercial/Marketing (CK)
- Crew Dispatch (OJ)
- Flight Dispatch (EA)
- Ramp Control (KR)

Operational Systems

AMEGA	Automated Maintenance Engineering Garuda (inventory control)
ARGA	Airline Reservation System (Garuda)
ARP	Airline Resource Planner
ARTEMIS	Long term Planning tool/production planning
CMS	Crew Management System/Crewlink
DCS	Departure Control System
ROC	Resource management Operations Control system
SNAG	Monitors the irregularities in the maintenance program of each aircraft in fleet

3.1 *Operations Planning (EP)*

The primary responsibility of Operations Planning (EP) is to generate the detailed Nominal Operations Schedules of the airline over a predetermined period, generally six months. The NOS is based on the desired Schedule of Services established by the Commercial / Marketing department using the Airline Resource Planning ARP software incorporating departure /arrival time-frames determined from through extensive market studies. Within Operations Planning, several printed formats of the flight schedules are made, as the existing data format of the ARP output is not fully compatible with the division's operating procedures and methodologies.

Currently, the flight scheduling process in EP is not directly influenced by crewing constraints (such as the availability of crew for a given schedule). Once an operating version of the flight schedule is established, it is reviewed by Crew and Maintenance Planning and modifications are made in an iterative process between EP and the other planning departments. After these iterations have been successfully completed, the final flight schedule is constructed using ARP, and aircraft turns are created based on (LIFO last in, first out, or FIFO first in, first out procedures). This schedule is then outputted on hard copy and on disk for transfer to the ROC monitoring system used by Operations Movement Control (EM).

Hard copies of the final version of the flight schedule are forwarded to Maintenance Planning, Commercial, Crew Planning, and Reservation Control (RC). The detailed data of the flight schedule can be generated in several standard formats including ASCII, and SSIM (IATA slot time request). The ARP is a stand alone system/program which cannot be supported on a local area network. There are three planning teams (wide-body, A300 and 737) working on developing the detailed flight schedules which are used throughout operations and maintenance planning.

3.2 *Operations Movement Control (EM)*

Operations Control is responsible for the monitoring of the operations of the airline on a 24 hour/day basis and serves as the core of Garuda's operations. The primary information system is the ROC Resource Management Operations Control system , which used for monitoring the actual operations of every Garuda flight. The airline's Nominal Operations Schedule which is generated by Operations Planning (EP) using ARP is electronically transferred (via floppy disk) to the ROC system. Both the ROC and ARP packages are developed by the same company RM Resource Management (Sweden). However there is no direct line connection between to the two computer systems.

Actual operational data in the form of a departure message from each airport station is transmitted via SITA telex, and automatically entered into the Resource Operations Control ROC database/graphical display system. The departure message includes information on actual arrival time at station, aircraft type, aircraft's next destination, departure time, estimated arrival time, delay status, passenger count, cargo, mail, captain in command, and fuel uplift data. The departure messages are stored for each flight leg in a centralized operations database in Dbase 3 format. This data can be accessed and analyzed using the database management system Paradox. Any additional changes or modifications in flight schedules such as charter flights, special flights, etc. are manually entered into the ROC system via keyboard. A hard copy output of the flight schedules from the ARP program (prepared by EP) is used as a back-up to computer systems, as well as to manually record changes in the schedule in the event of an irregular operation.

Historical operational data from the ROC system is stored on-line up to five months by Information Systems (DX) who has a direct feed from the ROC system. This data includes for each flight: aircraft type, flight number, scheduled origin/departure time, scheduled destination/arrival time, aircraft registration number, actual arrival time, actual departure

time, total passenger count, delay status (minutes), reasons for delay, airline code, fuel uplift, pilot in command, and the service area code. The flight data is down-loaded to one of their mainframe computer systems, and historical data is then transferred to tape for long term storage up to two years. Operation Control stores the hard copy of backup records and flight data for two years.

At the Operations Control facility, four micro-computers serve as a platform for the ROC monitoring system. One computer acts as a dedicated server, with the remaining three units providing display capabilities and limited operational access to the stored data. The ARP/ROC systems have been in use at Garuda since 1990. Before that all operations were manual. Operations Planning (EP) and Crew Planning (OB) have tried to implement Resource Management RM's crew management system with no success. As a result, the crew planning process is still done manually. Any additional telexes (related to airport closure, charter flights, short term changes) are stored manually in a folder in the control center. Operations Movement control (EM) has radio communication to all aircraft in the airline's fleet within the range between Abu Dhabi and Honolulu. In addition, Operations Control has access to the reservation system ARGA and the departure control system DCS database via a separate computer terminal. The information is used during irregular operations, to determine the impact of cancellations on revenue (manually).

Operations Movement Control is similar in function to the Operations Control Center OCC. However, EM actually makes all the operational decisions of the airline, and OCC simply serves as a monitor system for the directors and operations personnel at HQ. If there are any additional changes in the operational schedule, they are entered manually via keyboard at both EM and separately at OCC, since the two ROC systems are not directly connected. The two independent systems receive identical SITA telexes simultaneously. Irregularity reports are manually generated on a daily basis by EM and distributed to several airline departments (via hard copy), along with consequences of delay on the scheduled

operations. Each daily report outlines for each affected flight; the scheduled routing of the aircraft, the problem or irregularity, the impact of the aircraft's schedule, and how the problem was resolved. Maintenance does the same daily reporting manually.

3.3 Operations Control Centre (OCC)

The primary function of OCC is to serve as backup monitoring system to the EM operations control facilities using similar systems employed in EM. The OCC may also act as the emergency center in case of an accident. In addition, OCC personnel assist in the development of flight schedules during the planning process, and prepare daily reports on the airline's operations. The OCC has a direct data link (via satellite) to the operations database mainframe computer maintained by Information Systems. The ROC program is capable of generating several reports including aircraft utilization and passenger load factors system-wide. Some of these reports are published and reviewed by OCC personnel on a daily basis. The OCC also has access to the DCS Departure Control System (via direct terminal) which is maintained by Information Systems (DX) to monitor several aspects of the airline's operations (see Navigation discussion). As with EM, the Operations Control Center has access to the airline's reservation system (via direct terminal).

3.4 Maintenance Control Center(MCC)

The primary function of the Maintenance Control Center is to coordinate aircraft maintenance activities throughout the entire Garuda network, and to coordinate aircraft availability with Operations Control (EM). The MCC serves as the focal point for all line maintenance operations at Garuda. The Center coordinates line maintenance activities by maintaining continuous communication links with the line stations, enroute aircraft and, GA divisions at Cengkereng. The center also coordinates line maintenance requirements and flight schedule changes with Ramp Control and the Commercial division. They receive separate maintenance communications message directly from out-stations via SITA

telex and facsimile. After each aircraft departure, the station is also responsible for sending a standardized movement report on maintenance activities prior to departure. Although MCC uses databases extensively, there are currently no automated decision support systems in place in the division.

Most of the divisions within maintenance rely on the relational database management system ARTEMIS which was developed by Lucas Management Systems (UK) and is maintained by a local representative in Jakarta. Several program modules have been developed in the ARTEMIS system for the various functions within the maintenance division. The modules mainly used within the ARTEMIS system are AMEGA and SNAG. They are accessible from most international airport stations of the airline, but is not accessible by operations control (EM).

The maintenance inventory control program AMEGA is used by the engineering division to monitor the repair activity and available spares for each aircraft type, and for tracking the cumulative in-flight service times for each aircraft and major components. These service times are obtained via the Departure Control System DCS (not from ROC), as this information is entered into the system by station managers throughout the airline's network. The SNAG module monitors irregular maintenance related activities from the aircraft cockpit, on-line maintenance and other ramp activities. Additional modules within the ARTEMIS system are used for production management, repair job scheduling, short-term maintenance planning, aircraft maintenance management projections, job costing; and generating long-term maintenance scheduling. These computer systems have been installed at the Garuda Maintenance Facility GMF since 1991. Historical data from these software packages are stored at Information Systems (DX) for up to three years on-line, backed up on tape.

Although Maintenance is on the right track with the ARTEMIS computer system, they have a problem with communication, data transfer times, and processing times. The Airline Resource Planning ARP software has not been fully implemented in the maintenance planning department, but is used extensively throughout the rest of the airline. As a result, daily aircraft rotations planning are done manually in maintenance, based on long-term maintenance schedules (generated from the ARTEMIS computer system), updated flight schedules from Operations Planning (EP), and any additions input/comments from Commercial and Marketing. The final daily aircraft rotation (in text form) is then forwarded to Operations Control.

3.5 Maintenance Planning (MP)

The Maintenance Planning division is responsible for the strategic maintenance planning at GMF. Aircraft rotation planning is handled by this division in collaboration with Operations Planning (EP). The aircraft rotation generation is done manually, incorporating any effects of prolonged irregular operations and unplanned maintenance requirements. A complete summary of job descriptions in the aircraft rotation department is available, outlining each individual activity, the necessary input, required time/schedule, output, and the person responsible for the activity. Sample copies of weekly aircraft routing and maintenance schedules, bi-weekly schedules and monthly maintenance schedules are also available. The weekly rotations are used to keep track of aircraft switching, and show the actual rotation of a given aircraft. Recently Maintenance Planning started to store aircraft documentation/ certification records on disk (instead of on paper and on the wall). The maintenance aspects of irregular operations are handled by a separate division called the Line Maintenance department, who has access to all computer systems within maintenance, and the DCS system.

3.6 *Crew Planning and Dispatch*

Crew planning is almost entirely a manual process at Garuda. Information for crew planning is based on a hard copy of the flight schedules generated by Operations Planning in conjunction with the Commercial department. They have installed the Crew Management System (CMS) which is used to electronically generate/print out individual bid lines, and to keep track of crew flight hours, ratings, and personal information. The CMS program accepts as input (via keyboard) the final version of the crew trip patterns which have been manually and graphically generated. Within Crew Planning, cockpit and cabin crew bidlines are developed independently, based on pre-determined Garuda work rules and international standards. The crew bidlines are then forwarded to crew tracking for implementation. Crew Tracking, in conjunction with Crew Dispatch uses a state of the art mobile paging system, which allows them to maintain good communications with flight crews in the metropolitan area of Jakarta.

The Crew Management System (CMS or CREWLINK) is the only module used by Garuda of a larger computerized operation management information system, COMFORT. Other modules in the COMFORT system include FLTLINK, NAVLINK, FUELINK AND MGMLINK. The capabilities of the CREWLINK/CMS system include storing crew information and crew costs, planning crew rosters, crew tracking and crew dispatch. The CMS system maintains an extensive database on operational constraints, aircraft crew requirements, crew positioning costs, flight schedules, station and country information, and pattern data. Access to the CMS is limited to Crew Planning (OB), Flight Dispatch (EA), and the Operations Control Center (OCC), but not Operations Control (EM). Individual crew rotations are stored on disk since January 1994. This data could be very useful to EM operations, especially during irregular aircraft operations.

3.7 Flight Dispatch

The general function of this department is to decide on the final flight plans for all Garuda flights originating at Cengkereng. Currently, all flight plans at Garuda are computer generated by Jeppeson in the USA. Weather information (excluding wind data) from throughout Indonesia is reported manually to Flight Dispatch on a hourly basis from all domestic station managers. The Flight Operations Officer (FOO) is regarded as the pilot in command's assistant on the ground. In this position, the FOO has the ability to review prevailing operating conditions and anticipate developments in the daily operations of the carrier. Prior to the commencement of a flight, the Flight Operations Officer exercises a joint responsibility with the pilot in command in evaluating the weather, airport and navigation facilities, and they are jointly responsible for planning the most efficient flight consistent with safety. However, the final decision on flight plans is up to the pilot in command.

Primary communication channels are telex, telephone, and radio. In additional, there are terminals for access to the departure control DCS system readily available in the Flight Dispatch department. Garuda is in the process of installing ACARS units (aircraft communication system) in the 747-400 and 737 fleets. Irregular operations and special flight planning are handled by Operations Movement Control (EM) in conjunction with Flight Dispatch. The Flight Operations Officer when advising EM about a diversion of an aircraft in flight, should be able to recommend the best alternate airport available, considering the continuation of flight, flight operations services, the fuel situation and all other relevant flight information.

3.8 Airport Operations (KO)

Airport Operations is responsible for monitoring all ground services activities including aircraft fueling, catering, special requests, cargo activities and ramp crew scheduling. The DCS departure control system is used extensively in this department to monitor the preparation activities of departing flights. Primary communication channels are telex, telephone and radio. Airport Operations (KO) serves as the primary interface between Operations Control (EM) and Ramp Control (KR), and as liaison to the airport authority. One of its many roles is being in charge of gate handling and assignments for the daily operations of the carrier. In cases of irregular operations, Airport Operations is responsible for communicating between the airport authority and all divisions in Garuda.

3.9 Ramp Control (KR)

The primary function of Ramp Control is to execute the preparation activities for all departing Garuda flights at Cengkereng. It is a sub-division of Airport Operations. Personnel in Ramp Control deliver the final flight documents to the aircraft cockpit at the departing gate, and are responsible for ensuring that the aircraft is ready for departure before or at the scheduled departure time. After each flight departure, Ramp Control at each station is responsible for entering the relevant information for the flight into the Departure Control System, as well as sending a departure message via telex to the ROC system. This information includes the actual departure and arrival times of a given flight, fuel uplifts, start and completion times for all pre-flight activities, and ground handling times for fueling, cleaning, and catering.

In addition, daily aircraft rotations which are determined by Maintenance Planning, are manually entered into the Departure Control DCS computer system by Ramp Control, including aircraft swapping in the aftermath of irregular operations. The DCS computer

system was recently acquired from SwissAir and is maintained by Information System (DX). It is accessible by several out stations (such as AMS, FRA, SIN, HNL, BKK, SYD, PER) in Garuda's network, in addition to several departments in Jakarta including Operations Control (EM). The DCS system stores data on passenger listings for each departing flight, in addition to navigation data, maintenance tracking, and tariffs. Ramp control is also responsible for sending departure or arrival (movement) messages via telex to the resource operational control ROC system once the event has occurred for a given flight.

3.10 Navigation (ON)

Navigation information is entered and stored on the DCS database system. The system stores for each flight a list of potential aircraft routings, which the navigation division uses to send a flight plan request to Jeppeson for each flight. Jeppeson receives weather forecasts for the Indonesian airspace from the government's meteorology department. Meteorology data is obtained from CKG airport tower, the Indonesian meteorology department as well as from the Jeppeson data received for each flight. Data is manually inputted to DCS by Navigation including information received from airport authorities (world-wide), prescribed international aircraft routing, and historical flight planning data (based on information received from Jeppeson).

Flights plans (domestic and international) are requested from the Jeppeson database via SITA telex. The request for each flight plan requires data specific to the intended flight. These data include the designated flight number, captain in command, departure airport and taxi fuel required, destination airport, alternate airport with fuel requirement, time of departure, aircraft type identified by the aircraft registration, desired routings, optimal flight level request, standard cruise mode, payload, and standard reserve fuel. Each flight plan request requires approximately two minutes processing time (automatically generated from the Jeppeson database in Phoenix, Arizona) and the response is returned to Navigation

(ON). Once the flight plan request has been answered, the paper output is forwarded to Flight Dispatch and airport out-stations via telex. The flight plan data is also forwarded to Operations Control (EM) in paper form. Jeppeson flight planning has been used by Garuda for the past four years. There appears to be no optimization used in constructing flight plans.

The Navigation department doesn't participate in any flight following activities, but serves primarily as a strategic planning unit. In times of irregular operations, the flight planning may be done at the out-stations by third party companies on behalf of the carrier.

3.11 Information Systems (DX)

Information Systems (DX) provides computer support for all departments within the Garuda organization, maintaining all the operational computer systems outlined above. The following summary describes the data format, interface requirements, related computer systems, operational platform and the extent of historical data for each operational system.

Airline Reservations Garuda System (ARGA)

- IBM TPF (Transaction Processing Facility) data format
- Historical data for the past eleven months is stored off-line
- ARGA interfaces with DCS and automatically transfers passenger name lists for each flight to the DCS system 24 hours prior to departure
- Mainframe based operating system

Crew Management System (CMS)

- Dbase 2 data format
- Historical monthly data stored on disk
- Historical annual data since 1991 stored on tape
- Interface between CMS and crew dispatch via direct cable, other facilities via radio link
- Information is entered to CMS primarily manually
- Mainframe based operating system

Departure Control System (DCS)

- Historical data available since 1991
- Interfaces with the airline reservation system
- Mainframe based operating system (MVS)

Resource Operations Control (ROC)

- Dbase 3 data format
- Historical data since January 1991 available on disk, prior three months stored on-line
- Interface between DX and ROC system via local area network
- Information on aircraft movements is automatically entered to ROC via SITA telex
- DOS based computer system, requiring PC with 16 MB RAM and 500 MB hard-drive

Airline Resource Planning (ARP)

- Dbase 3/Paradox format
- Interface between ARP and ROC possible
- DOS based software package, requiring PC with 8MB RAM

3.12 *Summary of the Operational Scheduling Process at PT Garuda Indonesia*

The following figures present a summary of the operational scheduling process at Garuda. It outlines the each stage in the scheduling process as it currently exists at the airline. These functional flow diagram are useful in understanding the required data flow and the resulting relationship between various divisions within the airline organization.

The Scheduling Process at PT Garuda Indonesia

Functional Flow Diagram

Schedule Development

- Proposed Schedule of Services (Commercial CK)
- Study of Proposed Schedule of Services (Corporate Planning DQ)

Schedule Generation

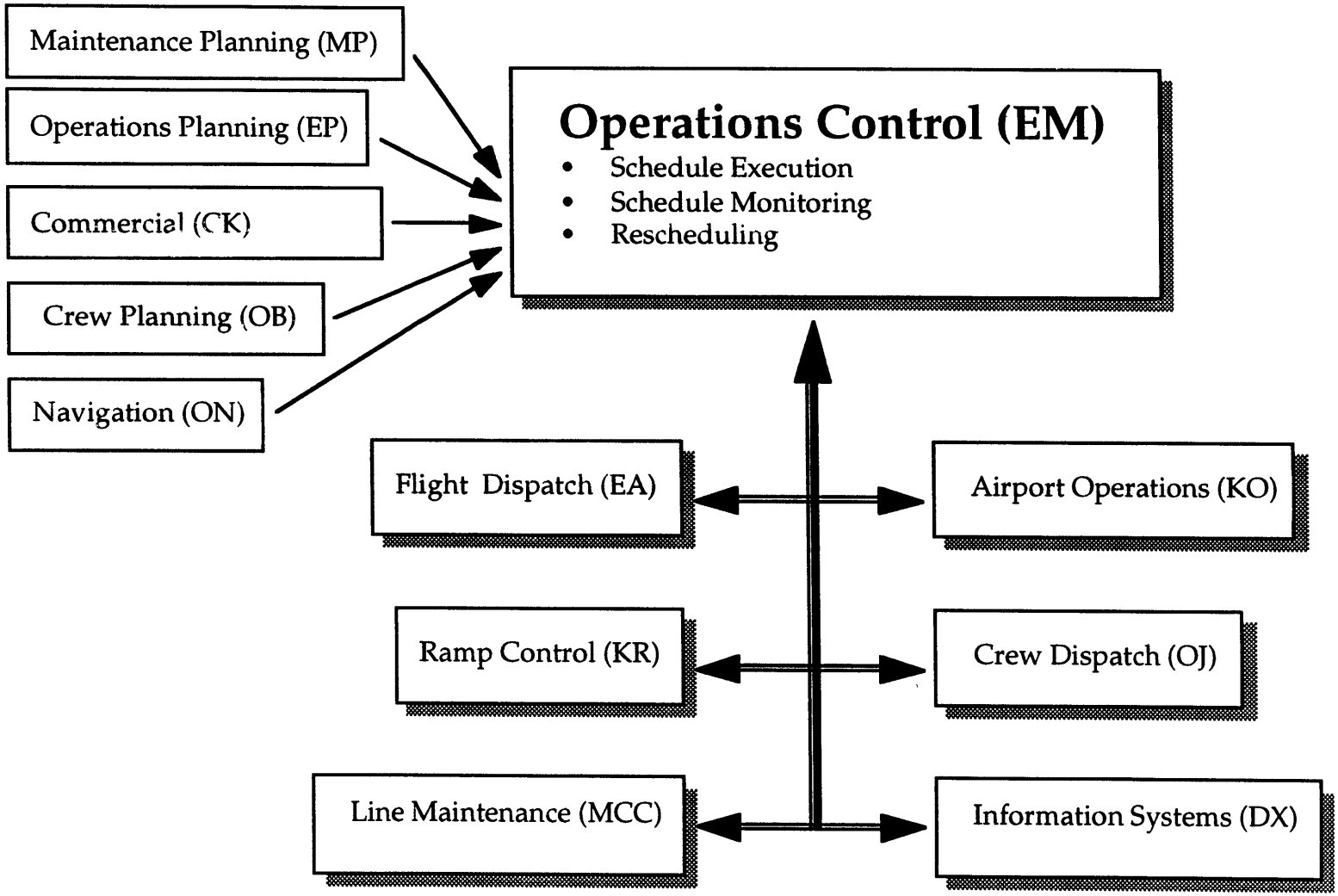
- Schedule Rationalization (Operations Planning EP)

Schedule Execution

- Schedule Monitoring (Operations Control EM)
  [Detailing on separate diagram]
- Rescheduling for Irergular Operations (EM)

Schedule Evaluation

- Operational Analysis (Operations Control Center)
- Schedule Restructuring (Commercial/Marketing)


Maintenance Planning (MP)
Operations Planning (EP)
Commercial (CK)
Crew Planning (OB)
Navigation (ON)
Operations Control (EM)
• Schedule Execution
• Schedule Monitoring
• Rescheduling
Flight Dispatch (EA)
Airport Operations (KO)
Ramp Control (KR)
Crew Dispatch (OJ)
Line Maintenance (MCC)
Information Systems (DX)

Division Functional Requirement

Commercial/Marketing

- Conduct Market Studies in conjunction with District/Area Managers
- Forecast passenger traffic levels for short-term planning
- Generate desired Schedule of Service outlining frequency of service in a given O/D market
- Coordinate service requests from Station/District/Area Managers

Corporate Planning (DQ)

- Generate annual production plan in conjunction with Commercial/Marketing
- Conduct fleet planning analysis (both Tactical and Strategic)
- Strategic Route Planning and Development
- Conduct Cost and Revenue Analysis

Division Functional Requirement

Operations Planning (EP)

- Flight Schedule generation, Resource Schedule generation
- Generate Nominal Aircraft Schedule for each fleet type
- Aircraft routing
- Coordinate information required for detailed scheduling process

Operations Control (EM)

- Monitor the daily operations of the airline
- Resolve any operational problems which may affect flight schedules in the network
- Coordinate information from all other divisions within Garuda related to operations
- Maintaining the Current Operations Schedule of the airline

Division Functional Requirement

Maintenance Planning (MP)

- Generate long-term maintenance schedules for each fleet type
- Generate Strategic aircraft rotations

Maintenance Control Center (MCC)

- Perform Aircraft tracking
- Coordinate Line maintenance support and services at all stations
- Coordinate all tactical maintenance activities

Navigation (ON)

- Coordinate and maintain all navigational databases
- Prepare and submit flight plan requests for departing aircraft

Division Functional Requirement

Crew Planning (OB)

- Generate crew rotations based on established flight schedule
- Generate crew bidlines
- Assign individual crews to a given trip

Crew Dispatch (OJ)

- Monitor crew trips, flight hours, and crew legality
- Coordinate crew availability with Operations Control

Flight Dispatch (EA)

- Prepare and finalize flight plans and conduct flight briefing
- Weight and balance analysis, Passenger manifest
- Take-off and Landing performance analysis

Division Functional Requirement

Airport Operations (KO)

- Execute flight schedules with Operation Control
- Communicate schedule changes with the airport authorities

Ramp Control (KR)

- Conduct flight departure and arrival processes for all flights at station
- Coordinate all ground activities at the base airport

Information Systems (DX)

- Maintain all computer databases necessary for operations
- Develop and implement computer systems for other divisions

4.0 Suggestions for Improvements within Operations Control

Recommendations for Future Actions and Improvements

MIT Flight Transportation Laboratory, Cambridge MA

In reviewing the existing operations control centre at Garuda, the project team has established several issues which could significantly improve the daily operations of the airline. It is by no means a comprehensive listing of the deficiencies in the operations control, but rather a list of issues and projects where possible improvements should be considered. In order to fully assist in the improvement of the operations control centre, several supporting groups within the airline will be subject to recommendations for improvement themselves.

Operations Planning (EP)

- Full implementation of the Airline Route Planning software, making use of dormant features in the software such as the optimization options
- Improved communication with Maintenance Planning and Crew Planning during the schedule generation process

Operations Control (EM)

- Improve communication channels currently in use at EM (telexes, facsimile, etc.)
- Implement a local area network incorporating MCC, OCC and EP to improve communications amongst the supporting groups
- Integrate new communication devices such ACARS in the daily operations at EM
- Improve access capabilities to the computer reservation system ARGA

- Improve access capabilities to the Departure Control System DCS in order to retrieve more detailed information regarding on-board passengers during irregularities
- In the event of irregular operations, create a dynamic need-based action group with personnel from operations related GA divisions, whose primary role would be to assist Controllers in resolving irregularities

Operations Control Centre (OCC)

- Implement a local area network incorporating Operations Control (EM) and the Operations Planning (EP)

Maintenance Control Centre (MCC)

- Improve interaction between MCC and EM in the schedule execution process
- Provide EM access to the airline maintenance engineering module AMEGA

Maintenance Planning (MP)

- Improve interaction between MP and EP in the schedule generation and aircraft routing process
- Implement computer systems for the aircraft routing process, thereby developing an operational database with planned aircraft routings

Crew Planning (OB)

- Crew scheduling and planning should be done with a computer based system
- Establish a more comprehensive database with improved records of operational crew patterns and rotation (such as historical data)

- Improved interaction between OB and EP during the generation phase of the operational flight schedule process
- Improve the format of graphical diagram formats outlining the final crew patterns used in Operations Control

Crew Dispatch (OJ)

- Complete the implementation of the Crew Management System, making use of the remaining modules in the computer system for crew planning
- Improve communications between all airport stations and EM especially in the event of irregular operations

Navigation (ON)

- Improve communications and distribution channels between EM and Navigation for irregular flight planning activities
- Distribute more comprehensive information to EM on navigation subjects such as NOTAM's, etc. which impact daily operations
- Establish a meteorology working group in conjunction with Flight Dispatch

Flight Dispatch (EA)

- Implement an in-house flight planning computer system in conjunction with Navigation for all domestic flight planning

Airport Operations (KO)

- Execute improvements in the departure control system, incorporating future suggestions from Operations Control (EM)
- Improve communication channels between KO and EM
- Automate communications between DCS and ROC computer systems

5.0 Appendices

- Appendix A

Job Descriptions for Personnel within the Flight Operations Division at PT Garuda Indonesia

- Appendix B

Organizational Flow Charts for the Operations Division of Garuda Indonesia

The following charts present a summary of the role of the various operational organizations and divisions in the daily operations of Garuda Indonesia.

Chart 1 Overview of Flight Operations Services Implementation at Home Base

Chart 2 Overview of Flight Operations Services Implementation at Ops Control

Chart 3 Overview of Flight Operations Services Implementation at Station dispatch