

A flexible approach to effective and efficient manpower planning for Ukraine International Airlines at main station Boryspil International Airport

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Abstract

Development of a flexible model for strategic manpower planning plays a crucial role in effective and efficient functioning of every successful airline. The paper describes application of this model at Ukraine International Airlines for their major maintenance station at Boryspil airport in Kyiv, Ukraine. The model could be used as a tool to support management of the Pre-Flight Check maintenance department. It would solve capacity planning issues related to manpower scheduling and requirement.

Keywords

analytical approach · flexible manpower planning · airlines · Pre-Flight Check

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1 Introduction

The major challenge for every airline is to have safe, airworthy and on-time aircraft every day. Therefore, it is necessary to provide efficient maintenance of growing fleet which should be planned and performed according to prescribed standards and procedures. Each fleet type has determined maintenance norms which specify what task and in what time interval should be scheduled. However, union rules and maintenance regulations cause additional constrains. As result, the airline industry is faced with some of the largest and most difficult planning problems known today [7].

Maintenance activities are the backbone of a successful and profitable airline company [1]. The largest expenses for an airline are typically fuel, other aircraft expenses and salaries. Therefore, efficient planning of manpower and aircrafts is important to maximize profits. Nevertheless, many airports and airlines still have to face departure delays and frequent changes in operations, miss revenue opportunities or waste money because of unused resources of every kind [3].

According to the Bureau of Transportation Statistics, 30.1% are Air Carrier delays. These are delays or cancelations that were caused by circumstances which are controlled by an airline (maintenance, Pre-Flight Checks, crew problem, aircraft cleaning, baggage loading, fueling, etc.). The biggest portion of delays 40.8% represent Aircraft Arriving late. The Security Conditions are only 0.1%, National Aviation System delays (attributed to the national aviation system that refer to different conditions such as ATC, traffic volume, airport operations, etc.) represent 24.8% and Weather Conditions cause only 4.1% of flight delays. Airlines are applying different systems to prevent delays caused by different reasons, and the main importance is the link between the airports and standardization of technology [5].

The aspect of aircraft checks itself is responsible for 26% of delays at Ukraine International Airlines, which is a considerable portion of Air Carrier delays.

Ukraine International Airlines (UIA), based in Kyiv Boryspil International Airport (KBP), Ukraine, is the flag-carrier of Ukraine serving over 40 capitals and key cities of Western Europe, the CIS, Asia, and Middle East, as well as operates do-

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mestic flights within Ukraine. UIA operates over 700 flights per week and provides connections with its international partners' flights to more than 3,000 other destinations across the world. According to the Boeing Company statistics, UIA is the only airline in the CIS which performs full technical maintenance for its own fleet. As of January 2013, the Ukraine International Airlines fleet consists of the following aircraft represented in Tab.1.

Tab. 1. UIA fleet

Equipment type	In Fleet	Orders
Antonov 148-100	3	1
Boeing 737-300	5	0
Boeing 737-400	4	0
Boeing 737-500	6	0
Boeing 737-800	6	2
Boeing 777-200LR	0	5
Total	24	8

To start flexible manpower planning it is important to know the flight schedule of UIA and all necessary input data which then will be used to create shift schedules for technicians.

2 Input data

Airline schedule

Once the flight schedule is completed (Tab.2.), the maintenance station at KBP receives its maintenance schedule. The management task is to build flexible staffing model which would improve efficiency, performance and minimize costs.

As the schedules of UIA change according to high and low season, the schedule used for manpower planning is an active schedule for 04 Feb 2013 (Monday).

To have efficient manpower planning the number of flights on a typical day of UIA should be calculated (Tab.3.) After that, the peak hours for the departures should be determined (Fig.1.).

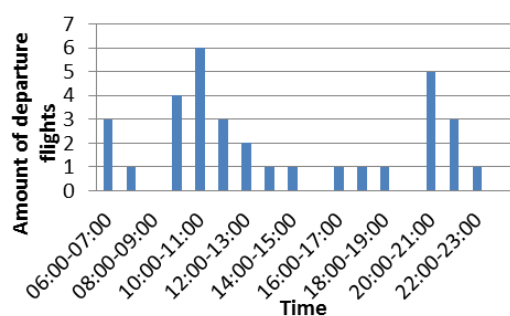


Fig. 1. Distribution of departures on one day of Ukraine International Airlines at KBP

Type of aircraft maintenance check

Aircraft maintenance checks are periodic inspections that have to be done on all commercial/civil aircraft after a certain amount of time or usage. There are distinguished the following checks: Transit check, Daily check, Weekly check, A-check, B-check, C-check and D-check. A-check and B-check are simple

Tab. 2. UIA schedule on a typical day (Monday 4 Feb 2013)

Time	Departure	Airport Code
06:20	Moscow	DME
06:25	Amsterdam	AMS
06:30	Paris	CDG
07:20	Vienna	VIE
09:40	Amsterdam	AMS
09:45	Madrid	MAD
09:50	Tel Aviv	TLV
09:55	Zurich	ZRH
10:00	Rome	FCO
10:00	London	LGW
10:15	Geneva	GVA
10:30	Brussels	BRU
10:40	Milan	MXP
10:55	Vienna	VIE
11:10	Frankfurt	FRA
11:20	Bangkok	BKK
11:55	Berlin	TXL
12:55	Helsinki	HEL
12:55	Tbilisi	TBS
13:30	Vienna	VIE
14:30	Moscow	DME
17:00	Amsterdam	AMS
17:45	Paris	CDG
18:45	Moscow	DME
20:40	Almaty	ALA
20:40	Tbilisi	TBS
20:50	Dnipropetrovsk	DNK
20:50	Lviv	LWO
20:55	Harkiv	HRK
21:00	Odessa	ODS
21:05	Donetsk	DOK
21:10	Simferopol	SIP
22:45	Astana	TSE

Tab. 3. Amount of UIA flights during one day

Equipment type	Number of departures
Narrow-body – domestic	6
Narrow-body – international	27

while C-check and D-check are complicated forms of technical service.

Transit check (PFC Pre-Flight Check) is the simplest form of aircraft service. It is done before every departure of aircraft. During PFC not everything can be checked because the transit time is limited. The constructors know that and they have made a maintenance schedule for that purpose. Before releasing aircraft the Preflight or Transit Check has to be done. It includes the following procedures:

Review technical logbook and take corrective actions:

- Carry out an aircraft walkaround for evidence of obvious damage which may have occurred during last flight, landing or taxi phases (Impact/FOD; Fluid leakages; missing or loose parts; missing overpressure discharge disks; obstruction of in-

- lets/outlets);
- Check AVX air extract valve/fan for correct position/operation;
- Check brake units for evidence of overheating or leaks, MLG and NLG shock absorber for normal condition, tires for wear, damage and evidence of under inflation;
- Check MLG pitch dampers nitrogen pressure drop indicators: no pop-out;
- Check engine oil level and hydraulics level.

Simplification: The paper describes manpower planning only for Pre-Flight Check of UIA aircrafts which arrive to KBP. The aircraft ground time is not taken into account for PFC.

For the Pre-Flight Check only Departure schedule of flights is taken into account.

Standard time for PFC 20 min

In case of some minor defects' detection, the standard time should be enough for their elimination. In case of significant defects' detection, PFC check may take more than 20 min, or lead to flight delay or cancelation.

Simplification: Only positive condition without significant defects' detection is taken into account. Each sub-shift has overlapping with a purpose of prevention of delays and lack of technicians.

Duration of every sub-shift is 8 hours

According to Labor Law of Ukraine and trade union requirements the working day cannot exceed 8 hours.

Amount of people needed for PFC check of one aircraft is 1

The availability of technicians at different times of the day is the main challenge for maintenance stations. On average, labor represents 13% of maintenance costs. That's why mathematical modeling techniques with other scheduling models are extremely important in manpower planning.

The challenge faced by the maintenance department is determining the number of technicians required and their schedules based on the flight schedule and the maintenance programs to be carried out.

3 Output

To derive the various performance measures analytical method was used, which can be applied also for more complicated systems, while using AutoStat analysis tool. Fig.2. presents the output of the flexible model for the Pre-Flight Check which is done 20 min before every departure. The figure gives explanation of how many working shifts should be available at airline station KBP to prevent aircraft delays and how many workers should be available at the same time to cover peak-hours.

Explanation to Fig.2.:

- 06:00, 06:05, 06:10, etc. is time of Pre-Flight Check start;
- DME 06:20, AMS 06:25, etc. is destination airport and time of departure;
- FCO/LGV means that there are two departures to different destinations at the same time;
- Time interval is 5 min.

As the figure suggests, there is almost equal demand for technicians during the Day shift and during the Afternoon shift.

There are two working shifts in 24 hours for PFC: day and afternoon shifts. Each shift is divided into sub-shifts. Tab.4. projects the shift and sub-shift schedules at Kyiv Boryspil International Airport.

Tab. 4. Shift and sub-shift schedules at KBP

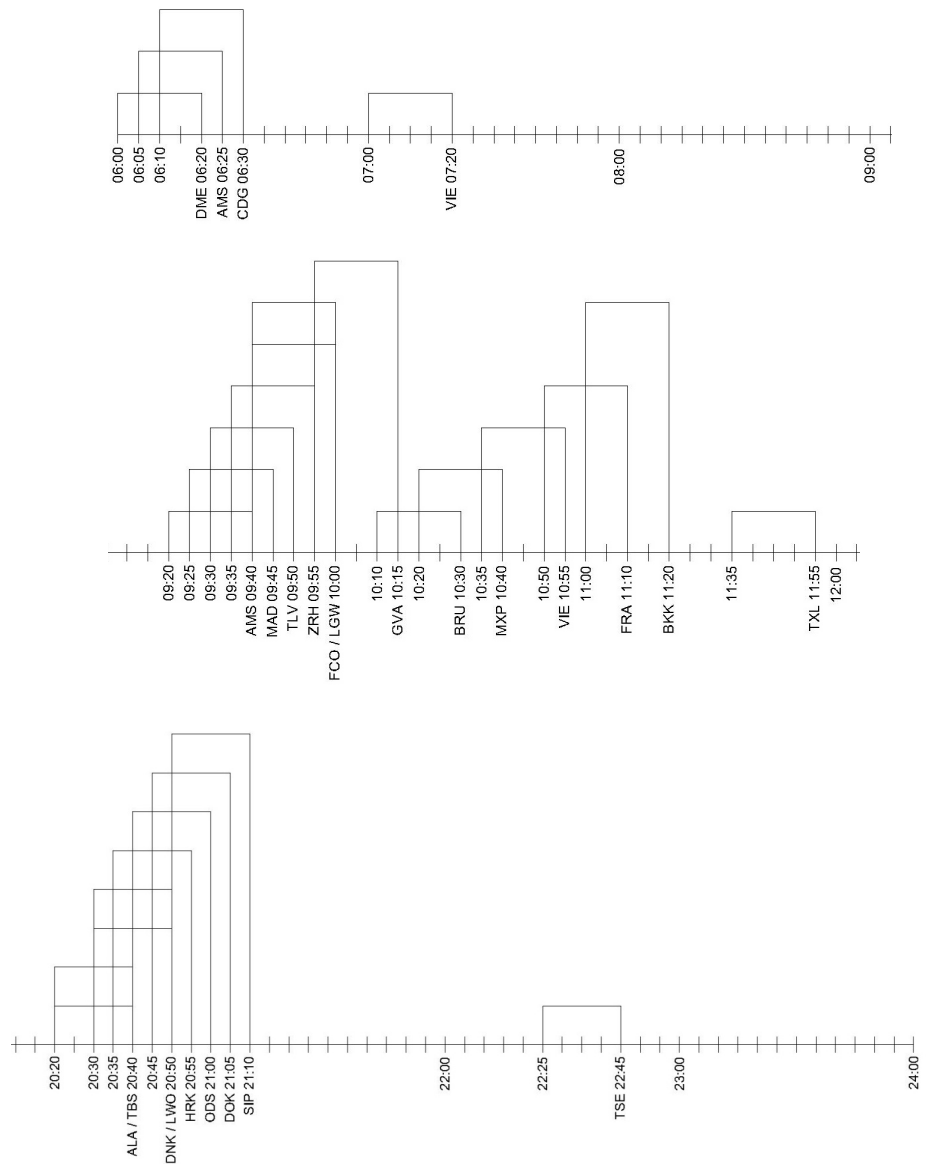
Shifts	Sub-shifts	Start time	End time	Amount of workers
Day	1	05:30	13:30	3
	2	09:00	17:00	2
Afternoon	1	14:00	22:00	3
	2	16:00	24:00	2

There are two peak hours at KBP in the morning from 09:00 till 11:00 and in the afternoon from 20:40 till 21:10. There are less departures during the Afternoon shift than Day shift, however, there are more flights which depart at the same time, thereby there is the same amount of workers in Afternoon shift as in Day shift.

4 Conclusion

The challenge of the work was to provide the number of technicians required and their shift schedules for the maintenance department of Ukraine International Airlines. The necessary amount of technicians for the Pre-Flight Check was determined. The analytical approach was used which can be also applied to higher-level checks. The airline was using standard models which were incapable of capturing the peaks in arrivals and departures, thus creating delays. The described flexible approach is promising in fulfilling the complexity of operations at the maintenance department. With its help it is possible to calculate the necessary amount of working personnel for any day of the week and to create shift schedules for weeks and months. On the basis of analytical planning, computerized simulation approach can be used. It would simplify manpower schedule formation for weeks and months. Analytical method is worth applying also to higher level checks. However, when using simulation approach to higher level checks the input data should be modified. It could be arrival and departure times; the aircraft ground time; duration of check itself; number of technicians needed for one specified check of one aircraft. Fleetwatch system can be also applied for simplification of planning. It allows planners to monitor aircraft anytime, see actual ground time and forecast maintenance checks. The technician working near his/her maximum capacity

Fig. 2. Time distribution for the Pre-Flight Check before flight departure (peak-hours)



represents a bottleneck, and a technician with a low percentage of utilization is considered underutilized. Therefore, it is important to consider and evaluate various system parameters and confirm their validity with the airline's existing figures.

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