AUTORITATEA AERONAUTICĂ CIVILĂ

A REPUBLICII MOLDOVA

GM-HRPS ATSU

MATERIALE de ÎNDRUMARE

Determinarea numărului necesar de personal în cadrul unității de control al traficului aerian

Ediția 01/ Septembrie 2020

REPUBLICA MOLDOVA
MINISTERUL ECONOMIEI
ŞI INFRASTRUCTURII

РЕСПУБЛИКА МОЛДОВА
МИНИСТЕРСТВО ЭКОНОМИКИ
И ИНФРАСТРУКТУРЫ

O R D I N

cu privire la aprobarea ediţiei 01 a materialelor de îndrumare „Determinarea numărului necesar de personal în cadrul unităţii de control al traficului aerian” (GM-HRPS ATSU)

nr. 37/GEN din 11.09.2020

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În temeiul art.7 alin.(3) subp.1) lit.d) din Codul aerian al Republicii Moldova nr.301/2017 şi punctului 10 subp.1) lit.d) din Hotărârea Guvernului Republicii Moldova nr.133/2019 cu privire la organizarea şi funcţionarea Autorităţii Aeronautice Civile, întru executarea atribuţiilor ce îi revin Autorităţii Aeronautice Civile în calitate de autoritate administrativă de certificare, supraveghere şi control în domeniul aviaţiei civile,

ORDON:

1. Se aprobă ediţia 01 a materialelor de îndrumare „Determinarea numărului necesar de personal în cadrul unităţii de control al traficului aerian” (GM-HRPS ATSU), conform anexei la prezentul ordin.

2. Autoritatea Aeronautică Civilă va pune la dispoziţia tuturor persoanelor interesate anexa la prezentul ordin prin publicarea pe pagina web oficială www.caa.md, la compartimentul Cadrul Normativ/GM”.

3. Prezentul ordin intră în vigoare la data publicării în Monitorul Oficial al Republicii Moldova.

DIRECTOR **Eugeniu COŞTEI**

Nr.37/GEN. Chişinău, 11 septembrie 2020.

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AMENDMENT RULES

(1) The provisions of the GM shall be modified only by amendment.

(2) The amendment shall be approved through the general Order of the CAA Director.

(3) After approval of the amendment, the GM's holder shall introduce the new issued pages and destroy the replaced pages.

(4) A new edition of GM is issued if the volume of changes exceeds 30% of its content.

AMENDMENT RECORDS

No.	Edition/amendment number	Effective date	Inserted by	Signature
1	Edition no.1	25.09.2020		

CHAPTER 1. GENERAL PROVISIONS

1.1 Definitions

When used in this GM, the terms below have the following meanings:

Tactical human resource planning - is a process that ensures that an operational organization has sufficient skilled human resources to meet existing operational requirements in accordance with the organization policy.

Operational factors - determine the human resources required to maintain the operational function of a facility. For example, the number of sectors and workload in each sector are some of the operational factors for an area control center.

Controller Capacity - can be defined as the number of aircraft that can be handled by a controller within a certain period of time for a given sector size, taking into account observable and non-observable tasks, plus any additional time which provides the controller a safe margin for recuperation.

The **"*Working Unit*"** is the hours per year a person is available to work. This definition is based upon the effective working hours per day and the effective workdays per year.

The **"*Operational Staffing Factor*"** is a figure representing the minimum number of staff to cover a work function (such as an ATC workstation or maintenance for a navigational aid facility) for a specified period of operation. It does not take into consideration any specific factors (i.e. rostering, special operational requirements). The mathematical figure is derived from the total operational hours in one year and the calculated *working unit.*

1.1.1. The acronyms/abbreviations

The acronyms/abbreviations used in this document have the following meanings:

ACC	Area Control Center
APP	Approach Control Unit
ANSP	Air Navigation Services Provider
ATC	Air Traffic Controller
ATS	Air Traffic Services
CAA	Civil Aviation Authority
CSV	Chief Supervisor of ATC shift
EU	European Union
EC	European Commission
FP	Focal Point
RAC	Civil Aviation Regulation
RM	Republic of Moldova

1.2 Purpose of GM

This guidance material is a non-binding material issued by Civil Aviation Authority in order to assist the Air Navigation Services Providers to assure compliance with the requirement RAC ANSPC 0010 (Regulation (EU) 2017/373 ATM/ANS.OR.B.001) “Technical and operational competence and capability”:

A service provider shall ensure that it is able to provide its services in a safe, efficient, continuous and sustainable manner, consistent with any foreseen level of overall demand for a given airspace. To this end, it shall maintain adequate technical and operational capacity and expertise.

According to the GM1 ATM/ANS.OR.B.001 issued by EASA - technical and operational capacity should include a sufficient number of personnel to perform its tasks and discharge its responsibilities.

Thus, this GM is aimed to assist ANSP in the determination of the need air traffic controllers’ resources in order to ensure the staffing of ATC unit and controller’s rostering.

1.3 Applicability

This GM is applicable to the Air Navigation Services Provider organization.

1.4 References

This GM was elaborated considering the information collected from the following documents and sources:

1) ICAO Doc. 9426 „Air Traffic Services Planning Manual” 1st Edition 1984;
2) Chapter 2 of the draft of the „Human Resource Planning Manual”, elaborated by the Air Navigation Commission under task entitled “Regional Human Resource Planning and Training Needs” (ANC Task PEL-9601);
3) Supporting material provided by EUROCONTROL „Guidelines for ATCO Manpower Planning Processes”.

CHAPTER 2. INTRODUCTION

2.1 The Planning Process

A human resource planning methodology is required to meet the operational needs for skilled personnel, on a day-to-day basis. The process is essentially a **tactical planning process** (see the definition) involving staff at all levels of an organization including senior management, supervisors and workers. This GM describes the basic elements of a tactical human resource planning process. The basic elements are:

- operational factors,
- staffing factors,
- the rostering of personnel.

As can be seen in Figure 1, the results of the planning process are also used to forecast the demand for skilled human resources. The results of the process can be affected by a change in technology.

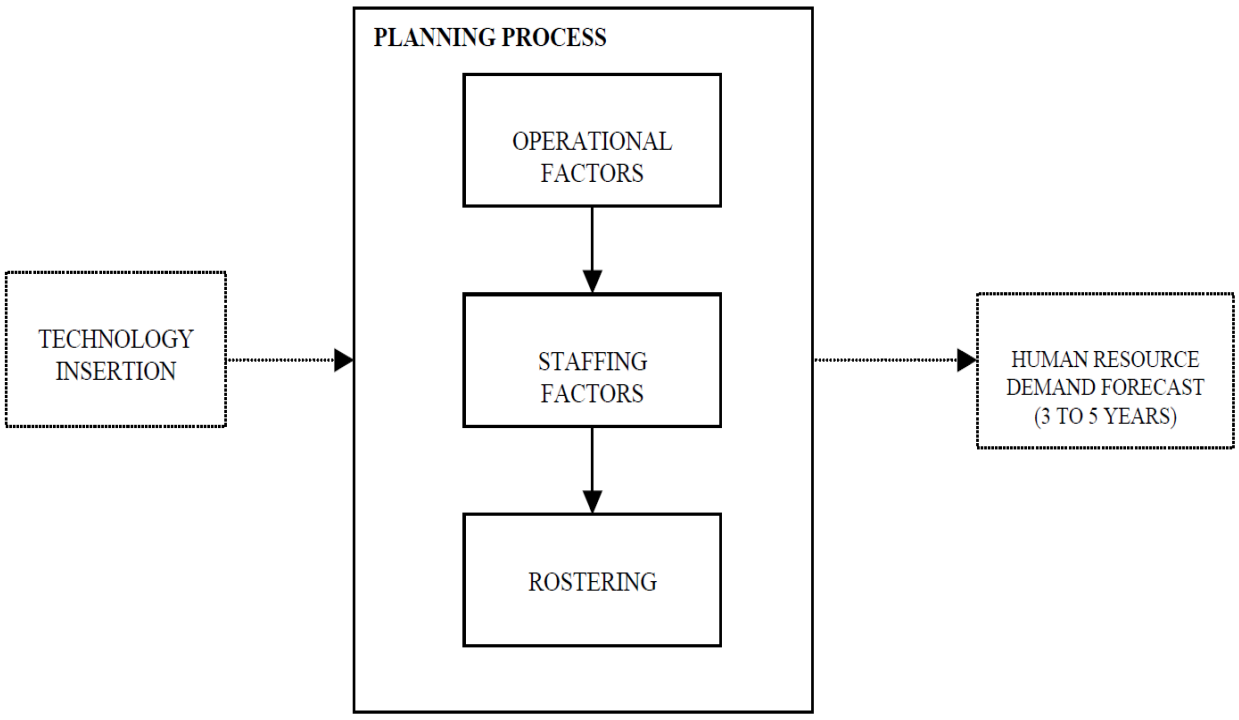


Figure 1 Planning Process

2.2 Evaluate the Organizational Activities

The first step in a tactical human resource planning process is to assess the organizational activities in order to quantify the human resources needed to meet those requirements. This is done for each service provided by an organization. For example, for air traffic control this involves the evaluation of traffic demand, airspace structure, distribution and mix of traffic over various time frames. The number of positions/sectors required is based on the traffic volume and its complexity. The operational activities (the opening and closing times for each position/sectors) will then determine the staff requirements.

The number of staff needed to meet operational requirements is not only based on the total number of activity hours in the planning period but also on other factors such as in service training, conditions of service and the rostering cycle. In addition, not all air traffic control positions/sectors will always be staffed on a 24-hour basis. On the other hand, there may be safety requirements that would necessitate 24-hour coverage of some air traffic control positions/sectors.

CHAPTER 3. OPERATIONAL FACTORS

Operational factors determine the human resources required to maintain the operational function of a facility. For example, the number of sectors and workload in each sector are some of the operational factors for an area control center.

Major factors to be considered when developing a tactical human resource plan for an air traffic control facility are the airspace organization and the controller workload. Here we deal with the operational factors of an intended airspace and the associated controller workload.

3.1 Airspace capacity

3.1.1. The capacity of an ATS system depends on many factors, including the ATS route structure, the navigation accuracy of the aircraft using the airspace, weather related factors, and controller workload.

3.1.2. The number of aircraft provided with ATC service should not exceed that which can be safely handled by the ATC unit concerned under the prevailing circumstances. In order to define the maximum number of flights that can be safely accommodated, the appropriate ATS authority should assess and indicate the ATC capacity for control areas, for control sectors within a control area and for aerodromes. ATC capacity is normally expressed as the maximum number of aircraft that can be accepted over a given period of time within the airspace or at the aerodrome concerned.

3.1.3. The most appropriate measure of capacity is likely to be the sustainable hourly traffic flow. Such hourly capacities can, for example, be converted into daily, monthly or annual values.

3.1.4. In assessing capacity values, factors to be taken into account should include:

a) the level and type and mix of traffic;
b) the structural complexity of the control area, the control sector or the aerodrome concerned;
c) the types of communications, navigation and surveillance systems in use, their degree of technical reliability and availability as well as the availability of back-up systems and/or procedures;
d) availability of ATC systems, providing controller support and alert functions; and
e) any other factor or element deemed relevant to controller workload.

Data gathered should be as detailed and precise as possible, taking into account seasonal peaks and weather conditions. These are factors that can have an impact on staffing and rostering. The expected traffic volume during a single day and on an hourly basis *determines the opening, and closing times of working positions and where appropriate sectors.* A given airspace may be divided into multiple sectors with each sector consisting of possibly one or more control positions. The objective of opening or closing a sector is to ensure a safe, efficient and orderly traffic flow.

3.2 Airspace organization

3.2.1 The solution to human resource shortages is not always adding additional staff. A re-arrangement of airspace can result in significant efficiencies, which in turn may reduce the number of staff required.

3.2.2. The organization of a given airspace, its division into sectors, the number of control positions in these sectors, the opening /closing times of positions together with present and predicted traffic volume are all important human planning factors to be considered. The configuration of the airspace should be broken down into and should take account of:

- number of ATS routes served;
- number of intersections of ATS routes;
- number of major terminal areas and total number of aerodromes (including military) in the area;
- proportions of aircraft in level flight and in climb or decent;
- airspeeds and levels used by groups of aircraft constituting a significant portion of the total;
- traffic.

3.2.3. The technical infrastructure of a given airspace can have a profound effect on human resource needs. There are many technology-related questions to be asked, some of them are:

- What kind of technical co-ordination is required between the different units, for example, six units, which include one upper airspace control center (UACC), four area control centers (ACCs) and one airport?
- To what extent should that coordination make use of new technologies?

3.3 Air Traffic Controller Workload

3.3.1. The air traffic controller's capacity is related to his or her capability to manage traffic. The more aircraft that are handled, the greater the capacity will be. In order to estimate the controller capacity and in turn workload, it is necessary to gather data on the airspace organization as detailed in paragraph 3.2 above.

3.3.2. Values of ATC workload should naturally be coordinated between the needs of operations staff and human resource planning. However, in practice, human resource planners cannot take into account solely the capacity/workload factor, because sector organization also affects the controller workload.

3.3.3. A method to determine a specific function of air traffic controller workload is outlined in the Air Traffic Services Planning Manual (Doc 9426-AN/924).The manual contains a summary of techniques for ATC sector/position capacity estimation. It focuses on the tasks, carried out by the air traffic controller and the workload estimated by summing the time spent on individual tasks.

3.3.4. To assess controller capacity (see definition) under a different airspace environment, with different equipment or procedures, and different traffic loading, a survey shall be done by the organization, considering all these factors at a local level.

3.3.5 It should be emphasized that controller capacity/workload is likely to vary among the different air traffic control positions and among individual controllers. Airspace capacity also differs among different control environments. These differences should be taken into account in any evaluation of controller capacity/workload.

3.4 Workload, a function of traffic flow

3.4.1. As stated previously, in order to estimate the controller workload, it is necessary to obtain data on the FIR geographical area and the traffic loading. However, human resource planners cannot take into account solely a workload factor, because the demand depends on the sector organization.

3.4.2. The data from operations will indicate when a sector should be opened, when it should be closed and what the expected throughput is. Afterwards, it is up to human resource planners to identify staff that will work in the sectors and at what times.

3.4.3. Controller workload can easily change as a function of traffic flow. When traffic builds up in the early hours of the morning, for example, with the arrival of specific international flights, workload can increase from a level of 60% to 90% of what could be considered the maximum levels as determined. There may also be a build-up of routine domestic traffic at the same time. Determining the exact level of controller workload is a complex task. There are qualitative issues such as traffic mix that can be stressful or a relief, depending on the context, to the quantitative traffic volumes. Air traffic controllers differ in their age and health, which could affect their stress and perceived workload levels. In most cases, expert controller opinions, or a

combination of consulting a representative association and expert controller assessment of the traffic conditions can revalidate the workload estimation.

3.5. Fast-time Modelling

3.5.1 It is possible to use fast-time modelling techniques, based on models of controller workload with varying degrees of sophistication, for example, covering different tasks. Basically, fast-time modelling is used to build up a function, on a sector-by-sector basis, relating number of aircraft to workload. Then, some workload threshold is used to define what can be termed as the “controller capacity”.

3.5.2 Some organizations use a method, which provides maximum and minimum data, presented in high-low charts. The workload is defined in terms of a maximum percentage of time, where the average workload is at a certain level and a peak that can reach a higher figure.

CHAPTER 4. STAFFING AND CALCULATION OF THE NUMBER OF AIR TRAFFIC CONTROLLERS NEEDS

In this Chapter are described the methodologies that may be used by an ANSP in order to calculate the number of the need air traffic controllers. Even the methodologies are provided by different sources, all of them starts, or in other words said are based on variables (inputs) that comes first of all from the assessment of the operational factors in which organization activates.

Namely, the operational factors are the most important in determining the necessary resources required to maintain the operational function of a facility.

Thus, at least following variables have to be determined in respect to operational factors:

1. Number of sectors and working positions to be operated by ANSP
2. Sector’s/ position’s capacities and associated measurable criteria for their opening, closing, combination, segregation.
3. Average of hours, days per year the sector/position will be functional based on expected traffic flow, which could be obtained from the EUROCONTROL NM.

The next important thing is to determine the average/estimative number of days that an individual controller works per year. It could be determined by subtracting from the days of the year the number of days the average controller is away from the facility, being in the: days off duty, leave, sick leave, trainings any other absences offered by national law and/or the organization.

All methods described below are based on that data.

4.1. Determination of the ATC needs using the methodology provided in the ICAO Doc.9426 PART IV, Section 1, Chapter 2

The calculation methodology is based on formula:

$$Personnel\ needed\ per\ position = \frac{Nr\ of\ days\ a\ position\ is\ in\ operation\ per\ year}{Nr\ of\ days\ of\ operation\ of\ the\ facility\ per\ year} * \frac{Nr\ of\ functional\ hours\ per\ year}{Average\ number\ of\ hours\ worked\ per\ year\ by\ a\ controller}$$

Example bellow shows the calculation process for determining the number of air traffic controllers for 2 sectors named ACC1 and ACC 2 of an ATC provider. It should be kept in mind that all figures used in this example are virtual used just to demonstrate the process.

1) Number of working positions = 2 ACC1+ 2 ACC2 = 4

ACC1		ACC2	
1 Executive working position	1 Planner working position	1 Executive working position	1 Planner working position

2) Establishment of measurable criteria for opening/closing combination/segregation of sectors based on determined sector's capacity

It is assumed that the capacities of the sectors were already determined and are following:

ACC1	ACC2
36 aircraft per hour	35 aircraft per hour

Taking the smaller capacity as a benchmark (35 aircraft per hour) it could be deducted that in periods of the day when the summed air traffic of both sectors is less than 35 aircraft per hours, theoretically both sectors could be combined (by closing one sector) without introducing any safety concerns related to the capacity. Thus, in this way we could define the measurable criteria which legally offer the possibility to close one of sector and vice versa to open it when the traffic grows up more than 35 aircraft per hour. Even, an additional safety margins could be introduced by reducing these criteria down to **30 aircraft per hour**. For our further calculation we will use the criteria 30 aircraft per hour.

Using the information provided by the EUROCONTROL NM on expected/planned air traffic, and applying the criteria stated above, it could be calculated the daily times period when the sector ACC 1 shall be functional. In example from the table below it is seen that the sector ACC1 has to be operational only **9 hours** in that day (between 08.00 and 17.00)

		Daily planned traffic in ACC 1 sector	Daily planned traffic in ACC 2 sector	Total traffic
00:00	01:00	2	10	12
01:00	02:00	2	2	4
02:00	03:00	2	15	17
03:00	04:00	4	20	24
05:00	06:00	4	8	12
07:00	08:00	4	10	14
08:00	09:00	5	30	35
09:00	10:00	5	32	37
10:00	11:00	10	25	35
11:00	12:00	5	30	35
12:00	13:00	5	30	35
13:00	14:00	20	18	38
14:00	15:00	9	24	33
15:00	16:00	5	25	30
16:00	17:00	10	20	30
17:00	18:00	10	18	28
18:00	19:00	8	20	28
19:00	20:00	4	25	29
21:00	22:00	4	10	14
22:00	23:00	3	5	8
23:00	24:00	3	3	6

3) Establishment of measurable criteria for opening/closing the Planner working positions

As stated above, both sectors ACC 1 and ACC 2 consists of two working positions: Executive and Planner. But in some circumstances when air traffic is low, the operating of both working position may be not justified. Thus, if the ATC provider wishes to consider the functionality/dysfunctionality of this working positions while determine the need of air traffic controllers, then it should be determined circumstances when activation of both positions are necessary and in what circumstances the only operation of the Executive working position is sufficient. In other words, saying, it should be defined a measurable benchmark, that will allow to understand when to activate the Planner working position and when to deactivate it. Chapter 3.3 above explains what should be considered in determination of the controller's workload capacity.

It is recommended to determine such criteria by simulation of the operational circumstances, using a STD accommodated, as much as possible, to the real operational working

position and to define it by applying of an additional safety margins, to ensure that it is optimal, safe and measurable.

In example below, it is assumed that such a criterion is established and for sectors ACC1 and ACC2 it forms 8 aircrafts per hour. In other words, saying, both positions must be operational when traffic flow is 8 aircrafts per hour and grater.

Thus, using the expected traffic data from Table above, it could be determined the daily functional hours of each working position from both sectors.

ACC 1	Executive	9 hours per day
	Planner	4 hours per day
ACC 2	Executive	24 hours per day
	Planner	19 hours per day

By multiplying the daily functional hours of the each working position to the number of days in the year (365), it could be calculated the numbers of functional hours per year for each working position.

ACC 1	Executive	9 x 365 = **3285** hours/year
	Planner	4 x 365 = **1460** hours/year
ACC 2	Executive	24 x365 = **8760** hours/year
	Planner	19 x 365 = **6935** hours/year

4) Determination of the average/estimative number of days that an individual controller works per year

First of all, we should determine the estimative number of days the average controller is away from the facility, being in the: days off duty, leave, sick leave, trainings any other absences offered by national law and/or the organization. The figures used in the example below are virtual and should not be considered as a default (common applicable). These figures could differ from organization to organization.

Annual leave for a ACC1 and ACC2 air traffic controller	47
Average number of sick leave for a ACC1 and ACC2 air traffic controller	6
Average number of days spent per year on trainings activities for a ACC1 and ACC2 air traffic controller	19
Average number of days that ACC1 and ACC2 air traffic controller is not able to work due to other restrictions/limitations	2
Average number of days that ACC1 and ACC2 air traffic controller is allowed by the organization to be out of duty, due to personal needs/events	4
	78 days

The number of days per year, that the controller is off duty according to the roaster used in the unit, in our example is calculate by formula:

(365 days / (number of the days in a roaster cycle)) x (number of the days in a roaster cycle – number of the working days in a roaster cycle)

(365:10) x (10-6) = 36,5 x 4 = **146 days**

Thus, the TOTAL number of days that the average controller is away from the facility is: 78 days + 146 days = 224 days

By subtraction the average number controller is away from the facility from the number of the day in the year, we determine the average number of the day that the controller is working per year.

365 days – 224 days = **141 days**

5) Determination of the average/estimative number of hours that an individual controller works per year

To calculate the average number of hours that an individual controller works per year it is necessary to determine the average duration of a working day (including times for hand over). So, in our example we will assume that the average duration of the air traffic controller's working days is 8,33 hours. It was calculated considering that the duration of the morning shift is 7 hours, the duration of the day shift is 6 hours and the duration of the night shift is 12 hours (7 + 6 + 12)/3 = 25/3 = 8,33 ore.

By multiplying the average number of the day that the controller is working per year with average duration of the working day, we will determine the average of number of hours worked per year by a controller 141 days x 8,33 hours = **1170,3 ore.**

6) Determination of the average/estimative number of air traffic controllers need to ensure the functionality of each working position

By introducing the above determined variables in formula:

$$Personnel\ needed\ per\ position = \frac{Nr\ of\ days\ a\ position\ is\ in\ operation\ per\ year}{Nr\ of\ days\ of\ operation\ of\ the\ facility\ per\ year} * \frac{Nr\ of\ functional\ hours\ per\ year}{Average\ number\ of\ hours\ worked\ per\ year\ by\ a\ controller}$$

we get the following results:

Sector	Working Position	Formula	Calculated number of ATC	Need number of ATC
ACC 1	Executive	(365:365) x (3285:1171)	2,80	3
	Planner	(365:365) x (1460:1171)	1,24	2
ACC 2	Executive	(365:365) x (8760:1171)	7,48	8
	Planner	(365:365) x (6935:1171)	5.92	6

So, calculation made for this example (considering all operational factors taken as example's condition), shows that to ensure the functionality of these two Sectors (ACC1 and ACC2) there are necessary **at least 19 Air Traffic Controllers**.

In such a way, it should be calculated the need of air traffic controllers for all others sectors/ working positions operated within ATC unit of an ATC provider and by summing them we will get the minimum total number of air traffic controllers that ATC provider needs.

4.2. Determination of the ATC needs using the methodology provided in the draft of the ICAO Human Resource Planning Guidance Manual Appendix A – Chapter 2

APPENDIX A
CHAPTER 2

HOW TO CALCULATE HUMAN RESOURCE NEEDS
"AIR TRAFFIC CONTROL"

1. Human Resource Analysis

1.1 Determine specific working variables

1.1.1 In order to provide sufficient staff to meet operational requirements, it is necessary to determined specific working variables. These variables include, identifying the total activity hours per year, the number of working hours in a year, and determining the number of productive hours in a workday and the number of operational days and hours required in a year. The variables would take into account periods of leave, sickness and training etc. In order to calculate the staff requirement for a particular operational/technical activity, it is necessary to obtain appropriate data regarding the local work regulations.

1.2 Staff Position Listing – Air Traffic Control (ATC)

1.2.1 It is preferable if a listing be produced (if not already available) of all ATC positions within the organization. This should include both operational, non-operational and management positions. It is sufficient enough for our needs to produce a simple outline of the titles and where the posts are active, i.e. headquarters, planning office, specific aerodrome control tower, and area control centre.

1.2.2 Figure 1 (*Worksheet 1*) demonstrates one such position listing. Computer spreadsheets are particularly useful when using tables to determine staffing needs *Worksheet 1* is part of a Microsoft Excel Spreadsheet workbook and it utilizes the "Data / Filter / Auto filter" mode. This enables the worksheet to act as a small database and filter out a variety of results.

1.2.3 The user of Worksheet 1, is required to enter a "1" or "0" into the appropriate cell in cell block E7…N26 (not shown in Figure 1). A "1" represent the requirement for that post in the specific location and a "0" represents no requirement for the post.

1.2.4 Figure 1 (*Worksheet 1*) shows a "*drop-down*" list for facility category "aerodrome grade II – International Airport No.1" (AD II" – "IA1). If Item "1" is selected then the worksheet will indicate the specific post that are required for this facility category. A useful aspect of "*worksheet 1*" is the ability of linking the worksheet data such as; *Posts* and *Post Code* to other worksheets within this and other workbooks. This action ensures the accuracy of this data in all worksheets and, reduces the amount of work if replacement of data is necessary. This approach is also used in the Chapter 8 Case Study.

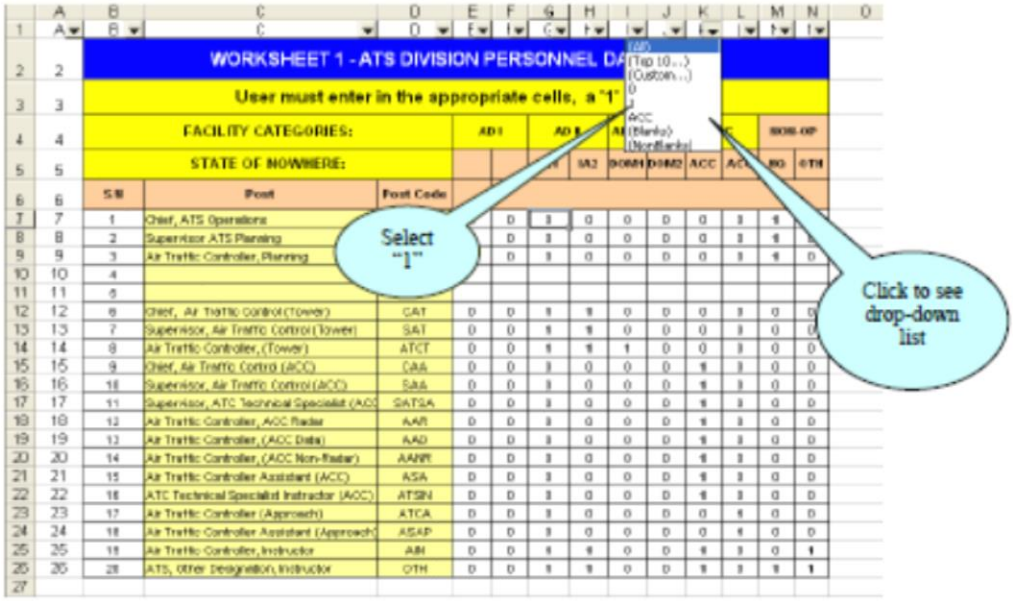


Figure 1 (*Worksheet 1)* ATS Division, Personnel Database

Legend for Worksheet 1

AD I	***Aerodrome Grade I***
AD II	***Aerodrome Grade II***
AD III	***Aerodrome Grade III***
AD IV	***Aerodrome Grade IV***
Non-Op	***Non operational facility***
1A1	***International Airport No. 1***
1A2	***International Airport No. 2***
ACC	***Area Control Centre***
AFTN	***AFTN Message Switch Centre***
DOM1	***Domestic Aerodrome Grade 1***
DOM2	***Domestic Aerodrome Grade 2***

1.2.7 The following are explanations regarding various abbreviations in Worksheet 1:

a) **Aerodrome Grade I and II** (AD Type I and II) are on a 24-hour service basis and high-density traffic, typically equipped with precision approach radar (PAR), instrument landing system (ILS Cat I, II or III). Approach services are an ACC responsibility. Difference between Grade I and II is the volume of traffic to be managed.

b) **Aerodrome Grade III and IV** (AD" Type III and IV) are non 24-hour operation aerodromes with reduced traffic to be managed. Typically navigation facilities for these aerodromes are VOR/DME, precision approach lighting or non-precision

approach lighting. Non-directional beacons (NDB's) are still common in many States.

c) **Area Control Centre - Radar** (ACC) are radar equipped, multiple sector to be controlled and with Oceanic Control. Simulator is in place for air traffic controller rating training. En-route navigation aids include VOR/DME

d) Area Control Centre – Non-Radar. This is a procedural control facility only.

1.3 Staffing Data Worksheet Input Data

1.3.1 The next step is to gather the relevant information, confirm its accuracy and input the data into the ATS Staffing Input Data Worksheet, *Worksheet 2* (Figure 2). The data after entry will automatically be transferred into the ATS Facility – *Staffing Calculation Worksheet, Worksheet 3* (Figure 3).

1.4 The *Staff Work Unit*

1.4.1 The first prime data that is determined by *worksheet 3* is the "*staff work unit*" which is defined as the available working hours per year for one staff member (in this case an Air Traffic Controller). A *staff work unit* is considered as one person who is capable of "x" number of hours of productive effort per year. This figure is derived from the "*effective hours per day*" that can be worked, and the "available work days per year".

1.5 The Minimum Staff Requirement – "*Operational Staffing Factor*"

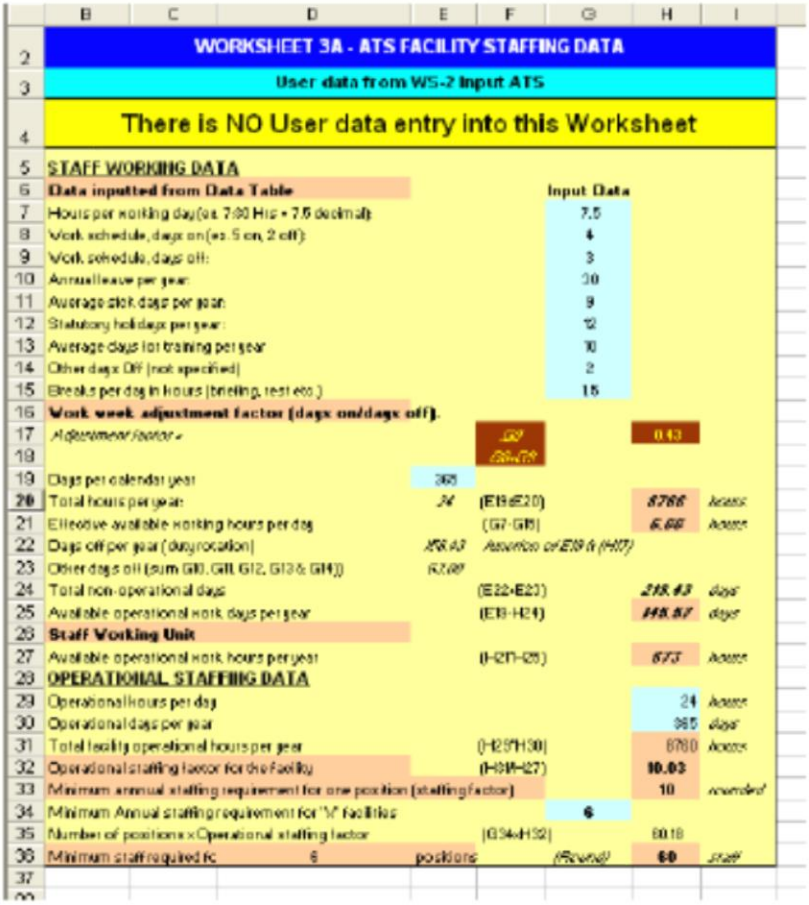
1.5.1 The "*operational staffing factor*" is a method used to determine the *minimum* number of staff required to support a specific operational requirement. It is a mathematical equation, which uses the determined "*staff work unit*" and the total number of working hours in one year. The calculations illustrated in "*Worksheet 3*" provide a method of deriving an "*operational staffing factor*". It is emphasised, that the "*operational staffing factor*" will provide a figure only for the minimum number of staff required for a specific function/facility (for example an air traffic control position or navigation aid facility) without taking into account other factors such as rostering, safety margins and on-the-job training.

	B	C	D
2	**WORKSHEET 2 - ATS STAFFING/OPERATIONAL INPUT DATA**		
3	**Enter data into Column 'C'. Press [TAB] or [Shift] [Tab] to move between fields. Use File / Save As, to save your work using a new file name. Save in an appropriate Folder.**		
4	**Description of Data**	**User Data Input**	
5	**PERSONNEL DATA**		
6	**Days per year:**	365	
7	**Hours per working day:**	7.5	
8	**Work schedule, Days On:**	4	
9	**Work schedule, Days Off:**	3	
10	**Annual leave, Days per year:**	30	
11	**Average sick days per year:**	9	
12	**Statutory holidays per year:**	12	
13	**Average training days per year:**	10	
14	**Other (days off per year):**	2	
15	**Breaks per working day (in Hours):**	1.5	
16	**OPERATIONAL DATA**		
17	**No. of work positions to be covered:**	6	
18	**Operation days per year:**	365	
19	**Operation hours/day:**	24	
20			

Figure 2 Staff data input sheet for ATC (*Worksheet 2*)

Note:

The data shown in Figure 2 are samples only and do not represent any specific working environment.



	B	C	D	E	F	G	H	I
2	WORKSHEET 3A - ATS FACILITY STAFFING DATA							
3	User data from WS-2 Input ATS							
4	There is NO User data entry into this Worksheet							
5	STAFF WORKING DATA							
6	Data inputted from Data Table					Input Data		
7	Hours per working day(ex 7:00 Hrs = 7.5 decimal)					7.5		
8	Work schedule, days on(ex 5 on, 2 off):					4		
9	Work schedule, days off:					3		
10	Annual leave per year:					30		
11	Average sick days per year:					9		
12	Statutory holidays per year:					12		
13	Average days for training per year					10		
14	Other days Off (not specified)					2		
15	Breaks per day in hours (briefing, rest etc.)					1.5		
16	Work week adjustment factor (days on/days off).							
17	*Adjustment factor =*				*(5/7 (5/7=0.71))*		0.43	
18								
19	Days per calendar year			365				
20	Total hours per year:			*24*	(E19xE20)		*8766*	*hours*
21	Effective available working hours per day				(G7-G8)		*6.00*	*hours*
22	Days off per year (duty/rotation)			*156.43*	*Assumes on E19 is (H07)*			
23	Other days off (sum G9, G11, G12, G13 & G14))			*52.00*				
24	Total non-operational days				(E22+E23)		*208.43*	*days*
25	Available operational work days per year				(E19-H24)		*146.57*	*days*
26	Staff Working Unit							
27	Available operational work hours per year				(H27=25)		*873*	*hours*
28	OPERATIONAL STAFFING DATA							
29	Operational hours per day						24	*hours*
30	Operational days per year						365	*days*
31	Total facility operational hours per year				(H29*H30)		8760	*hours*
32	Operational staffing factor for the Facility				(H09=H27)		**10.03**	
33	Minimum annual staffing requirement for one position (staffing factor)						**10**	*rounded*
34	Minimum Annual staffing requirement for 'N' facilities					**6**		
35	Number of positions x Operational staffing factor				(G34xH32)		60.18	
36	Minimum staff required fc	6	positions			*(Rounded)*	**60**	*staff*
37								

Figure 3 Determining Working Unit and Staffing Factors (*Worksheet 3*)

1.6 Data from Worksheet 3 (Figure 3)

a) **Working Unit** (effective working hours per year per person) **873** hours
b) **Staffing Factor** (total hours per year/effective hours per year) **10.03**
c) **Minimum** staff required for one or multi working positions

2. Determining Staffing for ATS Sectors

2.1 Occupation time of the positions in any given sector

2.1.1 The basis of human resource planning (on a sector level) is the occupation time of the positions in any given sector based on the opening and closing time of the positions. These times are derived from the amount of traffic to be processed in that sector, which are identified as the operational requirements.

2.1.2 The data shown in Figures 4 and 5 (*Worksheets 4 and 5*) is based on a two sector (west and east) area control centre (ACC). The west sector is non-radar while the east-sector is radar controlled. Air traffic controllers staff the positions as required to meet the operational requirements of the sectors and appropriate work timetable is used for staff working hours.

2.1.3 The first step in the ATC staff requirement analysis is to identify all the categories of staff that will be required to operate the ACC facilities. This information is extracted from *Worksheet 1* (Figure 1) ATC Division Personnel Database.

2.1.4 The following job categories and their abbreviations are used from *Worksheet 1*.

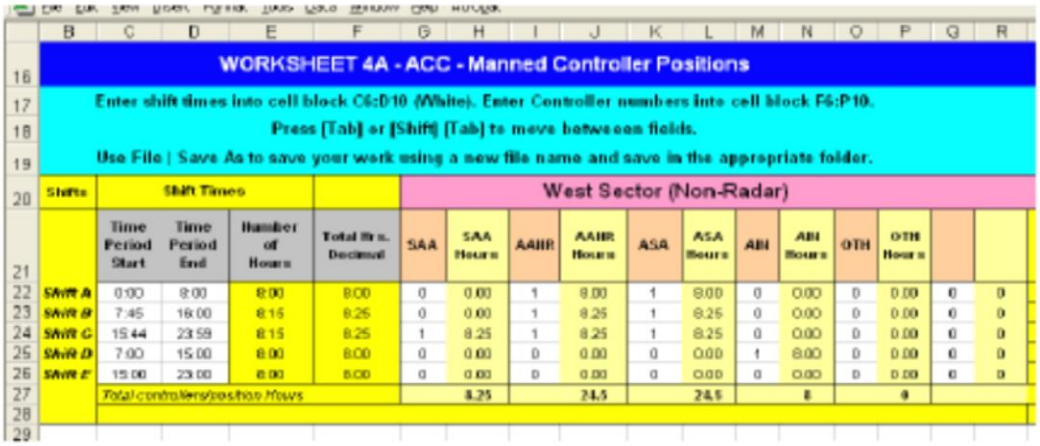
Data from: Worksheet 1 (WS-1) ATS Division Personnel Database

Code	Category Title
CAA	Chief, Air Traffic Control (ACC)
SAA	Supervisor, Air Traffic Control (ACC)
SATSA	Supervisor, ATC Technical Specialist (ACC)
AAR	Air Traffic Controller, ACC Radar
AAD	Air Traffic Controller, (ACC Data)
AANR	Air Traffic Controller, (ACC Non-Radar)
ASA	Air Traffic Controller Assistant (ACC)
ATSIN	ATC Technical Specialist Instructor (ACC)
AIN	Air Traffic Controller, Instructor

Table 1 ACC staff categories

2.2 Worksheet for ACC Staffing

2.2.1 Figure 4 (*Worksheet 4A*) is the data analysis worksheet for the ATC West Sector Area Control Centre (ACC). Figure 5 (*Worksheet 4B*) is the data analysis worksheet for the ATC East Sector Area Control Centre (ACC).



WORKSHEET 4A - ACC - Manned Controller Positions

Enter shift times into cell block C6:D10 (White). Enter Controller numbers into cell block F6:P10.
Press [Tab] or [Shift] [Tab] to move between fields.
Use File | Save As to save your work using a new file name and save in the appropriate folder.

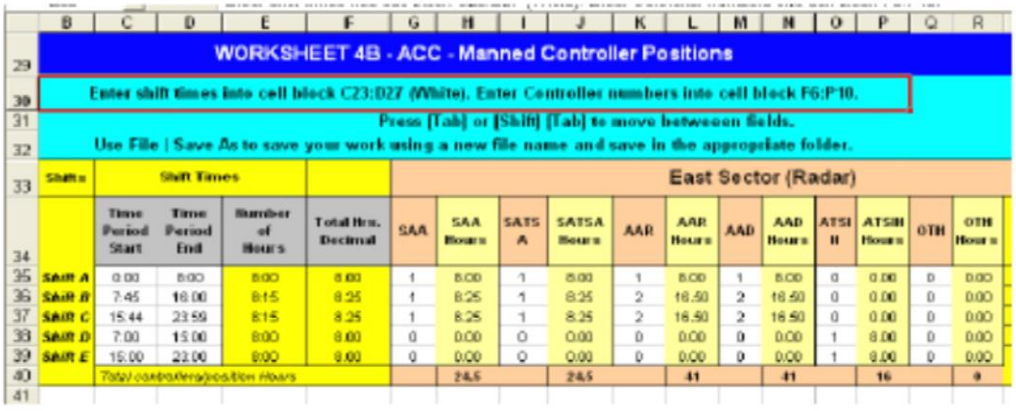
Shifts	Shift Times				West Sector (Non-Radar)											
	Time Period Start	Time Period End	Number of Hours	Total Hrs. Decimal	SAA	SAA Hours	AANR	AANR Hours	ASA	ASA Hours	AIN	AIN Hours	OTH	OTH Hours		
SAIR A	0:00	8:00	8:00	8.00	0	0.00	1	8.00	1	8.00	0	0.00	0	0.00	0	0
SAIR B	7:45	16:00	8:15	8.25	0	0.00	1	8.25	1	8.25	0	0.00	0	0.00	0	0
SAIR C	15:44	23:59	8:15	8.25	1	8.25	1	8.25	1	8.25	0	0.00	0	0.00	0	0
SAIR D	7:00	15:00	8:00	8.00	0	0.00	0	0.00	0	0.00	1	8.00	0	0.00	0	0
SAIR E	15:00	23:00	8:00	8.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0
	Total controllers/position Hours					8.25		24.5		24.5		8		0		

Figure 4 (*Worksheet 4A*) West Sector Shift Times and Staffing Requirements

2.2.2 The user is required to enter the appropriate information into the following cell-blocks of Figure 4 (*Worksheet 4A, West sector shift times and staffing requirements*).

- C21…D25, shift times for shifts A, B, C, D and E hours
- G21…G25, SAA requirements for each shift
- I21…I25, AANR requirements for each shift
- K21…K25, ASA requirements for each shift
- M21…M25, AIN requirements for each shift
- O21…O25, OTH requirements for each shift

All other data in Worksheet 4A, will be automatically computed.



WORKSHEET 4B - ACC - Manned Controller Positions

Enter shift times into cell block C23:D27 (White). Enter Controller numbers into cell block F6:P10.
Press [Tab] or [Shift] [Tab] to move between fields.
Use File | Save As to save your work using a new file name and save in the appropriate folder.

Shifts	Shift Times				East Sector (Radar)											
	Time Period Start	Time Period End	Number of Hours	Total Hrs. Decimal	SAA	SAA Hours	SATS A	SATSA Hours	AAR	AAR Hours	AAD	AAD Hours	ATSI H	ATSIH Hours	OTH	OTH Hours
SAIR A	0:00	8:00	8:00	8.00	1	8.00	1	8.00	1	8.00	1	8.00	0	0.00	0	0.00
SAIR B	7:45	16:00	8:15	8.25	1	8.25	1	8.25	2	16.50	2	16.50	0	0.00	0	0.00
SAIR C	15:44	23:59	8:15	8.25	1	8.25	1	8.25	2	16.50	2	16.50	0	0.00	0	0.00
SAIR D	7:00	15:00	8:00	8.00	0	0.00	0	0.00	0	0.00	0	0.00	1	8.00	0	0.00
SAIR E	15:00	23:00	8:00	8.00	0	0.00	0	0.00	0	0.00	0	0.00	1	8.00	0	0.00
	Total controllers/position Hours					24.5		24.5		41		41		16		0

Figure 5 (*Worksheet 4B*) East Sector Shift Times and Staffing Requirements

2.2.3 The user is required to enter the appropriate information into the following cell-blocks of Figure 5 (*Worksheet 4B, East sector shift times and staffing requirements*).

- C35…D39, shift times for shifts A, B, C, D and E hours
- G35…G39, SAA requirements for each shift
- I35…I39, SATSA requirements for each shift
- K35…K39, AAR requirements for each shift
- M35…M39, AAD requirements for each shift
- O35…O39, ATSIN requirements for each shift
- Q35…Q39, OTH requirements for each shift

All other data in Worksheet 4B, is automatically computed.

2.2.4 The process outlined in paragraphs 2.2.2 and 2.2.3 are also illustrated in Chapter 8, Case Study. Both worksheets 4A and 4B accommodate sufficient blank rows so the user can enter different shift times from those illustrated.

2.2.5 From an analysis of Figure 4 (Worksheet 4A) and Figure 5 (Worksheet 4B) we obtain the number of controllers required to staff all positions during the 24 hour operational period. The requirements to fill a position during a specific shift-period are determined by the operational requirements. The operational manager/supervisor will provide these figures and may adjust them time from time if there are any special factors to be considered.

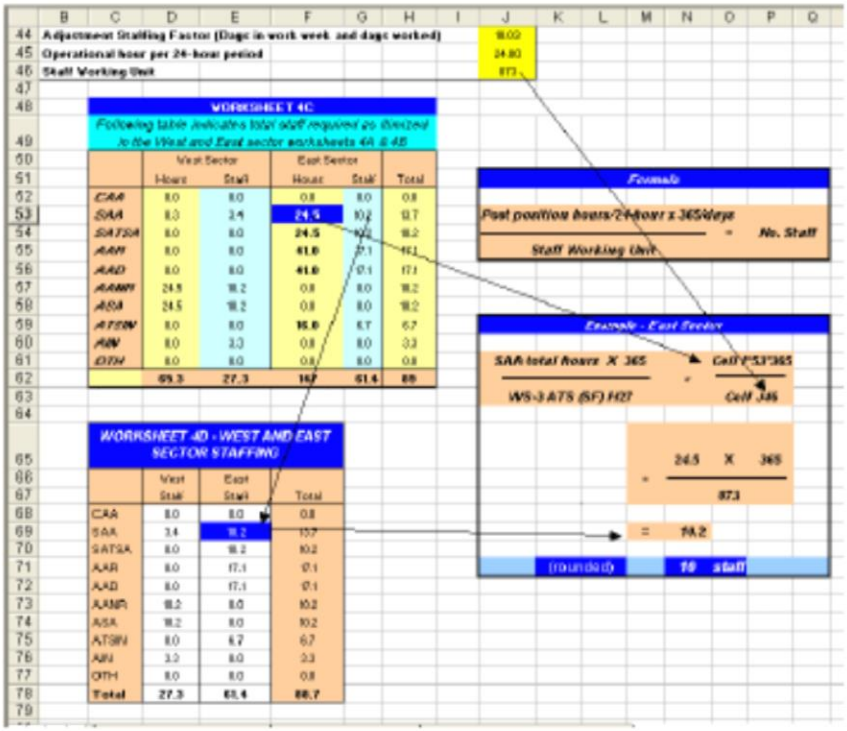


Figure 6 (*Worksheets 4C and 4D*) Total staff to support west and east sectors

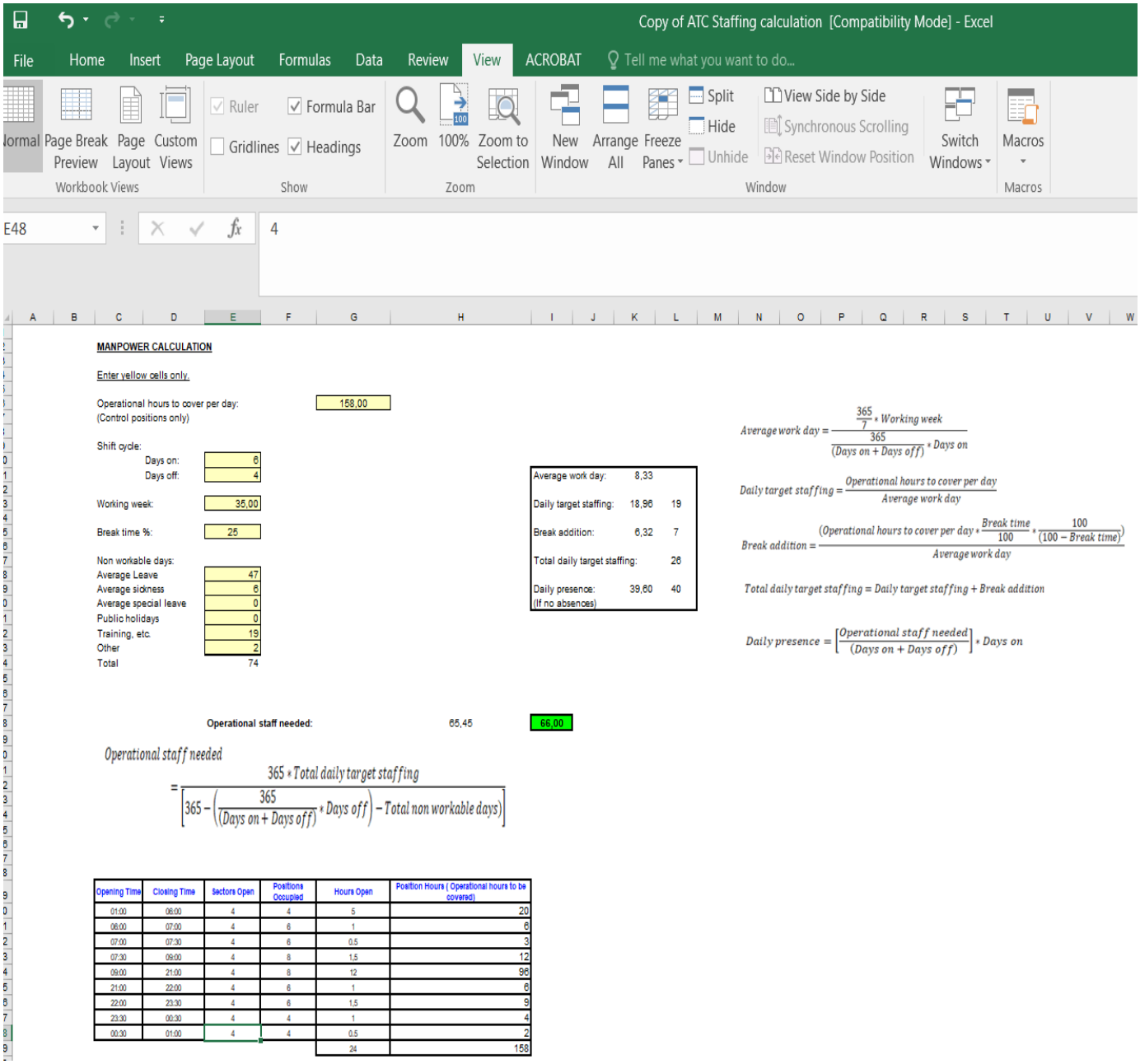
2.2.6 Figure 6 (*Worksheets 4C and 4D*) indicates the total number of staff required for each job category to cover the shift periods indicated in *Worksheet 4A and 4B*. It can be seen that the total number of staff required is 89 (*Worksheet 4D*). The *formula* and *example* show the method of calculating for number of staff required for one post. In this case the *Supervisor, Air Traffic Control, ACC East Sector (SAA)*. The inputs to the formula are, *total hours of SAA*, the *staff working unit* (from *Worksheet 3*) and *365 days per year*. The result with the parameters inputted into Worksheet 2, is *10 staff* to cover the 24-hour shift period for 365 days a year.

2.3 Variation between minimum staffing and optimum staffing to meet the operational requirements

2.3.1 Figure 3 (*Worksheet 3*), ATS Facility Staffing Data produces an "*operation staffing factor*" of 10.03 which in turn provides a minimum staffing figure for six-positions of 60. The figure "60" however can be misleading in this particular scenario. The figures in Worksheet 3, assume all six positions operate for the full 24-hour period. Whereas, Figures 4 and 5 (Worksheet 4A and 4B) provide different staffing for different periods, based on sector opening and closing times.

4.3. Determination of the ATC needs using the methodology provided by the EUROCONTROL Reference (Guidelines on ATCO Manpower Planning)

Below is presented the methodology from the EUROCONTROL deliverable “guidelines on ATCO Manpower Planning”. This methodology is based on the same inputs as previous two methodologies with the small difference in the formula used to calculate the operational staff needs. An excel sheet is used to determine the operational requirements with the formulas embedded for the respective cells. All used formulas are shown on the image. Once created, the sheet is easy to use, by inserting appropriate data in the yellow cells.



$$Average\ work\ day = \frac{\frac{365}{7} * Working\ week}{\frac{365}{(Days\ on + Days\ off)} * Days\ on}$$

$$Daily\ target\ staffing = \frac{Operational\ hours\ to\ cover\ per\ day}{Average\ work\ day}$$

$$Break\ addition = \frac{(Operational\ hours\ to\ cover\ per\ day * \frac{Break\ time}{100} * \frac{100}{(100 - Break\ time)})}{Average\ work\ day}$$

$$Total\ daily\ target\ staffing = Daily\ target\ staffing + Break\ addition$$

$$Daily\ presence = \left[\frac{Operational\ staff\ needed}{(Days\ on + Days\ off)}\right] * Days\ on$$

$$Operational\ staff\ needed = \frac{365 * Total\ daily\ target\ staffing}{\left[365 - \left(\frac{365}{(Days\ on + Days\ off)} * Days\ off\right) - Total\ non\ workable\ days\right]}$$