EUROPEAN AIRPORT MOVEMENT MANAGEMENT BY A-SMGCS

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Test Sites Operations Document for Prague-Ruzyne, Toulouse-Blagnac and Milan-Malpensa

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SICTA

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Table of Contents

1 Scope of Document

The scope of the EMMA D1.6.1_TSOD (Test Sites Operations Document for Prague-Ruzyne, Toulouse-Blagnac and Milan-Malpensa) is to provide readers with a global view of each Test-Site first and then both to describe the current way of operating at these three Airports and the new implementing Equipments and Operational Procedures that will be tested through the Validation Activities. Information contained in this document will be consistent with the EMMA Operational Requirements Document [3] and to plan the V&V activities with SP6.

2 Introduction

The whole European ATM community is working for the implementation of the “Gate to Gate” concept, by which a flight is considered as a whole process managed continuously within the ATM network throughout all its phases, starting from the “doors closed” event at the departure airport till the “doors open” event at destination airport. Ground operations, supported by A-SMGCS, have to be considered an integral part of this whole traffic management process.

Several A-SMGCS implementations are going on at the most congested European airports but the A-SMGCS is not yet a standard system, well harmonised and consolidated: systems have proprietary architectures and interfaces. Standard operations and their certification as well as standard performance and safety requirements are not developed enough to define peculiar level of service of airport air traffic management in Europe.

The harmonised and standardised implementation of A-SMGCS Level I & II, at busiest European airports, represents the main goal of the EMMA project, which shall bring A-SMGCS one further step towards the effectiveness of this concept.

In order to subdue aforementioned disadvantages and to provide the European ATM community with a valid reference for a harmonised implementation of A-SMGCS all over Europe, EMMA Phase1 project intends the implementation of A-SMGCS level I & II at three European airports: Prague-Ruzyne, Toulouse-Blagnac and Milan-Malpensa.

3 A-SMGCS Environment

As clearly stated in the international literature, implementations of A-SMGCS systems should be directed to large / medium-size airports in the ECAC area and in the timeframe of ATM2000+ Strategy (2000-2010). A-SMGCS concept has been extensively investigated by Operational Experts. On the basis of [ICAO-A-SMGCS], the gist of the ultimate level of A-SMGCS implementation is presented by four A-SMGCS functions: Surveillance, Control, Routing and Guidance.

As the first two functions will be primarily investigated in the context of EMMA project (Phase 1), brief and comprehensive descriptions of both Surveillance and Control functions and procedures are reported below:

Surveillance, which provides controllers, and eventually pilots and vehicle drivers, with the situational awareness in the movement area. The objective is that both identification and localization of all traffic should be provided, with an adequate update rate to give a continuous flow of traffic information.

Surveillance is an essential element of any SMGCS as well as an A-SMGCS. A combination of visual surveillance, SMR and radiotelephony is currently used by controllers to monitor movements. The monitoring of other aircraft and vehicles is also a significant function performed by pilots and vehicle drivers. As visibility is gradually reduced, the ability of controllers and pilots to carry out visual surveillance becomes increasingly impaired. Problems for controllers become significant when the manoeuvring area cannot be adequately observed from the control tower. When the visibility falls below 400 m, pilots' and vehicle drivers' ability to visually observe becomes seriously impaired.

Improvement of the surveillance function to overcome the above mentioned problems, down to the AVOL is one of the key requirements of an A-SMGCS. The surveillance therefore should provide identification and accurate positional information of all movements on the movement area including the runway strip.

The surveillance function provides the controller working position with a display of the graphical view of the airport and with the positions of all the mobile objects (aircraft and vehicles) located on the airport surface. It also provides identification and labelling of authorised movements and coping with moving and static aircraft as well as vehicles within the coverage area of the surveillance function.

As specified by ICAO, the need to cover the movement area is recognised, but the existing technology allows concentrating only on the manoeuvring area. However, as the need to track aircraft on the apron is confirmed by a majority of stakeholders because of push-back responsibility, the surveillance function should also identify the aircraft in the apron area. In the short term, A-SMGCS should not cover the apron area except for aircraft. To achieve this objective a system providing co-operative surveillance is likely to be required. For co-operative surveillance, targets need to be equipped with a means of communicating position and identity information to the A-SMGCS. It is also essential that some means of surveillance are available to enable the system to detect non co-operative targets including obstacles. The Surveillance element for an A-SMGCS may comprise several sensor systems. The information from these systems will be combined by a data fusion process to provide a comprehensive surveillance package.

Control, through which conflicts and collisions are prevented. This function provides alerts for incursions to runways and activates protection devices (e.g. stop bars or alarms). A-SMGCS, automated situation control is provided by the system detecting runway incursions, taxiway alert situations and other hazardous scenarios, and generating warnings to the controller and possibly directly to the pilots and/or vehicle drivers concerned. Where the system includes automated route planning, the Control function will have to compare the actual route of an aircraft or vehicle with its planned route and give an alert in the case of non conformance. The Control function does not replace the controller, but gives him/her automatic assistance in his/her control task.

4 Annex I - Prague-Ruzyne Airport

4.1 Airport global description

4.1.1 Airspace and Airport configuration characteristics

4.1.1.1 Airport areas and aerodrome characteristics

Prague Ruzyně Airport (LKPR/PRG), the main airport in the Czech Republic, is situated 10 km west of Prague. The Airport covers the area of about 1000 ha and consists of two main parts. See Figure 4-1 and Figure 4-2.

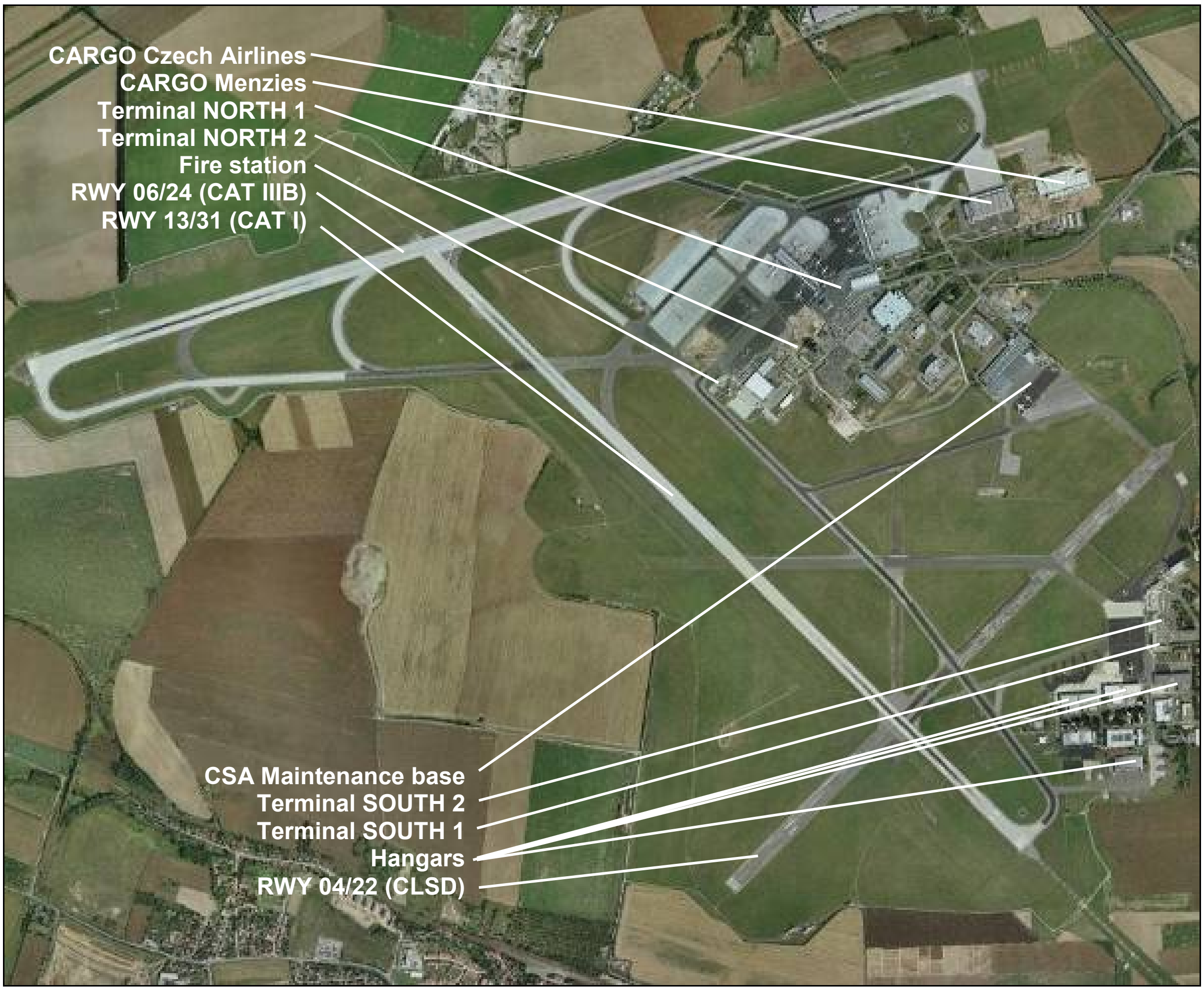

Figure 4-1: Prague Ruzyně Airport (LKPR/PRG), bird's eye view

NORTH part of the airport is intended mainly for scheduled & charter commercial flights. Passenger terminal, with annual capacity of 6,3 million passengers, is equipped with 27 gates and 17 boarding bridges. Around 6.5 million passengers use the existing terminal, with piers' A and B, each year. North Terminal 2, pier C, will offer an increase in capacity to 10 million passengers annually. The new Terminal North 2 has been opened beginning of 2006, it will increase the annual passenger-handling capacity to more than 10 million. From 2007 it will serve all flights from/to Schengen area.

In the northern part of the airport are situated also Cargo terminal Czech airlines, Cargo terminal of Menzies Aviation Group and maintenance base of Czech airlines, national flag carrier.

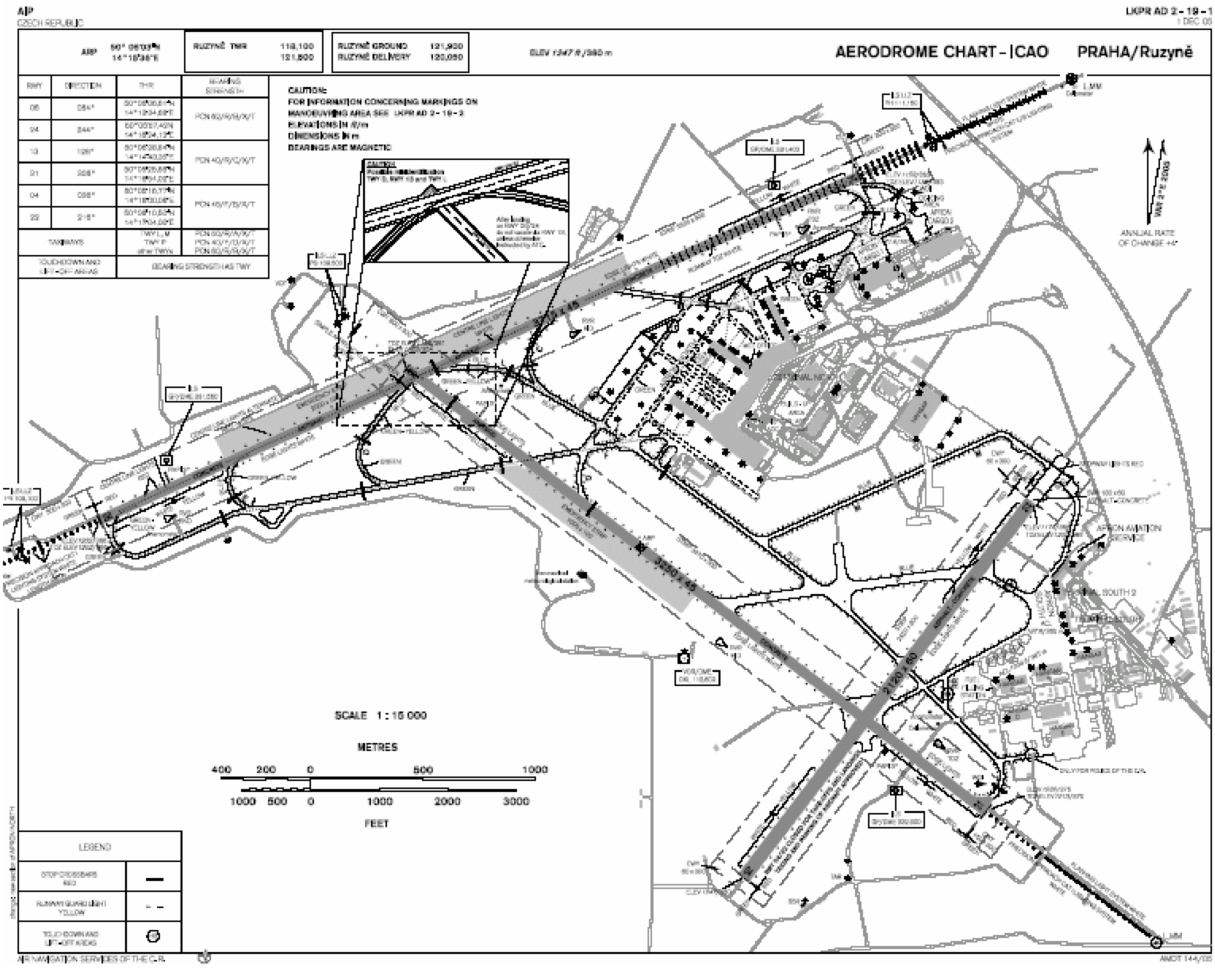

Figure 4-2: Aerodrome Chart of Prague Ruzyne Airport, April 2006

SOUTHERN part (“old airport”) serve military and governmental flights, all general aviation flights and selected low-cost and unscheduled flights.

LKPR has three RWYs, main 06/24 equipped for ICAO CAT IIIB operations. Usage of RWY 13/31 is strictly limited due to environmental reasons. RWY 04/22 is currently closed for takeoff and landings and is being used as long-term parking area. Preparations are under way for the construction of a new runway, parallel with the existing 06/24 main runway. In future, the new runway will increase the hourly airport traffic capacity, will make the use of runways under adverse weather conditions more efficient, and will make it possible for a maximum reduction in the auxiliary 13/ 31 runway operations to be achieved. As a result, fewer approaching planes will have to pass over residential areas.

The new RWY system will allow independent parallel take-offs and landings.

Expansion of manoeuvring area

1) 2005: Rapid exit TWYs for existing RWY 06/24 (done)
2) 2005: Holding bay for RWY 24 (done)
3) 2005: Extension of TWY G (done)
4) 2006: New terminal North 2 (done)
5) 2009: RWY 06R/24L

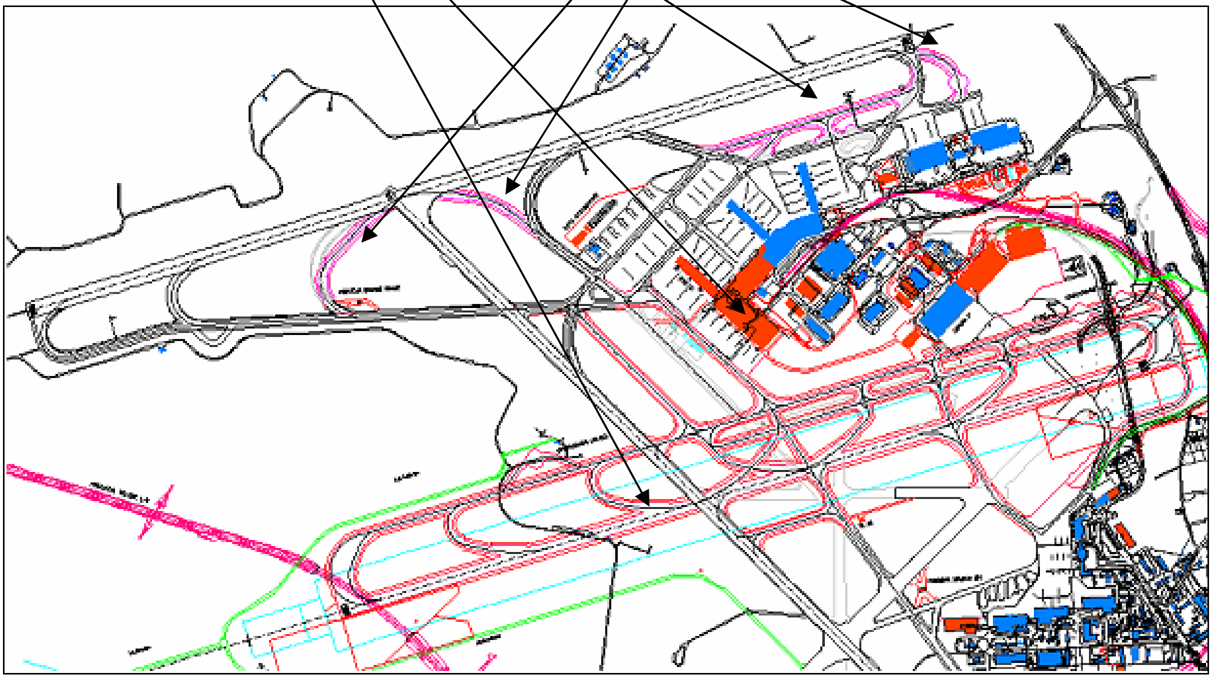

Figure 4-3: Planned layout of Prague Ruzyne Airport by 2009

4.1.1.2 Airspace characteristics

CTR airspace classification

CTR Ruzyně is an airspace class D.

Departure routes structure

There are two types of departure routes in Prague Ruzyně depending on flight rules. For VFR flights departure routes E1, S1, N1, W1.
For IFR flights different routes depending on runway used and type of aircraft – jet / propeller. Due to noise restrictions initial segment of departure routes follow the same profile to minimal distance of 2NM.

Approach procedures

Several types of approach procedures differ from runway to runway.
RWY 24: Visual, NDB-DME, ILS CAT I, II, IIIB, Circling
RWY 06: Visual, NDB-DME, ILS-DME, Circling
RWY 31: Visual, NDB-DME, ILS CAT I, II, IIIB, NDB-DME, ILS CAT I, Circling
RWY 13: Visual, VOR-DME, Circling

Noise, pollution and vibration restrictions

In CTR Ruzyně the aircraft noise is continuously measured, analysed and assessed by means of eleven monitoring stations (see LKPR AD 2-45) and a central evaluating station. The Maximum Noise Level LAmax and The Equivalent Noise Level LAeq are monitored on each of these stations. The maximum noise level limits are determined as follows:
– 85 dB (A) from 0500 to 2100 (0400-2000)

– 75 dB (A) from 2100 to 0500 (2000-0400)

4.1.1.3 Traffic characteristics

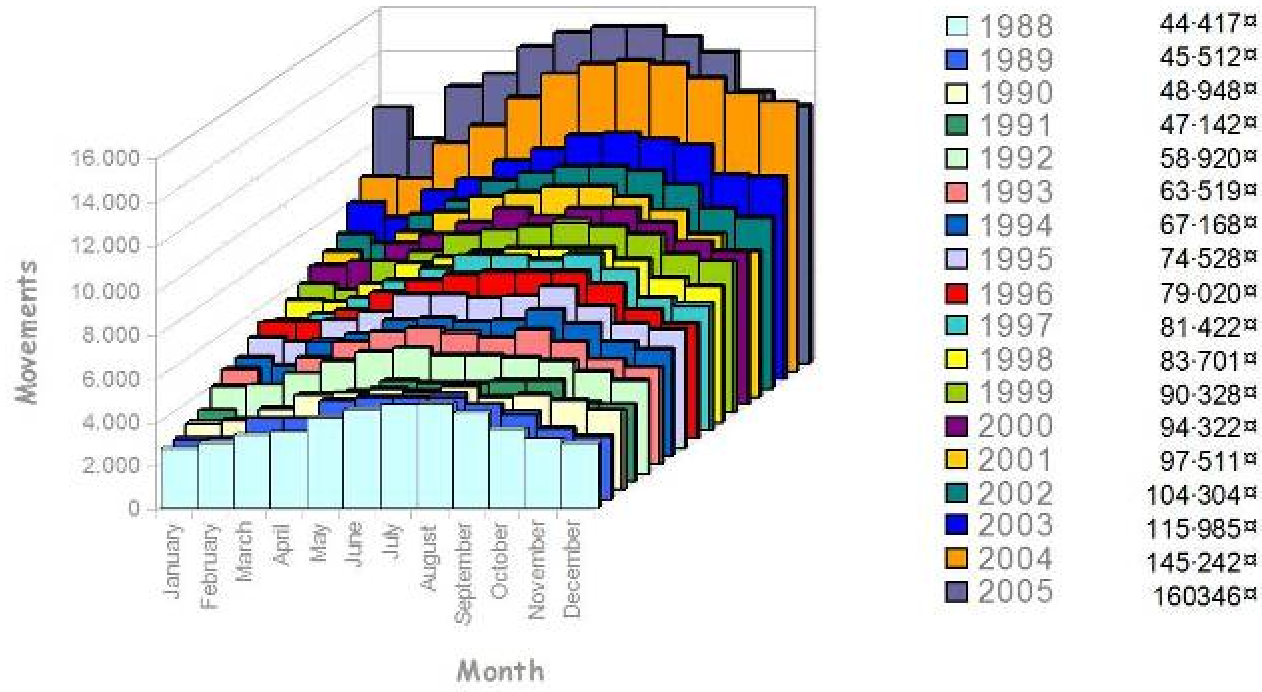

Figure 4-45: Annual traffic amount 1988-2005 (bar chart)

	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII.	Total
1988	2700	2934	3360	3376	4169	4454	4643	4730	4332	3597	3148	2974	44417
1989	2709	2718	3647	3666	4475	4684	4672	4690	4310	3880	3212	2849	45512
1990	3045	3165	3689	4381	4480	4627	4555	4700	4281	4356	4051	3618	48948
1991	3218	2856	3337	3778	4094	4567	4467	4511	4584	4624	3626	3480	47142
1992	3950	4015	4538	5110	5567	5740	5363	5347	5312	5140	4674	4164	58920
1993	4383	3394	4899	5633	6108	6214	6022	5793	6171	5590	4829	4483	63519
1994	4499	4153	5275	5605	6185	6277	6125	6257	6637	6035	5229	4891	67168
1995	5024	4849	5808	6201	7014	7019	6845	6917	7370	6492	5629	5360	74528
1996	5345	5349	5913	6687	7246	7496	7618	7573	7629	7072	5859	5233	79020
1997	5047	5289	6021	6826	7430	7956	7918	7797	8048	7349	6010	5731	81422
1998	5605	5519	6323	7165	7491	7756	7940	7946	7873	7348	6551	6184	83701
1999	5892	5611	6905	7368	8162	8306	8531	8742	8504	8180	7275	6852	90328
2000	6326	6504	7276	7796	8343	8924	8601	8952	8952	8285	7445	6919	94323
2001	6598	6120	7482	8366	9121	9302	9542	9537	9064	8429	7370	6580	97511
2002	6966	6550	7871	8516	9465	9821	10064	10081	9862	9211	8200	7697	104304
2003	8019	7291	8607	9137	9959	10497	11125	11211	10916	10673	9331	9219	115985
2004	8832	8731	10336	11162	12417	13511	14008	14138	13945	13307	12583	12272	145221
2005	11575	10113	12596	13110	14383	15044	15261	15303	14828	14152	12312	11696	160346

Figure 4-6: Annual traffic amount 1988-2005 (table)

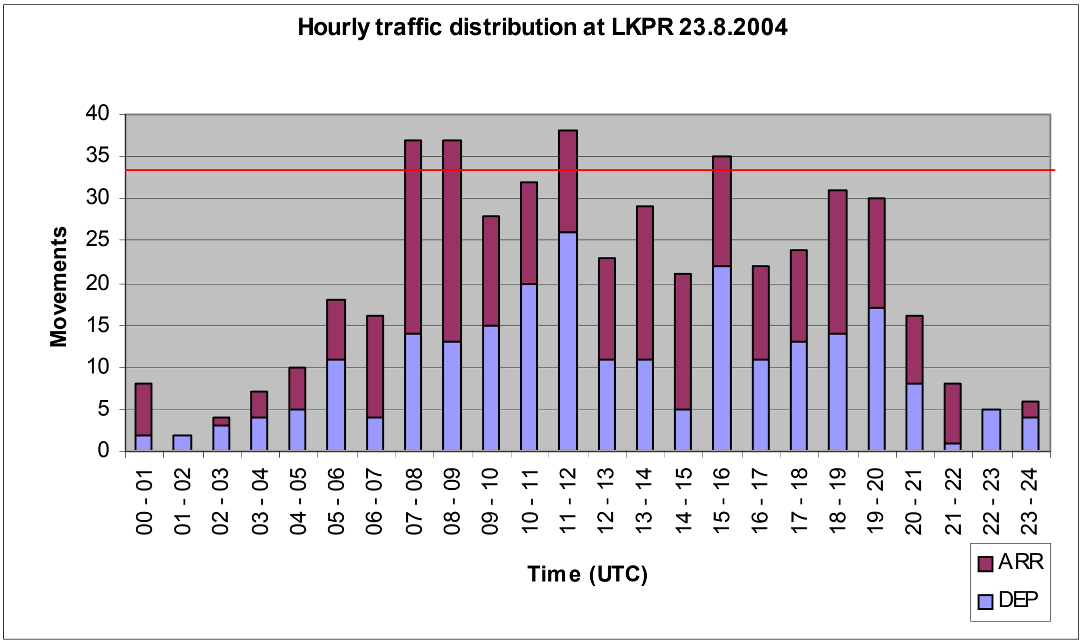

Figure 4-7: Traffic distribution over the day

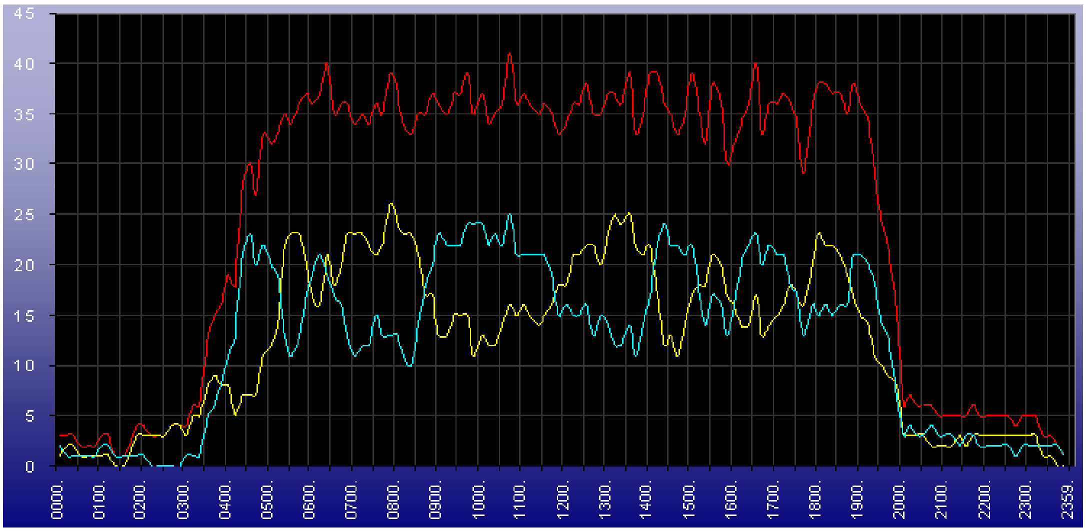

Figure 4-8: Traffic distribution over the day 5 in a week (prognosis for summer season 2005)

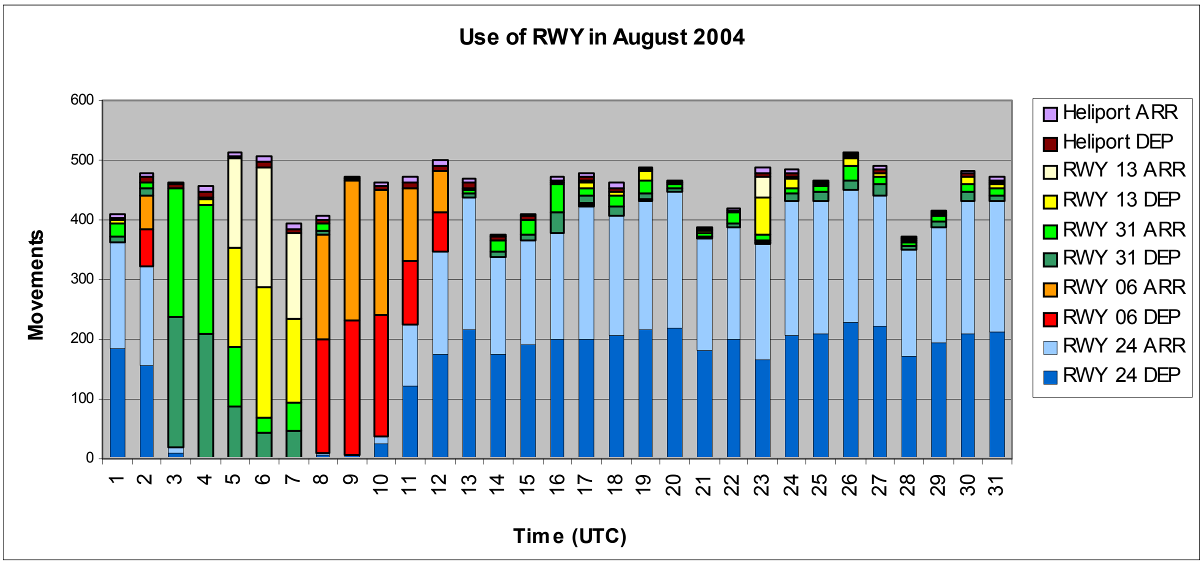

Figure 4-9: Use of runway system during the month

Time (UTC, hrs)	DEP	ARR	ARR/DEP ratio
00 - 01	1	1	1,00
01 - 02	0	2	2,00
02 - 03	2	1	0,50
03 - 04	1	5	5,00
04 - 05	5	10	2,00
05 - 06	14	8	0,57
06 - 07	9	12	1,33
07 - 08	12	19	1,58
08 - 09	18	22	1,22
09 - 10	11	23	2,09
10 - 11	27	9	0,33
11 - 12	22	14	0,64
12 - 13	12	10	0,83
13 - 14	12	20	1,67
14 - 15	14	15	1,07
15 - 16	15	15	1,00
16 - 17	8	19	2,38
17 - 18	23	8	0,35
18 - 19	16	16	1,00
19 - 20	14	13	0,93
20 - 21	11	4	0,36
21 - 22	3	5	1,67
22 - 23	2	3	1,50
23 - 24	3	3	1,00

Figure 4-10: Percentage of Aircraft types 11.7.2004

A310	1,5%	B734	20,0%	C17	0,5%	E135	1,0%	MD83	1,0%
A320	4,5%	B735	19,0%	C210	1,0%	E145	0,5%	P28T	0,5%
A321	1,5%	B737	2,0%	C550	1,0%	F100	1,0%	PA34	0,5%
AT43-5	8,5%	B738	6,5%	CRJ2	0,5%	F70	0,5%	PA44	0,5%
AT72	5,0%	B752	1,0%	DH8C	0,5%	GLF5	0,5%	PA46	0,5%
B462	3,0%	B763	0,5%	DH8D	3,0%	L410	0,5%	RJ1H	1,0%
B733	9,0%	B772	0,5%	E120	1,0%	M20P	0,5%	T154	1,5%

Figure 4-11: Percentage of Aircraft types 11.7.2004

Type of AC	From Take-off CLR (min)	From role on start (min)
Airbus	0:50	0:35
Boeing	0:50	0:35
ATR	0:42	0:24

Figure 4-12: Runway occupancy times of three typical aircraft types

Taxi-time

Block of stands	Stands
BL1	1, 2, 3
BL2	4, 4A, 5, 6, 7, 8, 9, 10, 11, 11A, 12, 13, 13A
BL3	14, 14A, 14B, 15, 16, 18, 19, 20, 21
BL4	22, 23, 24
BL5	30, 30A, 31, 32, 33
BL6	34, 35, 35A, 35B, 36, 36A, 36B, 37, 38, 38A, 38B, 40, 41, 42, 43, 44, 45, 50, 51, 52, 53, 54, 55
BL7	B1-B21, B51-B55, M1-M3, RWY 22
BL8	C1, C1A, C2, C2A, C2B, D1, D1A, D1B

Figure 4-13: Arrangement of stands to clusters of blocks

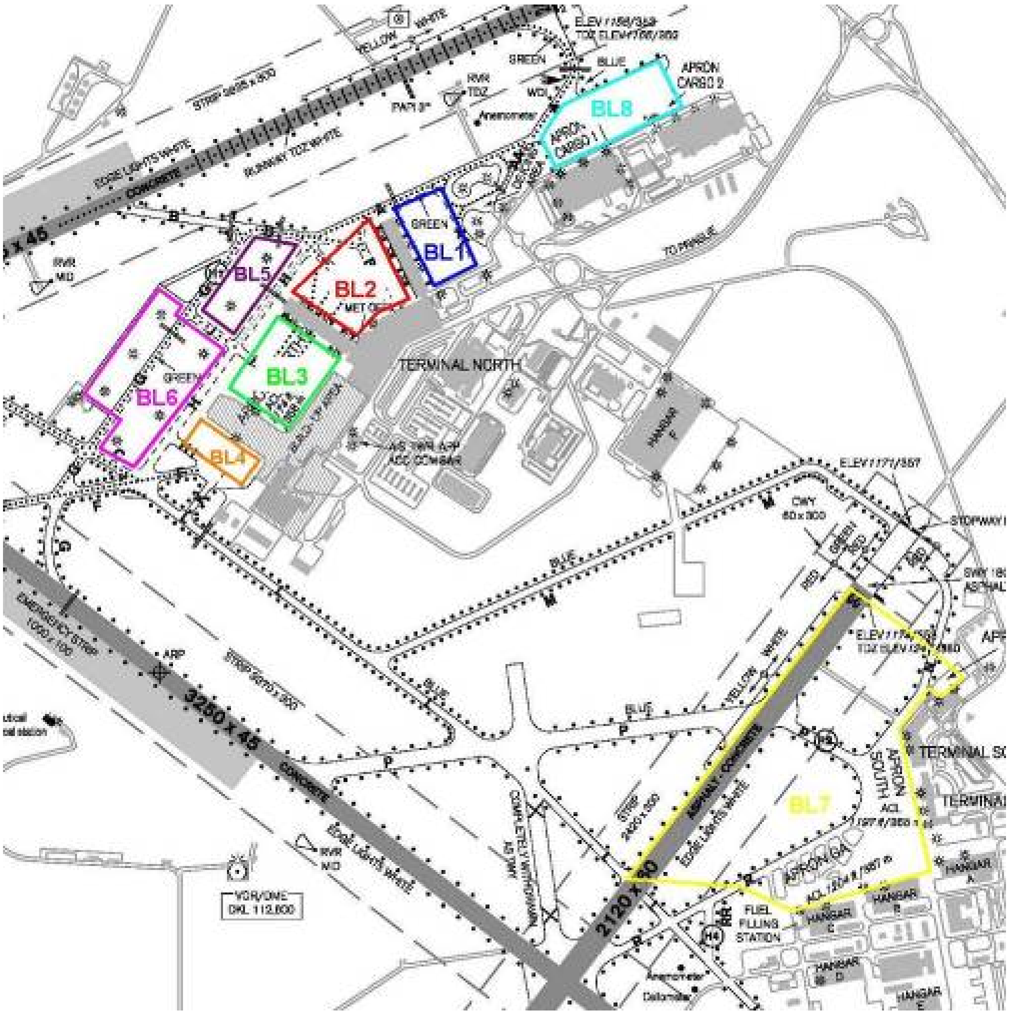

Figure 4-14: Graphical Representation stand blocks on airport Prague Ruzyně

Block of stands	RWY 24			
	Holding position - TWY A		Holding position - TWY B	
	Time (s)	SMODCH (s)	Time (s)	SMODCH (s)
BL1	129,1	14,5		
BL2	159,6	37,3	110,0	0,0
BL3	196,9	30,8	100,0	0,0
BL4	180,5	37,6		
BL5	158,2	35,3	71,0	0,0
BL6	181,4	34,7	128,0	25,2
BL7	415,3	17,5	393,0	0,0
BL8				

Block of stands	RWY 06					
	Holding position - TWY D		Holding position - TWY E		Holding position - TWY F	
	Time (s)	SMODCH (s)	Time (s)	SMODCH (s)	Time (s)	SMODCH (s)
BL1					445,6	55,8
BL2	337,0	47,0	316,3	14,3	380,7	50,0
BL3			297,5	7,5	339,9	73,9
BL4					255,0	0,0
BL5	276,0	0,0			322,8	41,3
BL6	205,5	25,5	243,4	41,0	263,0	40,5
BL7	456,0	0,0			486,0	26,0
BL8						

Block of stands	RWY 31			
	Holding position - TWY L		Holding position - TWY R	
	Time (s)	SMODCH (s)	Time (s)	SMODCH (s)
BL1	338,0	0,0		
BL2	307,7	43,6	231,0	4,0
BL3	287,3	38,3	215,5	10,5
BL4				
BL5	286,0	0,0		
BL6	285,8	31,2	246,5	14,5
BL7				
BL8				

Block of stands	RWY 13			
	Holding position - TWY F		Holding position - TWY P	
	Time (s)	SMODCH (s)	Time (s)	SMODCH (s)
BL1	256,2	49,5		
BL2	221,9	43,3		
BL3	172,8	40,2		
BL4				
BL5	145,4	34,6		
BL6	116,8	43,8		
BL7	301,5	23,5	245,0	0,0
BL8	477,0	0,0		

4.1.1.4 Vehicle mix

Following vehicles operate on the movement area:

- Ground guidance cars (Follow me)
- Fire fighting vehicles
- RWY inspection cars
- Meteo cars
- Bird activity observation vehicles
- Ramp service vehicles (refuelling tanks, ground power units, catering, stairs, towing etc.)
- Electrical engineering vehicles
- Maintenance vehicles

- Security department vehicles
- Airport development vehicles

Drivers have to request clearance for entering the manoeuvring area from Tower Planning controller (TPC). A separate frequency is being used for communication between TWR and vehicle drivers.

Vehicles on the manoeuvring area have to be equipped with radio station for communication with TWR, with beacon, and from 1.1.2005 with S-mode transponder. All drivers must pass through communication training (provided by ANS_CR) and training for drivers (CSL)

4.1.1.5 Weather conditions

WIND

The prevailing wind direction is from the west therefore RWY 24 is a main RWY at Prague airport. One of the criterions of RWY preference is a tailwind component exceeding 5 kts and/or a crosswind component exceeding 15 kts (10 kts on a wet RWY).

From January to September 2004 the utilization of the RWYs was following:
RWY 24 - 61%
RWY 06 – 13%
RWY 31 – 19%
RWY 13 – 7%

The figure below outlines the frequencies of wind directions and velocity in a graphically way:

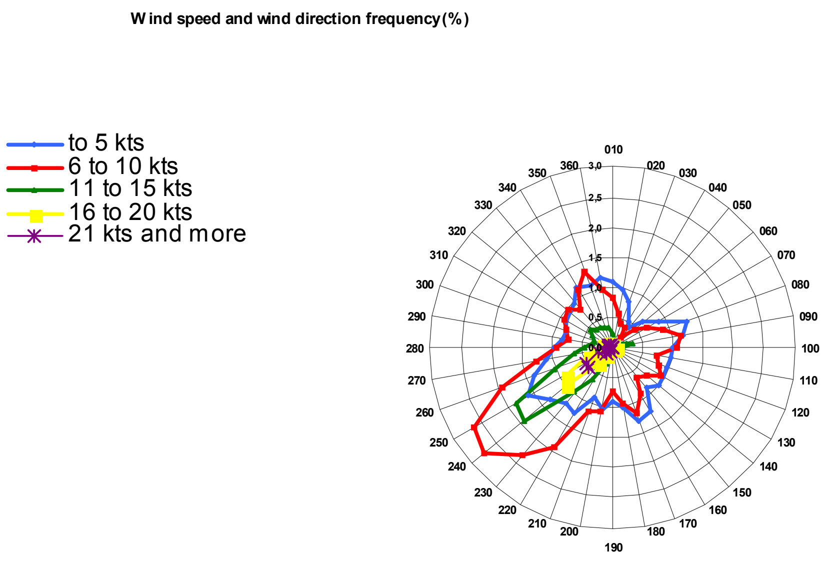

Figure 4-15: Compass rose and frequencies of wind directions and velocity

Low Visibility

The distances of THRs from the TWR are between 1150m (THR RWY 24) and 2900m (THR RWY 06) There is no statistic about the number of hours when TWR controller cannot see the THR of RWY in use.

Year	No. of hours	No. of movements
1997	182	941
1998	238	1809
1999	177	1531
2000	385	3409
2001	378	4329
2002	343	3485
2003	291	2464

Table 4-1: Number of hours and movements under LVC

SNOW and LOW TEMPERATURE

These two atmospheric phenomena have influence almost the whole winter. The requests on de-icing procedures very often don't correspond with the de-icing capacity and this reality has a direct influence on the capacity of the airport.
It is almost impossible to predict the de-icing time and to calculate with this time in planning procedures. Missing slots, nervousness of the crews and ATC are among the consequences of this situation.

Temperature

Average temperature	7,5 - 8,0°C
Average temp in July	23,3°C
Freezing	35 - 40 days

Snow

	season	94/95	95/96	96/97	97/98	98/99	99/00	00/01	01/02	02/03	03/04
days with snow	days	28	63	13	44	41	32	17	20	18	32
amount of snow	cm³	50,8	78,8	29,8	21	73	32,8	36,3	53	24,2	107
freezing	days	9	24	6	21	26	23	34	44	10	30

Winter season is announced from 1st November to 31st March every year.

RAIN

Rain has minimum influence on the airport

4.1.1.6 Complexity

- Crossing runways: RWY 13/31 crosses RWY 24/06 at the threshold RWY 13.
- RWY 04/22 is used only as taxiway and parking area.
- An active runway crossed by aircraft taxiing to or from the parking positions or by vehicles operating on the manoeuvring area: Taxiway F is crossing the active RWY 13/31.
- The presence of multiple aprons, i.e. for passengers, freight, business, general aviation, etc., with a resulting complex taxi procedures, especially when taxiways, runways or another apron have to be crossed
  There are 6 terminals at the airport.
  - The main ones - Terminal North I and II –
    - have a capacity of ca 7 million passengers per year. The passengers are served via 16 Gates (11 of them are equipped with passenger boarding bridges).
    - Apron North, in the front of these terminals, has a capacity of 30 aircraft's.

- Terminal South I and II - terminals in the south part of the airport mainly used for GA aircraft's. The Apron South, which is connected with the terminals, has a capacity of 21 aircraft.

- For cargo flights the fifth terminal – CARGO Menzies - with a capacity of 80.000 tons of cargo and the sixth terminal Cargo CSA are used. The CARGO terminals have their own Apron for four freight aircraft.

- Restrictions with taxiways:
  - TWY H on the apron is available for aircraft up to 52m wingspan (ICAO code D)
  - TWY J on the apron will have two alternative taxi lanes for code C aircraft - J ORANGE and J BLUE
  - Two new rapid exit taxiways are going to be built on the RWY 06/24

4.1.1.7 Runway configurations

By the next figures seven typical runway configurations are described:

4.1.1.7.1 QFU 24

- The most often used configuration
- Arrivals are generally not allowed to vacate RWY 24 after landing via RWY 13 but must use TWYs C, D, E or F). Exception is possible with TWR approval only.
- For taxing for DEP is possible to used parallel TWY G and holding bay on TWY A and Z.
- In this mode certain types of aircraft are allowed to use RWY 13 for departure (all propeller aircraft and jet aircraft up to MTOW 9t)
- TWY L and service road are connection between Apron North and Apron South, therefore in this mode TWY L has to be shared by aircraft taxiing to and from apron South, towed aircraft and vehicles
- Towed aircraft must be coordinated with taxiing aircraft on Apron North and South (coordination between GEC and TPC)
- ARR on RWY 31 is allowed for light aircraft only.

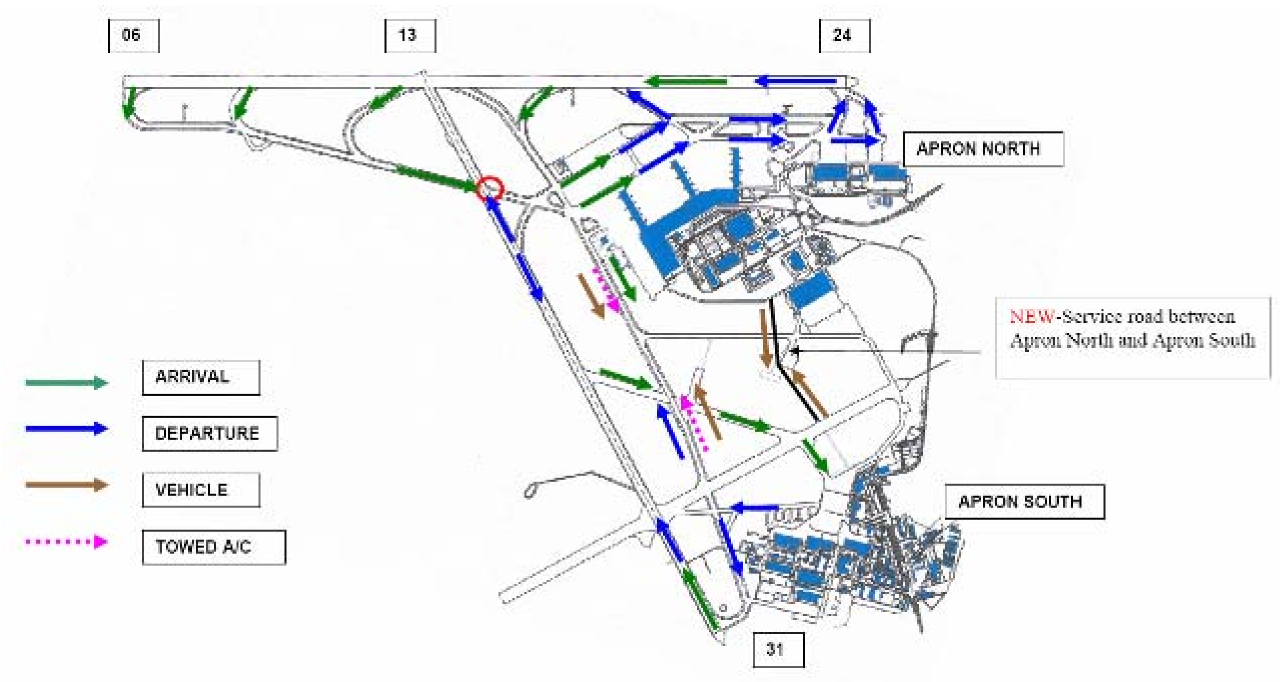

Figure 4-16: QFU 24

4.1.1.7.2 QFU 31

- This configuration is in use when RWY 06/24 is closed for some reasons or there are inconvenient conditions on RWY 06/24, like components of wind are exceeding allowed limits, inconvenient braking actions etc.
- This mode is the most demanding for coordination between TPC and GEC (coordination between towing and taxiing aircraft on TWY L)
- aircraft for DEP and after LDG have opposite direction of movement so GEC has to coordinate aircraft taxiing to gates after LDG on Apron North and aircraft taxiing for DEP
- TWY L and service road are connection between Apron North and Apron South, therefore in this mode TWY L has to be shared by aircraft taxiing to and from apron South, towed aircraft and vehicles
- Towed aircraft have to be coordinated with taxiing aircraft on Apron North and South (coordination between GEC and TPC)

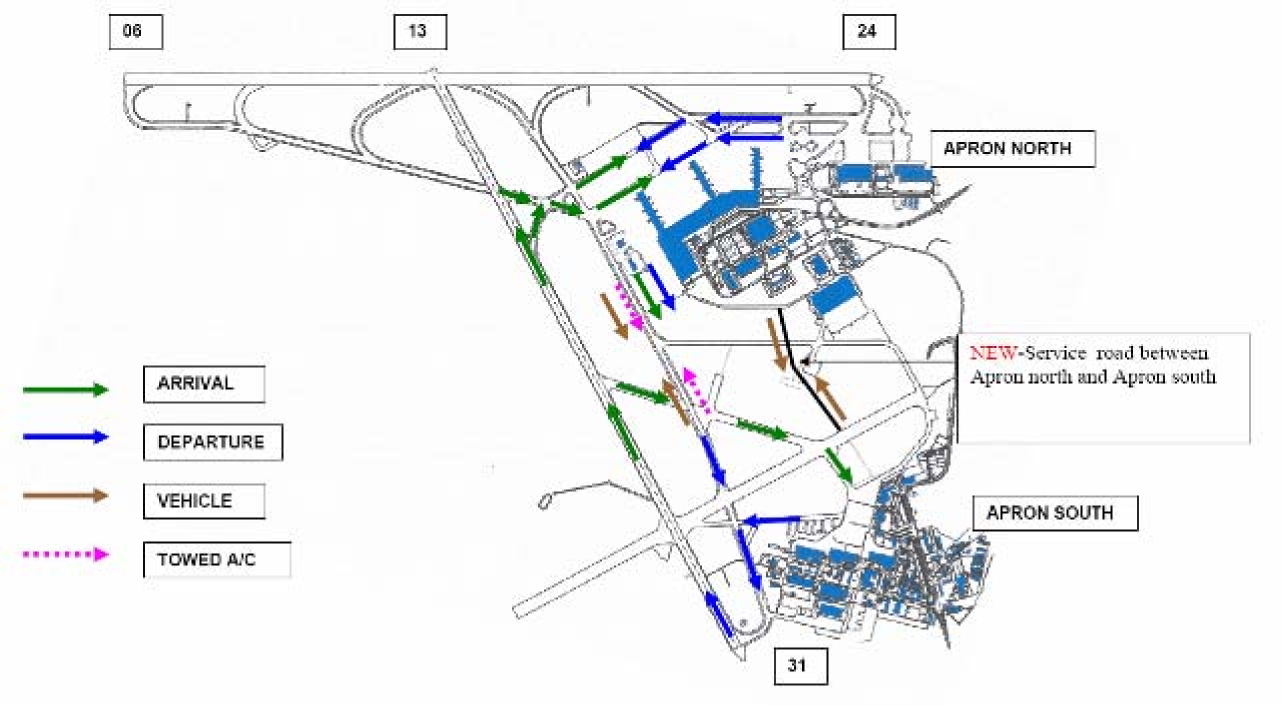

Figure 4-17: QFU 31

4.1.1.7.3 QFU 06

- The main reason to use RWY06 is a meteo situation (the wind).
- There is a logical traffic flow on the Apron North between departing and arriving aircraft.
- Certain types of aircraft are allowed to use RWY 13/31 for DEP and ARR therefore some aircraft taxiing on TWY F have to stop in front of RWY 13/31.Aircraft are allowed to use TWYs D, E and F for lining up on the RWY (It depends on pilot decision or request of ATCO to expedite traffic).
- It is possible to increase the capacity when some aircraft depart from RWY 13(Depend on direction after departure)

- TWY L and service road are connection between Apron North and Apron South, therefore in this mode TWY L has to be shared by aircraft taxiing to and from apron South, towed aircraft and vehicles.
- Towed aircraft have to be coordinated with taxiing aircraft on Apron North and South (coordination between GEC and TPC
- ARR on RWY 31 is allowed for light aircraft only.

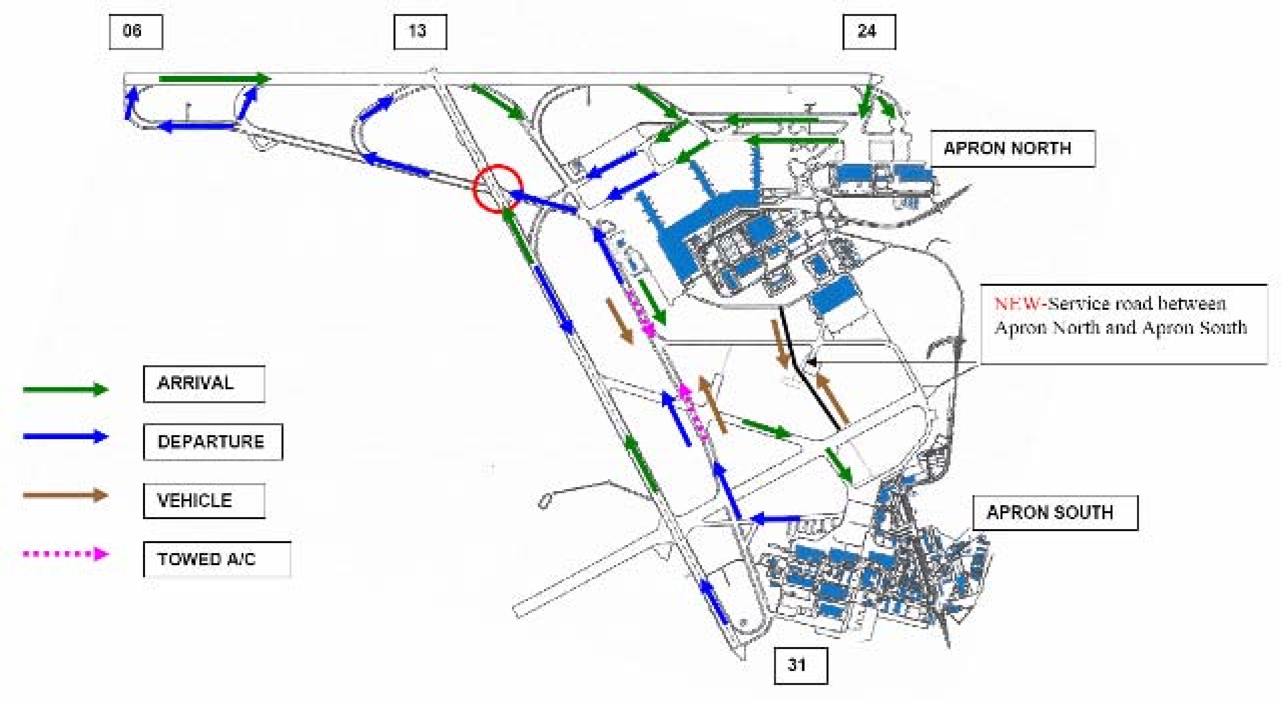

Figure 4-18: QFU 06

4.1.1.7.4 QFU 13

- There is only one reason to use RWY13-the wind.
- RWY 13 has VOR/DME approach; therefore there are the highest visibility minima for approach.
- There is a logical flow of traffic on Apron North except the situation described in a yellow frame.
- In this case departing aircraft have to stop in front of RWY 13 on TWY F in case of arrival on RWY 13.
- GEC has to coordinate the arriving aircraft taxiing on TWY L with those which request departure from TWY F or G.
- TWY L and service road are connection between Apron North and Apron South, therefore in this mode TWY L has to be shared by aircraft taxiing to and from apron South, towed aircraft and vehicles
- If some aircraft request to depart from TWY P (especially light aircraft) TEC has to ensure that arriving aircraft will not vacate via TWY P(GEC and TEC have to coordinate in this case)
- TWY L has to be shared by arriving aircraft, aircraft taxiing for DEP from Apron South, towing aircraft and vehicles
- Towed aircraft have to be coordinated with taxiing aircraft on Apron North and South (coordination between GEC and TPC)

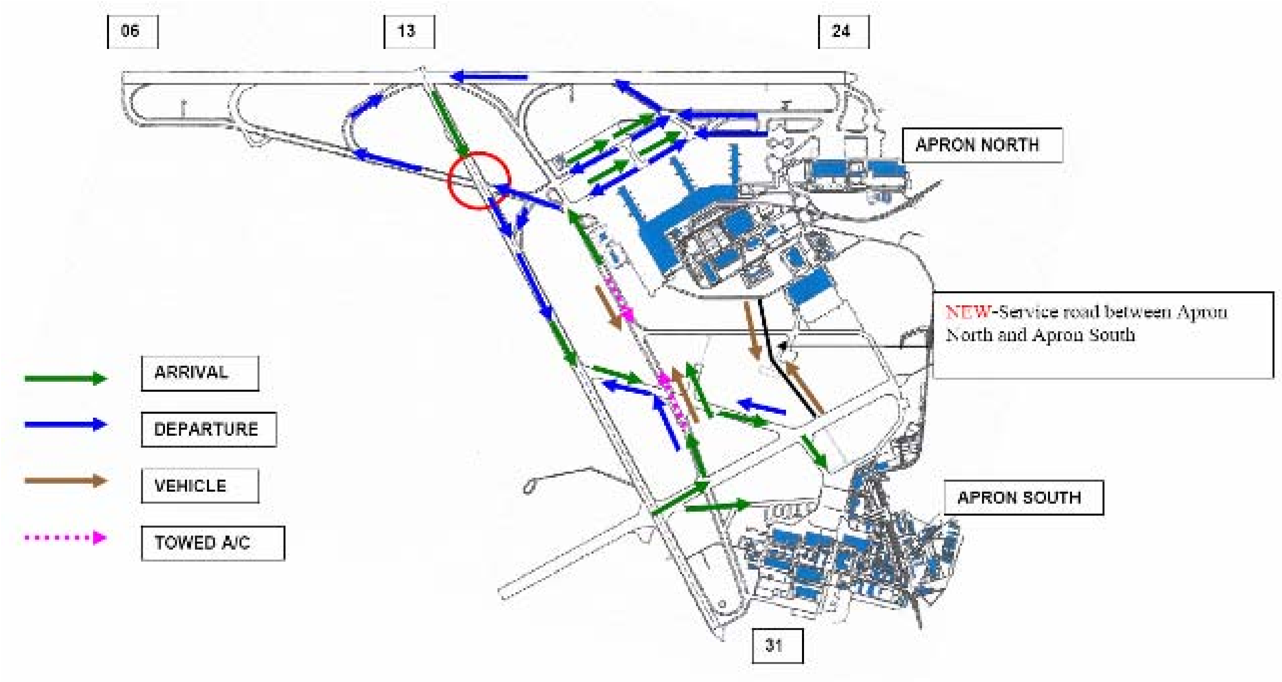

Figure 4-19: QFU 13

4.1.1.7.5 QFU 24 for DEP; QFU 31 for ARR

- This mode is used when prevailing wind allows using this mode.
- The second reason is to expedite traffic.
- There is a logic flow of traffic on Apron North.
- For taxing for DEP is possible to used parallel TWY G and holding bay on TWY A and Z.
- A difficulty is an intersection of RWY 13/31 and TWY F. Aircraft vacating RWY 24 via TWY D, E or F have to stop in front of RWY 13/31 in case of arrival on RWY 31.
- Departures from RWY 31 and arrivals on RWY 24 are also allowed .In those cases the traffic has to be coordinated with APP.
- TWY L and service road are connection between Apron North and Apron South, therefore in this mode TWY L has to be shared by aircraft taxiing to and from apron South, towed aircraft and vehicles
- Towed aircraft have to be coordinated with taxiing aircraft on Apron North and South(coordination between GEC and TPC)

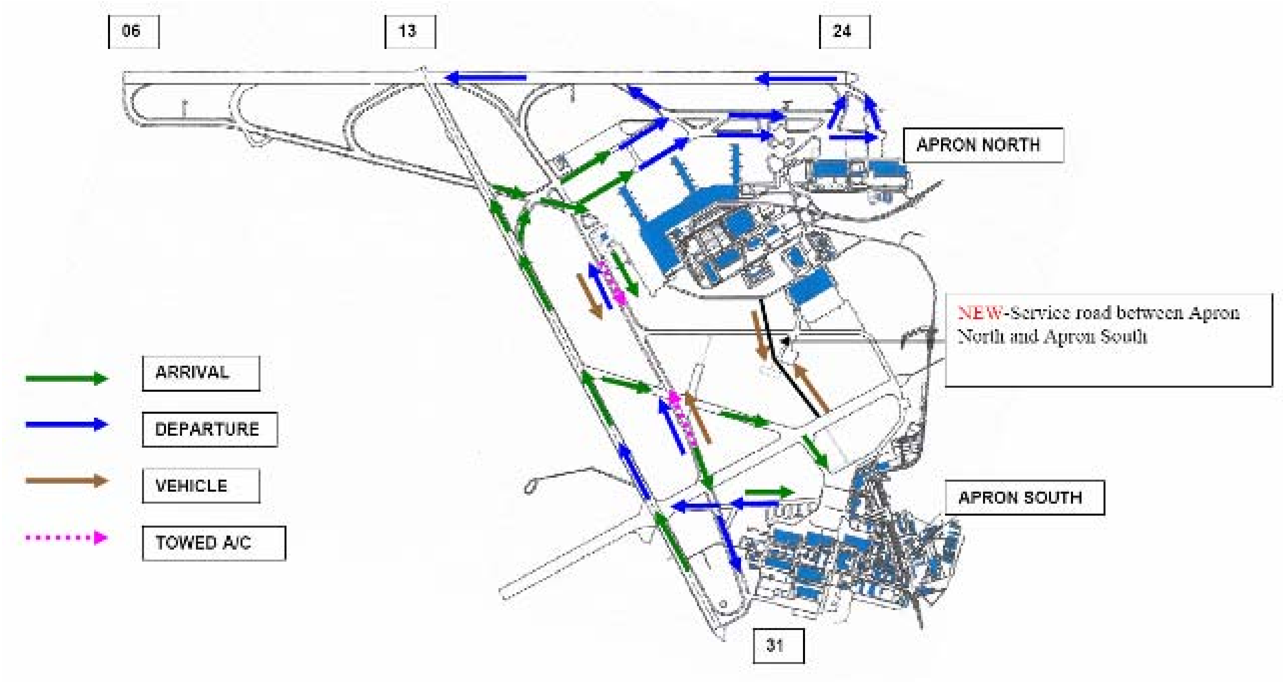

Figure 4-20: QFU 24 for DEP; QFU 31 for ARR

4.1.1.7.6 QFU 13 for ARR; QFU 06 for DEP

- In this mode the main difficulty is a intersection of RWY 13/31 and TWY F.
- All aircraft taxiing for DEP have to request crossing clearance by TEC to cross the RWY 13/31 what is a time demanding task in rush hours.
- When departing aircraft cannot cross the RWY 13 because of arriving traffic on RWY 13 aircraft have to wait on TWY F, G or H that hampers aircraft taxiing on TWY L after landing
- Towed aircraft have to be coordinated with taxiing aircraft on Apron North and South (coordination between GEC and TPC)

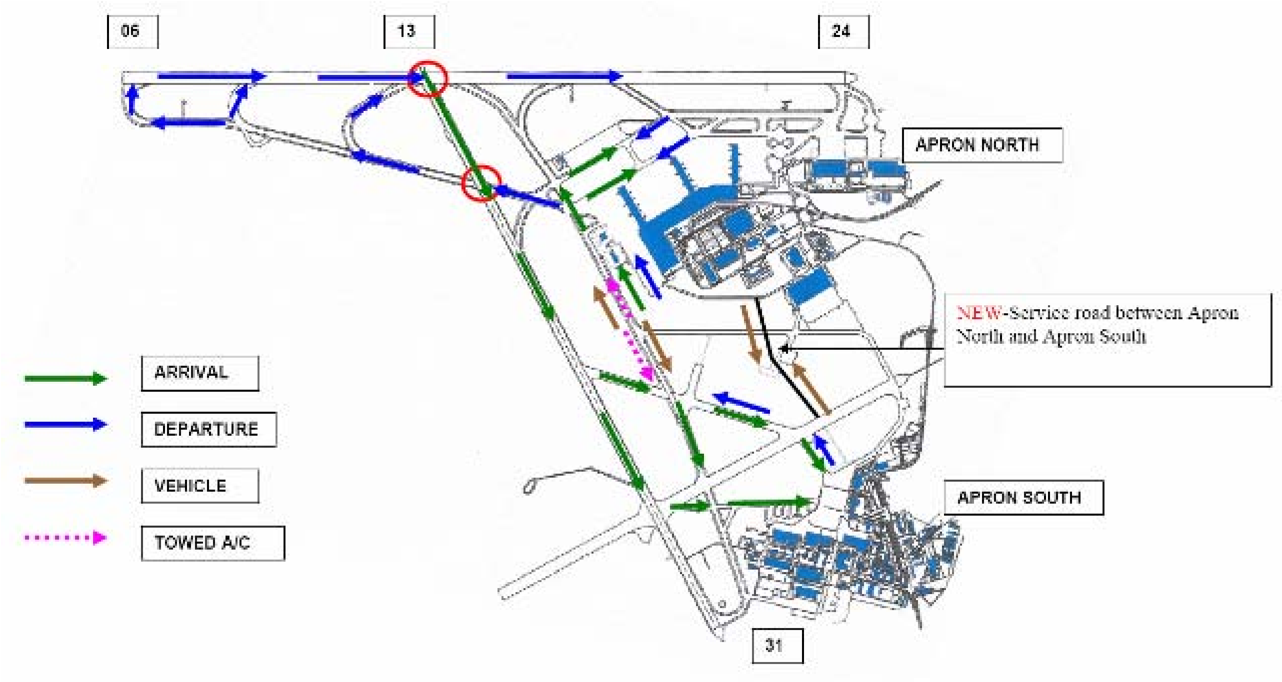

Figure 4-21: QFU 13 for ARR; QFU 06 for DEP

4.1.1.7.7 QFU 13 for ARR; QFU 24 for DEP

- This mode is used very seldom because of difficulties of Approach centre to co-ordinate arrivals and departures
- There is a logic traffic flow on Apron North.
- For taxing for DEP is possible to used parallel TWY G and holding bay on TWY A and Z.
- TWY L and service road are connection between Apron North and Apron South, therefore in this mode TWY L has to be shared by aircraft taxiing to and from apron South, towed aircraft and vehicles
- Certain types of aircraft are allowed to depart from RWY 13.
- Towed aircraft have to be coordinated with taxiing aircraft on Apron North and South (coordination between GEC and TPC)

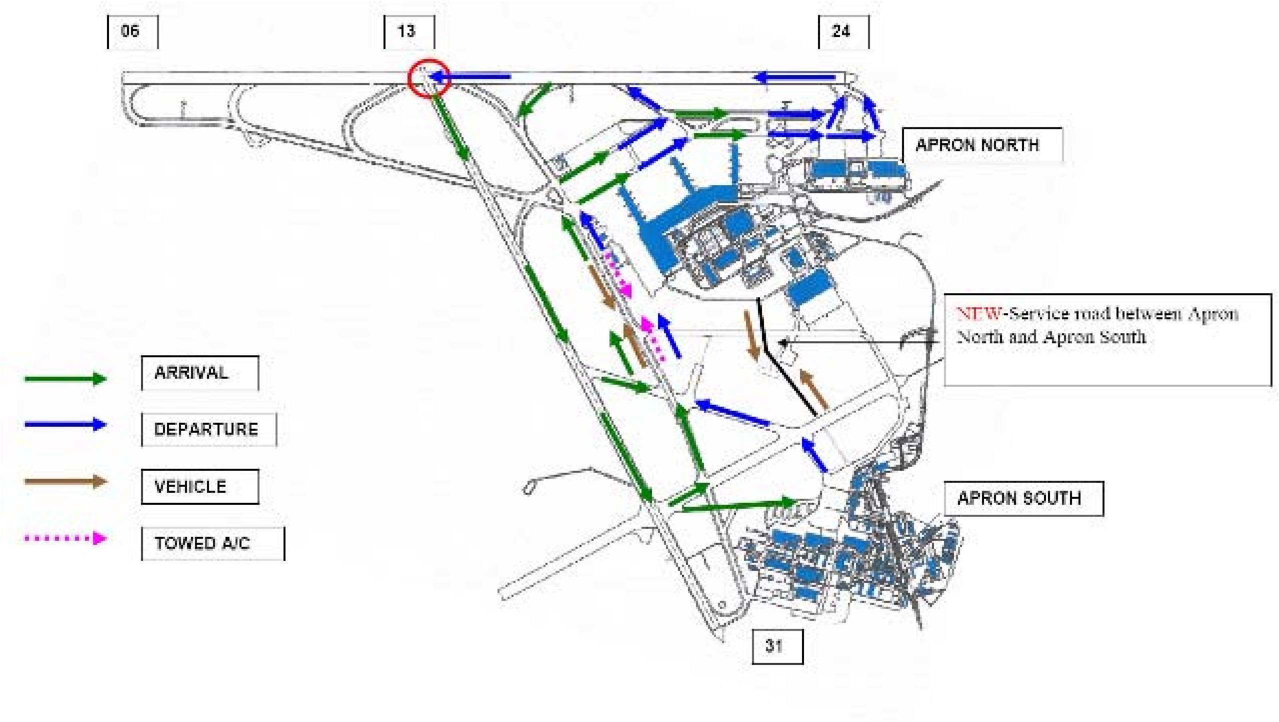

Figure 4-22: QFU 13 for ARR; QFU 24 for DEP

4.1.1.8 CNS Coverage

4.1.1.8.1 Communication

VHF Communication

APP
PRAHA RADAR

TWR
RUZYNE DELEVERY
RUZYNE GROUND
RUZYNE TOWER

ATIS
RUZYNE ATIS

4.1.1.8.2 Navigation

Radio Navigation and Landing Aids available

VOR	VHF omni-directional radio range
DME	Distance measuring equipment
NDB	Non-directional radio beacon
VDF	VHF direction finding station
ILS	Instrument landing system

Instrument Approach on RWY

RWY 24
NDB – DME approach
ILS CAT IIIb approach

RWY 06
NDB – DME approach
ILS CAT I approach

RWY 31
NDB – DME approach
ILS CAT I approach

RWY 13
VOR – DME approach

4.1.1.8.3 Surveillance

- ASR
- SMR
- MLAT

4.1.1.8.4 System failure management

Different systems degradation possibilities and fallback means

4.1.2 Controller Working Position (TWR and Apron)

4.1.2.1 TWR Controller Working Position

The controller working positions in the Tower are outlined in Figure 4-23 and for the gate management in.

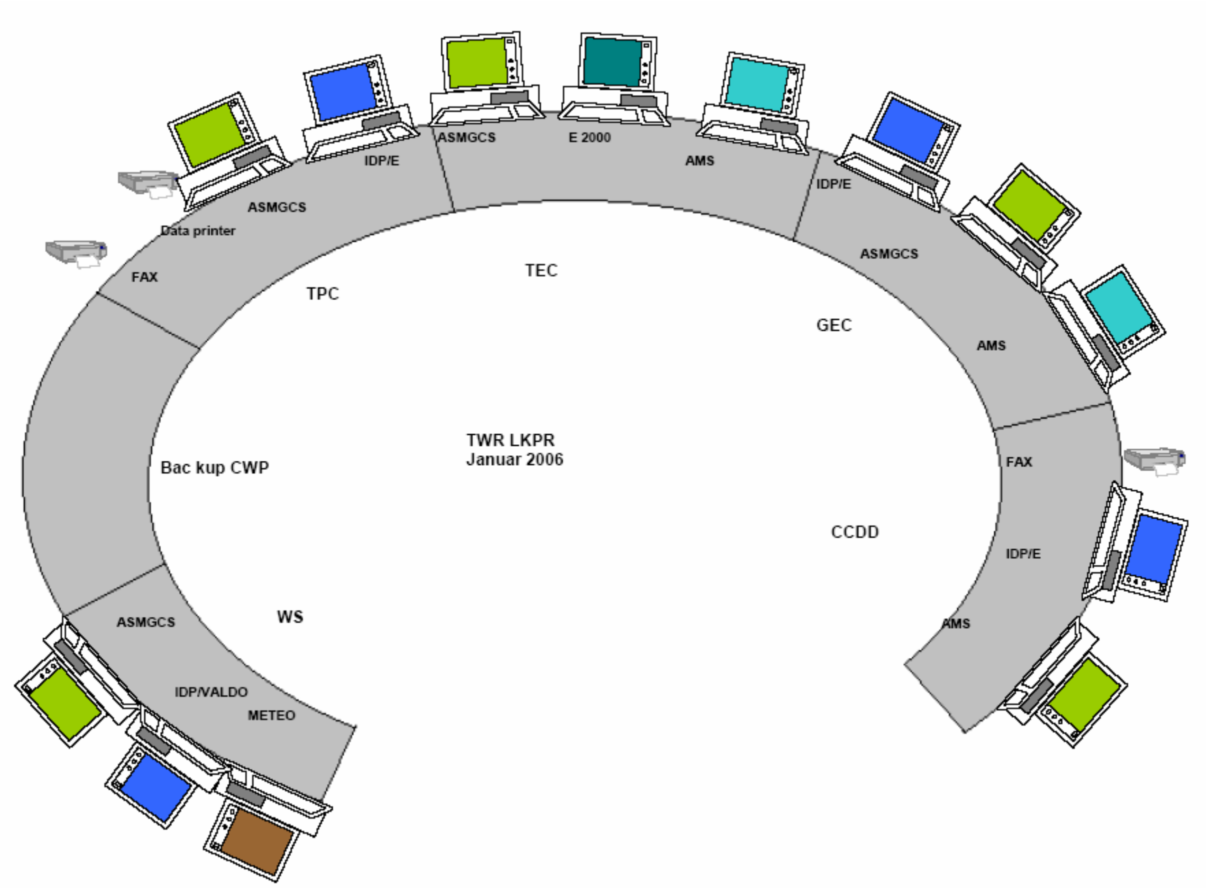

Figure 4-23 Arrangements of CWP at Tower Prague

The work allocation at the Tower is defined as follows:

CDD (Clearance Delivery Controller):

- Has responsibility about departing aircraft only
- Issues Departure clearance, i.e. SID(standard instrument departure) / VFR departure route and SSR code
- Has information about slot times, coordinates with FMP (Flow management point, which is located on ACC).
- Has information about SID,SSR code and slot time which is printed on a paper strip
- Passes on information to APP about aircraft, which are going to depart from RWY, which is not declared as RWY in use
- Sends REA message on request of crews
- Fills-in the shortened FPL of VFR flights without FPL and has to inform APP about such a flights(outbound flights)
- In case of manual coordination(in case of failure of FDP system) coordinates with ACC all departing flights
- Coordinates with GEC a request of crews about de-icing
- Coordinates with APP departure clearances in case of IFR / VFR departing from RWY that is not in use

GEC (Ground Executive Controller):

- Has responsibility about departing and arriving aircraft(IFR and VFR)
- Issues push-back and taxi clearance for departing aircraft and taxi clearance and stand allocation for arriving aircraft

- Coordinates with Apron (Ramp ?) control, when there are some problems with stands(normally stands are depicted on monitor of information system)
- Decides about position of de-icing(according slot, type of aircraft ,departure sequence and handling company)
- Passes on stands of arriving aircraft to Follow me
- Coordinates with TPC towed aircraft
- Data about ARR and DEP aircraft are in a form of a paper strip.
- Prevents aircraft from collision on TWYs during LVP and/or VIS 600m or below
- Prevents aircraft from collision with obstacles (including vehicles) on TWYs during LVP and/or VIS 600m or below

TEC (Tower Executive Controller):
- Issues Landing and Take-off clearance
- Operates the RWY and TWY lights
- During a night (from 9 p.m. to 7 a.m. local time) takes over duties of all positions
- Issues clearance to cross or to enter RWY for arriving traffic (especially when RWY 24 is in use and aircraft vacate on RWY 13)
- Declares LVP (Low visibility procedures) according RVR and cloud base and operates AMS-1 (monitoring system for LVP)
- Finishes LVP

TPC (Tower Planning Controller):
- Has responsibility and issues clearance for vehicles to enter and move on manoeuvring areas. Clearance for vehicles to enter RWY
- Coordinates with TEC
- Has responsibility and issues clearance for towed aircraft (coordinates with GEC)
- Operates FDP system, i.e. inputs time of departure into system
- Coordinates with adjacent units
- Fills-in shortened FPL for VFR flights without FPL (inbound flights) and takes over ETA of VFR flights from APP
- Passes on information about inbound VFR flights to Apron control
- Continuous listening of Tower frequency and TEC action to be able to start necessary coordination
- Coordinates with APP all flights, which are going to depart from a RWY, which is not declared as RWY in use
- Coordinates with APP all Go arounds

4.1.2.2 ROS Dispatching - Stand&gate Management Working Position

The work allocation at the Stand &Gate Management is defined as follows:

- **Dispatch Arrivals:**
  - Stand allocation, Gate Management, Ramp Management
- **Dispatch Departures:**
  - Gate Management, Ramp Management
- **Dispatch Assistant:**
  - SITA update, Slot check, information systems AMIS, AGORA
- **Ramp Control:**
  - Apron Lighting Control, Winter Service
- **Supervisor:**
  - Operation Check, Emergency situations

- **Systems being used at ROS Dispatching:**

AMS2	- Airport Monitoring System
A-SMGCS	- Level 1 - Surveillance
AMIS	- Secondary radar Display
AGORA	- Airport Information System Docking System
Visualisation	- System showing current status of every boarding bridge
SITA	
Scofox	- System for gate allocation
Multiview	- CCTV system
Porthos	- System of Czech Airlines showing information about all CSA flights
IRIS	- Flight strips - ARR, DEP

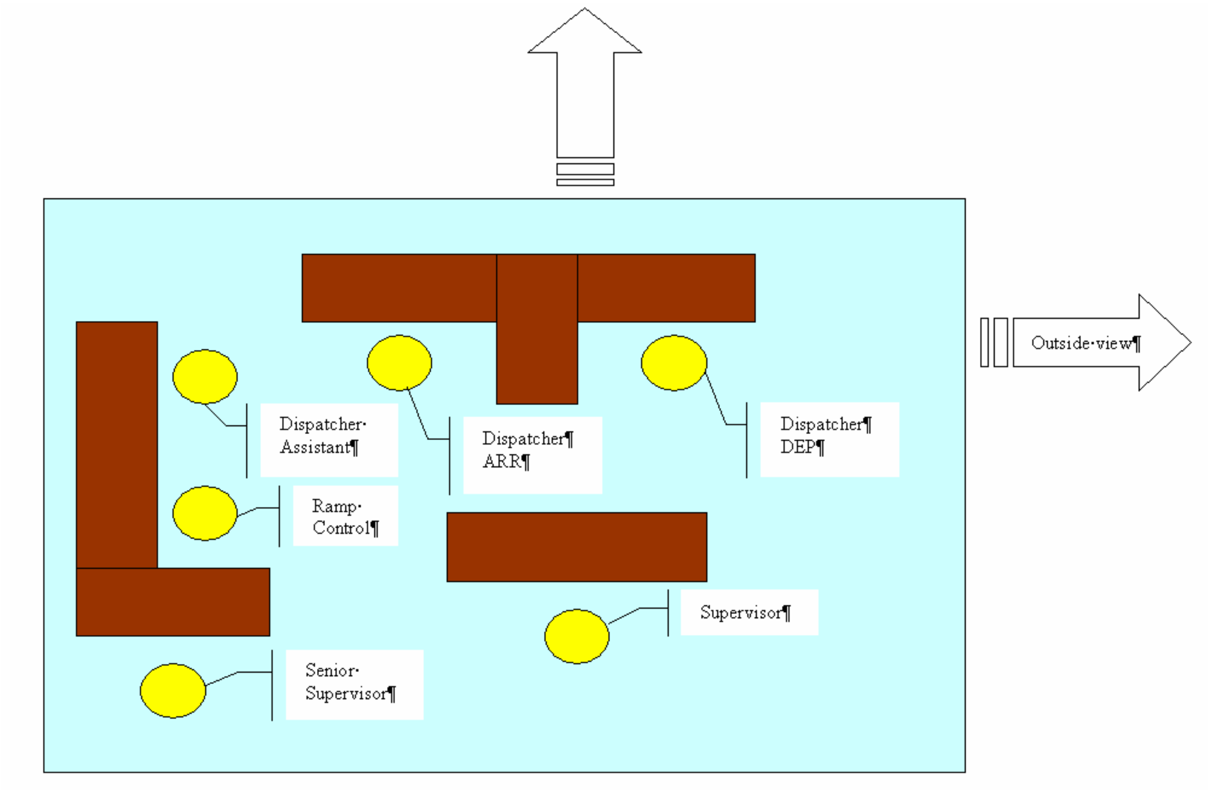

Figure 4-24 Arrangements of Working Positions at Prague Ruzyne Gate Management

4.1.2.2.1 The general information flow sequence

Exchange of information between CSL (Czech airport authority) and ANS_CR (Air navigation services of the Czech republic).
ANS_CR affords CSL basic information about flight plans of arriving aircraft (when received an "activation message" (ACT) from adjacent unit) and departing aircraft (40 min before estimated Off-Block time).
CSL responses with GAT message i.e. stands for arriving and departing aircraft, which are depicted in system AMS-2.
ANS_CR affords CSL radar information about arriving aircraft (system track).
CSL worked out the approaching sequence. Approaching sequence is regularly updated until approaching aircraft passes FAF. This sequence is depicted in system AMS-1 in the table of arriving aircraft and is used by the Tower controller

4.2 Local Current Operations

4.2.1 Current Operations at Prague Ruzyne – Typical Flight

Phase	Institution	Process	Technology	Information
ARR	**ANS CR** APP PEC (AEC)	Hand over-out Instructions to transfer from APP AEC to TWR TEC	E2000 GAREX Tx Technisonic Tx	In-flight position, status
	System	Positional and FPL data transfer	ESUP to AMIS	In-flight position, sequence
	Aircraft 1 Pilot	Instructions to transfer to TWR TEC readback	GAREX Rx Technisonic Rx	
	ANS CR TWR TEC	Hand over-in	E2000	In-flight position, status
		APP area check	Visual perception A-SMGCS E2000 IDP	In-flight position, conflict
		Separation assurance	Visual perception A-SMGCS E2000 IDP	In-flight position, conflict
		Instructions to continue ARR for Aircraft 1	GAREX Tx Technisonic Rx Light gun	
	Aircraft 1 Pilot	Instructions to continue ARR readback	GAREX Rx Technisonic Rx	

	ČSL Driver	Requests entry RWY for inspection	Motorola Rx	
	ANS CR TWR TEC (TPC)	Request denied due to DEP and ARR	GAREX Tx Technisonic Tx SZZ	
	Aircraft 2 Pilot	Reports ready for DEP	GAREX Rx Technisonic Rx	
	ANS CR TWR TEC	RWY area check	Visual perception A-SMGCS	In-flight position, conflict
		Separation assurance	Visual perception A-SMGCS E2000 IDP	In-flight position, conflict
		Clearance to entry RWY and DEP for Aircraft 2	GAREX Tx Technisonic Tx Light gun	
	Aircraft 2 Pilot	Clearance to entry RWY and DEP readback	GAREX Rx Technisonic Rx	
	ANS CR TWR TPC (TEC)	Aircraft 2 DEP message entry	ESUP	Status
	ANS CR TWR TEC	APP and RWY area check including all exits to TWYs	Visual perception A-SMGCS E2000 IDP	In-flight position, conflict
		Separation assurance	Visual perception A-SMGCS E2000 IDP	In-flight position, conflict
		Clearance to land for Aircraft 1	GAREX Tx Technisonic Tx Light gun	
		Possible instructions for RWY vacation after landing	GAREX Tx Technisonic Tx Light gun	
	Aircraft 1 Pilot	Clearance to land and vacation instructions readback	GAREX Rx Technisonic Rx Light gun	

	ČSL ŘOS	Gate or stand number determination	AMIS	Sequence, post-flight position
	System	Gate or stand number transfer	AMIS to ESUP	Sequence, post-flight position
	ANS CR TWR TEC	Instructions for RWY vacation and transfer from TWR TEC to TWR GEC	GAREX Tx Technisonic Tx	
	Aircraft 1 Pilot	Instructions for RWY vacation and transfer to TWR GEC readback	GAREX Rx Technisonic Rx	
	ANS CR TWR TEC	Clearance to entry RWY for inspection for ČSL driver	GAREX Tx Technisonic Tx	
	ČSL Driver	Clearance to entry RWY for inspection readback	Motorola Rx	
	ANS CR System	Gate or stand number transfer	ESUP to AMS and to Intranet (SMC)	Sequence, post-flight position
	TWR GEC	Instructions for TAXI via TWY to stand or gate for Aircraft 1	GAREX Tx Technisonic Tx	
		Taxi route check	Visual perception A-SMGCS	In-flight position, sequence, conflict

		Separation assurance	Visual perception A-SMGCS	In-flight position, sequence, conflict
	Aircraft 1 Pilot	Instructions for TAXI via TWY to stand or gate readback	GAREX Rx Technisonic rx	
	ANS CR SMC	Guidance of Aircraft 1 to stand or gate in case of LVP	Marshalling Technisonic Tx	
	ČSL Driver	Request for towing of Aircraft 3 from point A to point B	GAREX Rx Technisonic Rx	
	ANS CR TWR GEC	Separation assurance	Visual perception A-SMGCS	In-flight position, sequence, conflict
		Clearance to tow Aircraft 3 from point A to point B for ČSL driver	GAREX Tx Technisonic Tx	

	ANS CR TWR GEC	Instructions for TAXI via APRON to stand or gate for Aircraft 1	GAREX Tx Technisonic Tx	
		Taxi route check	Visual perception A-SMGCS	In-flight position, sequence, conflict
		Coordination of conditions for docking or parking of Aircraft 1 (waiting for free gate/stand or gate/stand change etc.)	GAREX phone	
	ČSL ŘOP	Gate or stand change	GAREX phone AMIS to ESUP	Sequence, post-flight position
	ANS CR System	Gate or stand number transfer	ESUP to AMS and to Intranet (SMC)	Sequence, post-flight position
	TWR GEC	Instructions for TAXI to newly allocated gate or stand for Aircraft 1	GAREX Tx Technisonic Tx	
		Taxi route check	Visual perception A-SMGCS	In-flight position, sequence, conflict
		Separation assurance	Visual perception A-SMGCS	In-flight position, sequence, conflict

Phase	Institution	Process	Technology	Information
DEP	**ANS CR** TWR GEC (CDD)	Update of information gained from ČSL needed for ATS provision	GAREX phone	
	Aircraft 4 Pilot	Confirmation of relevant traffic information, airways and start-up clearance request, information about anti/de-icing	GAREX Rx Technisonic Rx	
	ANS CR TWR CDD	Issuance of clearance to Aircraft 4, negotiation of SAM if needed	GAREX Tx Technisonic Tx ESUP	
		Aircraft 4 identification	Visual perception A-SMGCS	Pre-flight position, status
	Aircraft 5 Pilot	Confirmation of relevant traffic information, airways and start-up clearance request, information about anti/de-icing	GAREX Rx Technisonic Tx	
	ANSCR TWR CDD	Issuance of clearance to Aircraft 5, negotiation of SAM if needed	GAREX Tx Technisonic Tx ESUP	
		Aircraft 5 identification	Visual perception A-SMGCS	Pre-flight position, status
	Aircraft 4 and 5 Pilots	Instructions for transfer from TWR CDD to TWR GND for Aircraft 4 and Aircraft 5	GAREX Tx Technisonic Tx	
		Instructions for transfer from TWR CDD an TWR GEC readback	GAREX Rx Technisonic Rx	
	Aircraft 4 Pilot	Push-back request, information about anti/de-icing needs, TAXI to anti/de-icing spot request	GAREX Rx Technisonic Rx	
	Aircraft 5 Pilot	Push-back request, information about anti/de-icing needs, repositioning to anti/de-icing spot request	GAREX Rx Technisonic Tx	
	ANS CR TWR GEC	Push-back instructions to vehicles about sequence and direction of push-back	GAREX Tx Visual perception A-SMGCS	Pre-flight position, sequence, conflict

		Push-back clearance for Aircraft 5 with regard to aircraft type and CTOT and repositioning to anti/de-icing spot	GAREX Tx Technisonic Tx	
		Push-back clearance for Aircraft 4 with regard to aircraft type and CTOT	GAREX Tx Technisonic Tx	
	Aircraft 4 and 5 Pilots	Push-back clearance readback	GAREX Rx Technisonic Rx	
	ČSL Driver	Information about the need of refuelling of push-back car	GAREX Rx Technisonic Rx	
	ANS CR TWR GEC	Clearance to proceed for refuelling for push-back car (ČSL driver)	GAREX Tx Technisonic Tx	
		Taxi route check	Visual perception A-SMGCS	In-flight position, sequence, conflict
		Separation assurance among Aircraft 4, Aircraft 5 and push-back car	Visual perception A-SMGCS	In-flight position, sequence, conflict
	Aircraft 4 Pilot	Request to TAXI to anti/de-icing spot	GAREX Rx Technisonic Rx	
	ANS CR TWR GEC	Instructions for TAXI to anti/de-icing spot via APRON for Aircraft 4	GAREX Tx Technisonic Tx	
		Coordination of TAXI conditions on TWY and APRON between GND and TWR (TEC, TPC)	GAREX phone Human to Human	
		Coordination of anti/de-icing process with CSL	GAREX phone	
		Instructions for SMC for Aircraft 4 and Aircraft 5 guidance in case of LVP	GAREX Tx Technisonic Tx	
	SMC	Instructions for Aircraft 4 and Aircraft 5 guidance in case of LVP readback	GAREX Rx Technisonic Rx	
		Guidance of Aircraft 4 and Aircraft 5 to holding position QFU in case of LVP	Marshalling Technisonic Tx	
	TWR GEC	Clearance to TAXI to holding position QFU for Aircraft 4 and Aircraft 5	Visual perception A-SMGCS	In-flight position, sequence, conflict
		Taxi route check		

		Separation assurance	Visual perception A-SMGCS	In-flight position, sequence, conflict
	Aircraft 4 and 5 Pilots	Clearance to TAXI to holding position QFU readback	GAREX Rx Technisonic Rx	
	Aircraft 4 Pilot	Reports ready for DEP	GAREX Rx Technisonic Rx	
	ANS CR TWR GEC	Instructions for transfer from TWR GEC to TWR TEC for Aircraft 4	GAREX Tx Technisonic Tx	
	Aircraft 4 Pilot	Instructions for transfer from TWR GEC to TWR TEC readback	GAREX Rx Technisonic Rx	
	ANS CR TWR TEC	RWY area check	Visual perception A-SMGCS	In-flight position, sequence, conflict
		Separation assurance	Visual perception A-SMGCS E2000 IDP	In-flight position, sequence, conflict
		Clearance to line-up RWY and DEP for Aircraft 4	GAREX Tx Technisonic Tx Light gun	
	Aircraft 4 Pilot	Clearance to line-up RWY and DEP readback	GAREX Rx Technisonic Rx	
	ANS CR TWR TEC (TPC)	Aircraft 4 DEP message entry	ESUP	Status
	System	FPL data transfer	ESUP to AMIS	Status

4.2.2 Low Visibility Procedures

- Description of facilities
  - RWY 24 is equipped with ILS and is approved for CAT II and III operations and for Low Visibility Take-Off (LVTO).

- Criteria for the initiation and termination of Low Visibility Procedures.
  - LVP and LVTO will be initiated if the Runway Visual Range (RVR) decreases to 600m and less.

- Details of RWY exits
  - Aircraft landing on RWY 24 must only exit via the TWY C, D, E or F. Exit via RWY 13 and via TWY B is not permitted.
  - RWY exits for RWY 24 are equipped with green/yellow coded taxiway centreline lights indicate the boundary of localiser sensitive area.
  - RWY exits for RWY 24 on rapid exit TWY D is equipped Rapid exit taxiway indicator lights (RETIL)

- Details of holding points to be used.
    - Aircraft departing on RWY 24 shall use the CAT II/III holding position on TWY A or B.

- Description of LVP
    - CAT II/III Approach and Landing
    - Pilots will be informed by ATIS or RTF broadcasting about:
        - Preparedness of LVP or LFTO procedures
        - Initiation of operating LVP or LVTO procedures
    - Aircraft will be vectored to intercept the ILS at least 3NM from FAF.
    - The localiser sensitive area will be protected when a landing aircraft is within 2 NM from touchdown and when an aircraft is conducting a guided take off. For these purposes ATC will provide suitable separations between aircraft on final approach. For LVP/CAT II operations the separation of 8 NM and for LVP/CAT III operations the separation of 10NM are supposed to be enough.
    - Low Visibility Take-Off
        - Pilots wishing to conduct a guided take off must inform ATC on engine start-up in order to ensure that protection of the localiser sensitive area is provided.

- Restriction on traffic flow
    - The following hourly traffic rates of RWY 24 are anticipated in LVP:
        - RVR from 600m to 350 m 15 arrivals
        - RVR less than 350 m 12 or less arrivals

- Other information
    - Strobe lighting and runway threshold identification lights for RWY 24 are turned on, when CAT II and CAT III operations are in progress, only on request.
    - Simultaneously line-up RWY 24 from TWY A and TWY B is not permitted in LVP or LVTO.

4.3 A-SMGCS Operations (Levels 1 & 2)

4.3.1 A-SMGCS - DEFINITION

A-SMGCS - ADVANCED SURFACE MOVEMENT GUIDANCE AND CONTROL SYSTEM
Systems providing routing, guidance, surveillance and control to aircraft and affected vehicles in order to maintain movement rates under all local weather conditions within the Aerodrome Visibility Operational Level (AVOL) whilst maintaining the required level of safety

4.3.2 A-SMGCS operational levels at Prague

A-SMGCS Level I Surveillance Function

A-SMGCS Level II Level I + Control Function (Runway Incursion Monitoring and Conflict Alert Sub-system)

4.3.3 Operating Conditions at Prague - Ruzyně Airport

The particular operating conditions are as follows:

<u>LEVEL 1 OPERATIONS</u>
An operating level, when the A-SMGCS is used for radar control of the airport movement area in any weather condition and when the controller is able to check compliance with issued clearances by using radar display. Controller uses the „Control Function“ only to notice crossing a „STOP BAR“.

LEVEL 2 OPERATIONS
An operating level, when the A-SMGCS is used both for „Surveillance“ and „Control“ functions without any operational limit. (Control function is about to be introduced later.)

4.3.3.1 A-SMGCS FUNCTIONS

4.3.3.1.1 Surveillance

4.3.3.1.1.1 Sources of position data

The A-SMGCS displays targets operating on the airport defined areas. Information about positions is an interface of the SMR, passive system P3D/AS and the EUROCAT 2000.

4.3.3.1.1.2 Radar data display

Symbols of component operational modes:

◇	PSR/SMR and P3D/AS	-	Cooperative target
+	PSR/SMR only	-	Non-cooperative target (SMR mode)
*	Computed position (Coasted)		

4.3.3.1.2 Control

To be supplemented prior to introduction of the function to the regular operation.

4.3.3.1.2.1 HMI Functions

The information displayed on the radar screen can be used for the following actions during provision of air traffic services:

a) To monitor whether aircraft and vehicles on the manoeuvring area comply with issued clearances and instructions;
b) To check that the runway is clear before arrival or departure;
c) To provide information on essential local traffic on the manoeuvring area or its vicinity;
d) To determine position of aircraft and vehicles on the manoeuvring area;
e) To provide taxi routing information to aircraft when requested by pilot or deemed necessary by controller. Except for specific circumstances, e.g. emergencies, this information should not be an instruction giving a heading;
f) To help and give advice to emergency vehicles;
g) To check that there are no targets on the runway;
h) To check that an arrival has vacated the runway;
i) To check that a departing aircraft has commenced roll;
j) To solve a possible conflict on airport manoeuvring area;
k) To provide help and advice to aircraft;
l) To check position reported by target;
m) To monitor manoeuvring area and identify an optimal taxi route to reduce accumulation of traffic and contribute to an expeditious flow of traffic in poor weather conditions.
n) To provide information that a switched-on stop bar has been crossed.
o) Don't use the A-SMGCS screen for vectoring during taxi, excluding emergency.

4.3.3.1.2.2 Identification

When using the A-SMGCS, aircraft can be identified by correlation of a callsign of a known airport movement with a displayed target on the A-SMGCS screen.

Target identification is provided:

a) Automatically – Mode-S equipped aircraft
b) By direct identification (pointing by finger / pencil, etc.) of A-SMGCS position indication
c) By comparison of a concrete radar position indication with:
    - Aircraft position visually observed by controller;
    - Aircraft position reported by pilot; or
    - Identified indication of radar position displayed on the surveillance radar screen;

d) By handover of radar identification
e) By automatic labelling of SQB transmitter equipped vehicles

Note 1: Automatic identification is possible only when aircraft has a valid flight plan, is equipped with Mode S and has correct Mode A setting.
Note 2: Identification of vehicles is guaranteed for cooperative targets by automatic designation of a vehicle with a callsign.

4.3.4 A-SMGCS Operating Procedures

Operating procedures define utility of the A-SMGCS for control of the airport traffic. The procedures make it possible for the tower controller to issue instructions and clearances to airport traffic using information provided by the A-SMGCS.
Apart from duties resulting from this directive, controllers must comply with other Czech aviation regulations and operational documents.

4.3.4.1 System configuration

The basic system configuration consists of four working positions. These positions are as follows:

- TPC,
- TEC,
- GEC,
- CDD.

All working positions have common HMI setting. This setting is fixed.

Current state of stop-bars is indicated on the radar display.

The display makes it possible to outline RWY, TWY and apron restricted areas. These portions of airport are marked with red borderline (Temporary maps).

The display makes it possible to outline RWY responsibility area. Current state of these portions is marked with red dashed bar.

4.3.4.2 Operating procedures for manual target marking

The following procedures aim to reduce the probability of not noticing migration of label on the RWY:

- A moving target on the RWY cannot be manually correlated.
- Any manual correlation has to be marked by „M“ letter on strip.

4.3.4.3 Operational limitation of manually labelled target

The A-SMGCS has been operating in a mixed environment. That means that not all vehicles or aircraft are equipped with Mode S transponder or their Mode S is inoperative.

The physical closeness of targets on the ground can cause migration of labels among the targets.

It is unlikely that the label will migrate between two correlated targets. Such a migration can be rather expected between one marked primary target (SMR) and another unlabelled target. In this case the controller will use the TRACK RELEASE function to erase the label.

Before manual correlation of target within the scope of the controller's responsibility, which has not been automatically labelled or its label has been lost or the crew hasn't complied with prescribed procedures, use the set phraseology.

We can assume that the controlled who manually labels a target **notices** its possible migration to an unlabelled target. However, during hand off of responsibility from one control position to another, there is a certain danger that the migration **won't be noticed.** The new controller doesn't need to realize that the label has migrated.

4.3.4.4 Arrival window

A callsign of an arriving aircraft is displayed in the IAW (Impending Arrival Window) in time intervals of 30, 45, 60, 75 and 90 seconds before its arrival over the THR of the runway.

4.3.5 Operational Procedures

Operational procedures are defined for arrivals, departures and vehicles operating on the airport manoeuvring area.

4.3.5.1 Surveillance

4.3.5.1.1 Outbound

When an aircraft is identified - automatically or in a different way, displayed data can be used as follows:

- Manual aircraft labelling on the airport movement area outside the RWY zone in case that it hasn't been labelled automatically,
- Use information about crossed stop-bar prior to possible issue of landing clearance,
- During take off, use information about position of the target relative to the THR for application of reduced separation minima for one RWY (after authorization of these minima).

4.3.5.1.2 Inbound

When an aircraft after landing is identified - automatically or in a different way, displayed data can be used as follows:

- Use information about vacating of CAT I protective zone, CAT II / III respectively,
- Manual aircraft labelling on the airport movement area outside the RWY zone in case that it hasn't been labelled automatically,
- Get information about crossing of RWY or TWY without the crew reporting this crossing.

4.3.5.1.3 Vehicles

When a vehicle is identified - automatically or in a different way, displayed data can be used as follows:

- A vehicle not equipped with the SQB transmitter will not be cleared to cross or enter the RWY. To get the clearance, target must be automatically labelled and carry the „◊" symbol
- Use information about crossed stop-bar prior to possible issue of landing clearance,
- During RWY maintenance it is considered sufficient when only one vehicle, which is in charge of the maintenance is labelled.

4.3.5.2 Control

Description of control function will be amended before its introduction into regular operation. So far, the only control function which is now being used is the control of unauthorized crossing of stop bar.

4.3.5.2.1 Stop bars monitoring

The system monitors unauthorized crossing of stop bar before entering the RWY.
Unauthorized crossing of stop bar is displayed on the A-SMGCS monitor by a switchable audio signal and indication of the information with the appropriate stop bar.

CROSSED

After such information has been displayed, the controller asks the crew whether they stay at the holding point and checks the possible movement of the aircraft, respectively its position, on the A-SMGCS monitor. In case that the aircraft crosses the CAT II / III holding point, but not the one for CAT I, the following information will be passed to the inbound aircraft:

LLZ CAT III sensitive area infringed. (type of aircraft) crossed CAT II/III holding point

Information about possible infringement of the LLZ protective area must be transmitted to the crew of the arriving aircraft if they are 1 NM or further from the THR.

When an aircraft crosses not only the CAT II / III holding point, but also the CAT I holding point, the following information will be passed to the inbound aircraft:

Essential local traffic information. (type of aircraft) infringed CAT I holding point

4.3.5.3 Controller Working Positions and their Responsibilities

4.3.5.3.1 TSC – Tower Senior Controller

The TSC has the following duties during control of the airport traffic on the airport movement area associated with the A-SMGCS:

- TSC has the final decision about operating condition of the A-SMGCS system.
- Informs the ASC and airport operator about the A-SMGCS operating condition.
- TSC has the final decision about total non-readiness of the A-SMGCS services on the airport.

4.3.5.3.2 CDD – Clearance Delivery Dispatcher

The CDD has the following duties associated with the A-SMGCS:

- CDD enters callsign of a VFR flight without a flight plan into the DEP table by using the EDIT function

4.3.5.3.3 GEC – Ground Executive Controller

The GEC has the following duties during control of the airport traffic on the airport movement area associated with the A-SMGCS:

Departures

- When aircraft requests push-back or taxi and its label is already displayed, checks whether the position of label corresponds with reported number of stand.
- Asks aircraft with switched-off Mode S transponder to switch it on by using phrase **„SQUAWK ON“**.
- Makes manual labelling of aircraft without automatic label after this has been identified.
- Does not make any manual labelling of aircraft out of is scope of responsibility or when such a correlation has not been coordinated with neighbouring working position.
- Marks a manually labelled target with the letter „M“ on the paper strip.

Arrivals

- Asks aircraft after landing, which switched off the transponder after vacating the RWY to switch it on again using a phrase „SQUAWK ON UNTIL REACHING THE STAND“.
- When aircraft parks at its stand and its Mode S is still on, the GEC asks the crew „SQUAWK STANDBY“.
- Makes a manual labelling of aircraft without automatic label after this has been identified.
- In case of the P3D-AS failure, the controlled has the right to quit using the A-SMGCS for control of the traffic on the airport manoeuvring area and use the surveillance information only for monitoring of the primary targets.

4.3.5.3.4 TEC – Tower Executive Controller

The TEC has the following duties during control of the airport traffic on the airport movement area associated with the A-SMGCS:

- After request from the TPC, hands over the responsibility for a corresponding RWY to the TPC by clicking this RWY icon.
- Asks aircraft after landing, which switched off the transponder after vacating the RWY to switch it on again using a phrase **„SQUAWK ON UNTIL REACHING THE STAND**“.
- In case of the P3D-AS failure, the controlled has the right to quit using the A-SMGCS for control of the traffic on the airport manoeuvring area and use the surveillance information only for monitoring of the primary targets.

4.3.5.3.5 TPC – Tower Planning Controller

The TPC has the following duties during control of the airport traffic on the airport movement area associated with the A-SMGCS:

- Manually labels vehicles not equipped with the SQB transmitter which don't have an automatic label when entering the airport manoeuvring area (except for the RWY). Callsigns are pre-set in an appropriate chart.
- Clears cooperative targets (this is only vehicles equipped with the Mode S transmitter) to cross the RWY.
- Hands back the responsibility for RWY operation to the TEC by clicking on the appropriate icon.
- In case of the P3D-AS failure, the controlled has the right to quit using the A-SMGCS for control of the traffic on the airport manoeuvring area and use the surveillance information only for monitoring of the primary targets.

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4.3.5.3.6 Operational Interpretation of the Procedures

The TWS decides about manual labelling of targets. This decision depends on the amount of airport traffic. To get a reliable surveillance information it is essential that the GEC makes manual aircraft labelling in the maximum possible way. Manual labelling of vehicles not equipped with the SQB transmitter is not compulsory.
A crossed-bar alert before entering the RWY does not necessarily mean prohibition of landing on this RWY.

4.3.5.4 Phraseology – Mode S Ground Operations

Example 1

After landing, aircraft equipped with Mode S transponder vacates the runway and:

- *Its automatic label disappears*
- *Aircraft identification disappears and remains only Mode A (e.g. A2000)*

SQUAWK ON UNTIL REACHING THE STAND

Example 2

After landing, aircraft equipped with Mode S continues with working SQUAWK to its stand. When it finally parks at its stand, please use the following phrase:

SQUAWK STANDBY

Example 3

Outbound aircraft equipped with Mode S has received its push-back or taxi clearance but cannot be seen on the surveillance radar screen (there is no answer from the Mode S).

SQUAWK ON

4.3.5.5 Operational procedures when A-SMGCS is out of work

- Tower Senior Controller

TSC immediately informs the ASC that the A-SMGCS is U/S.

5 Annex II - Toulouse-Blagnac Airport

5.1 Airport global description

5.1.1 Airspace and Airport configuration characteristics

The international airport of Toulouse Blagnac is situated Southwest of France and depends on the Toulouse Control Centre. Figure 5-1 shows the area of ATC competence of Toulouse Control Centre.

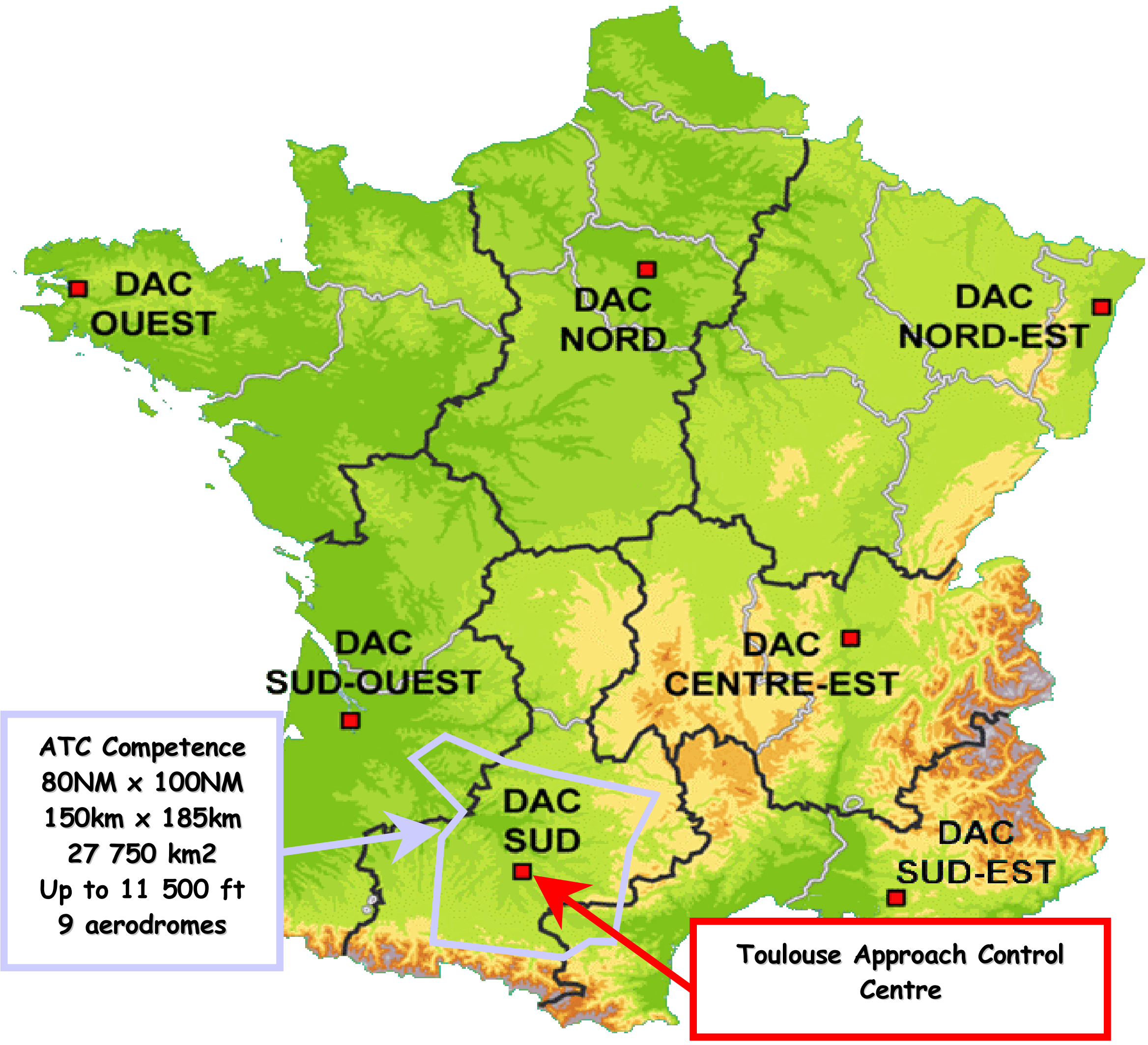


Figure 5-1 Location of the Toulouse Blagnac Airport

5.1.1.1 Airport areas and aerodrome characteristics

5.1.1.1.1 Airport description

The Toulouse airport has two dependent runways oriented QFU 14 and 32. The Toulouse airport runways and taxiways layout is presented. “Bikini” is the apron area dedicated to Airbus test and certification activities and thus restricted to Airbus Aircraft.

Blagnac 2 and Blagnac 1 represent the apron area for commercial, freight and business operations. The Darse and Golf parking are mainly for maintenance and sundry aeronautical activities and general aviation aircraft can park at Charlie area.

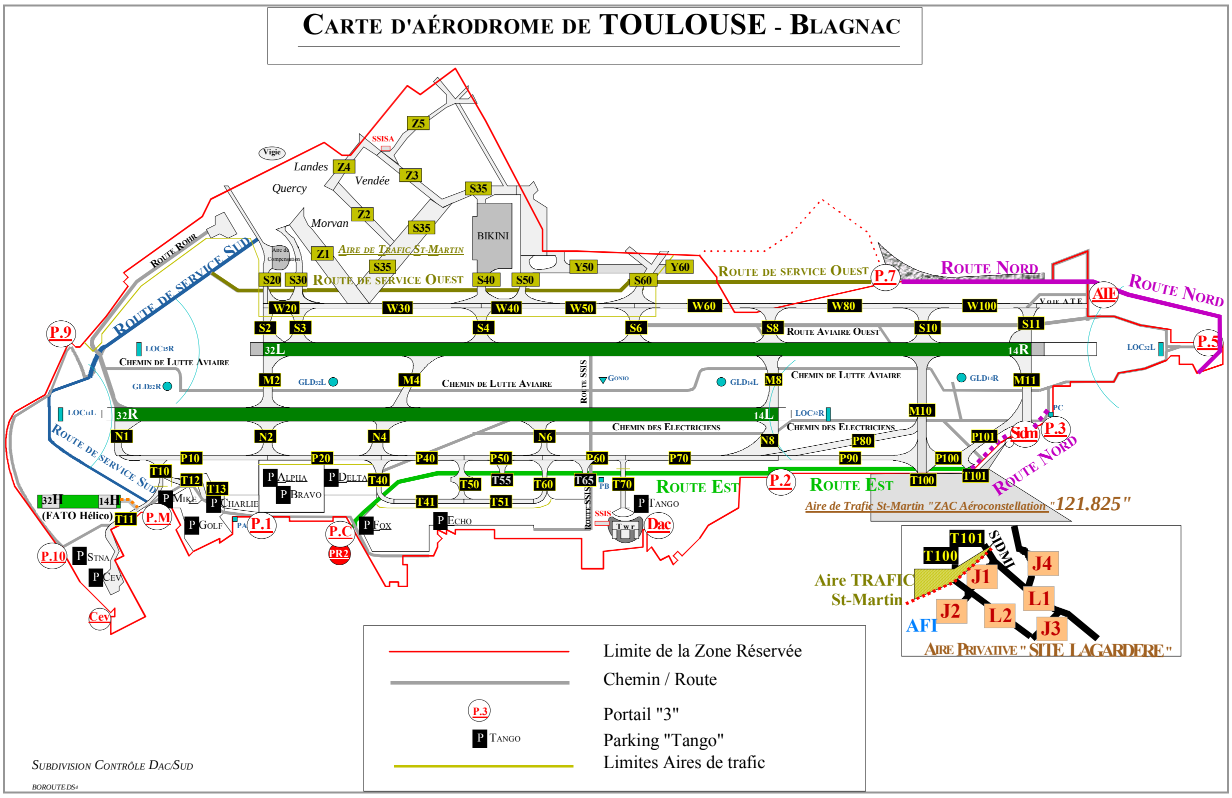


Figure 5-2 Toulouse Runways & Taxiways

5.1.1.1.2 Configurations

The two runways are separated by 300 meters. They are, as such, considered as dependant runways. There is just one QFU used in LVP condition: 14 R. Both runways are used for landing and take off purposes even if the runway (14R - 32L) is more often used. For example, in 2001, two third of the total landing and four fifth of the take-off have been made on runways (14R - 32L). However, in the future there is a trend to use more extensively the runway (14R - 32L) for environmental purposes.

5.1.1.2 Airspace characteristics

The region of Toulouse presents intense aeronautical activities. As shown in. There are several aerodromes (LFCK, LFBF, LFBR, LFCX, LFCI, LFMK, and LFDJ) around Toulouse to which the Toulouse Control Centre provides approach control services. Moreover, Toulouse airport itself has to cope with commercial activities mixed with Airbus trial and certification activities.

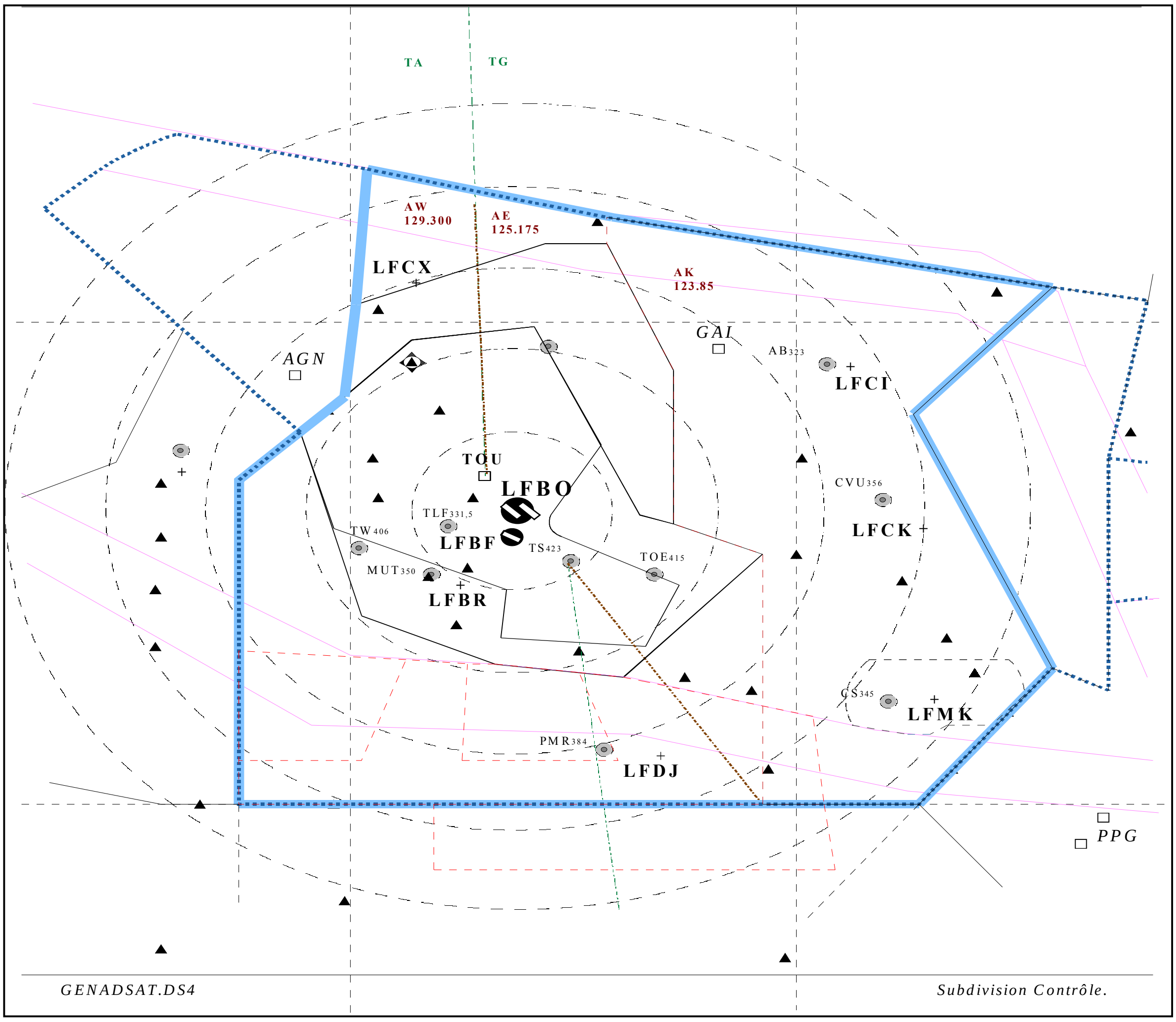


Figure 5-3 Toulouse surrounding air traffic

5.1.1.3 Route Configuration & Complexity

The SID/STAR systems and patterns used to feed the airport runways are presented in Figure 5-4 and in Figure 5-5.

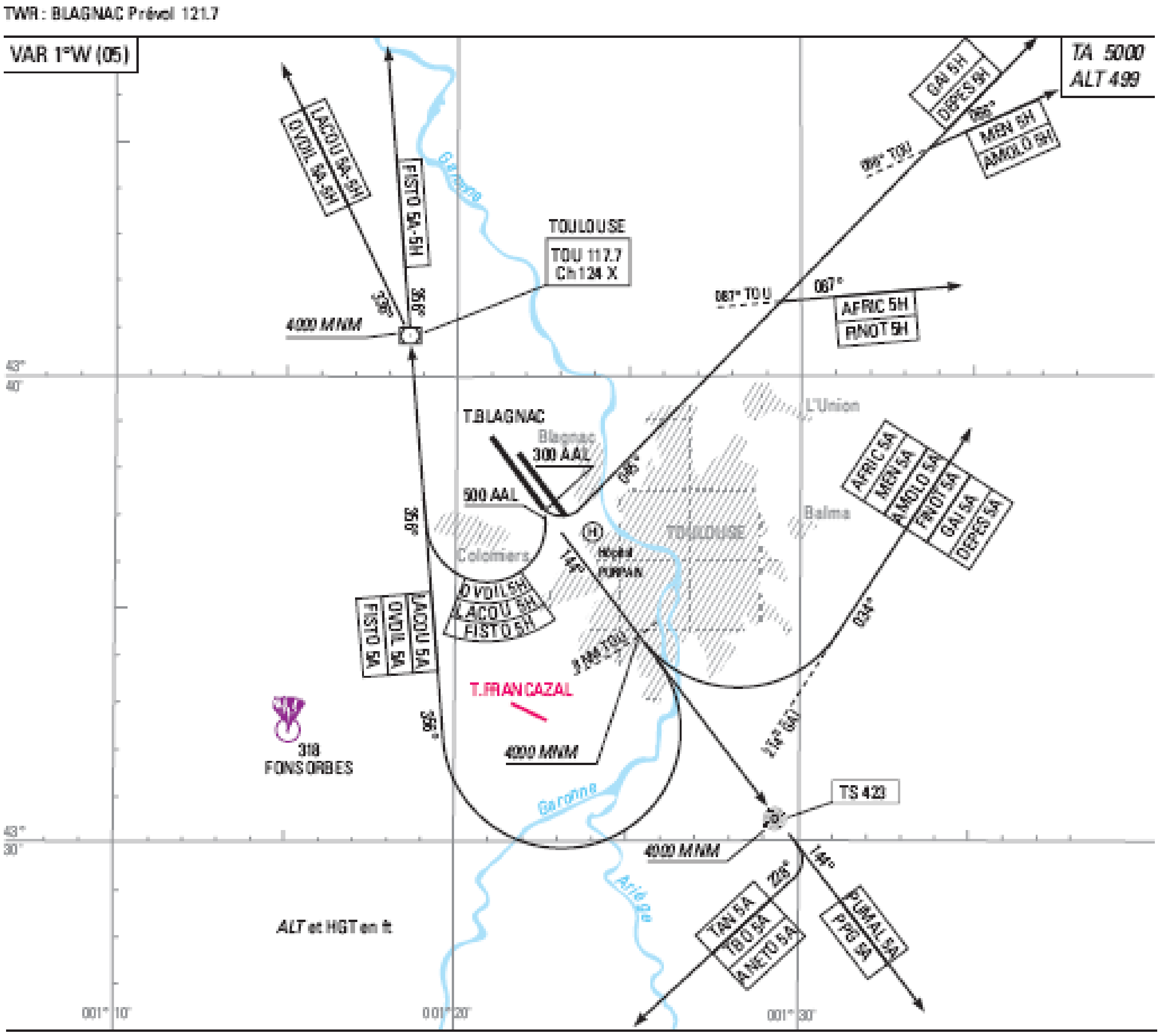


Figure 5-4 SID / STAR 14 L / 14 R

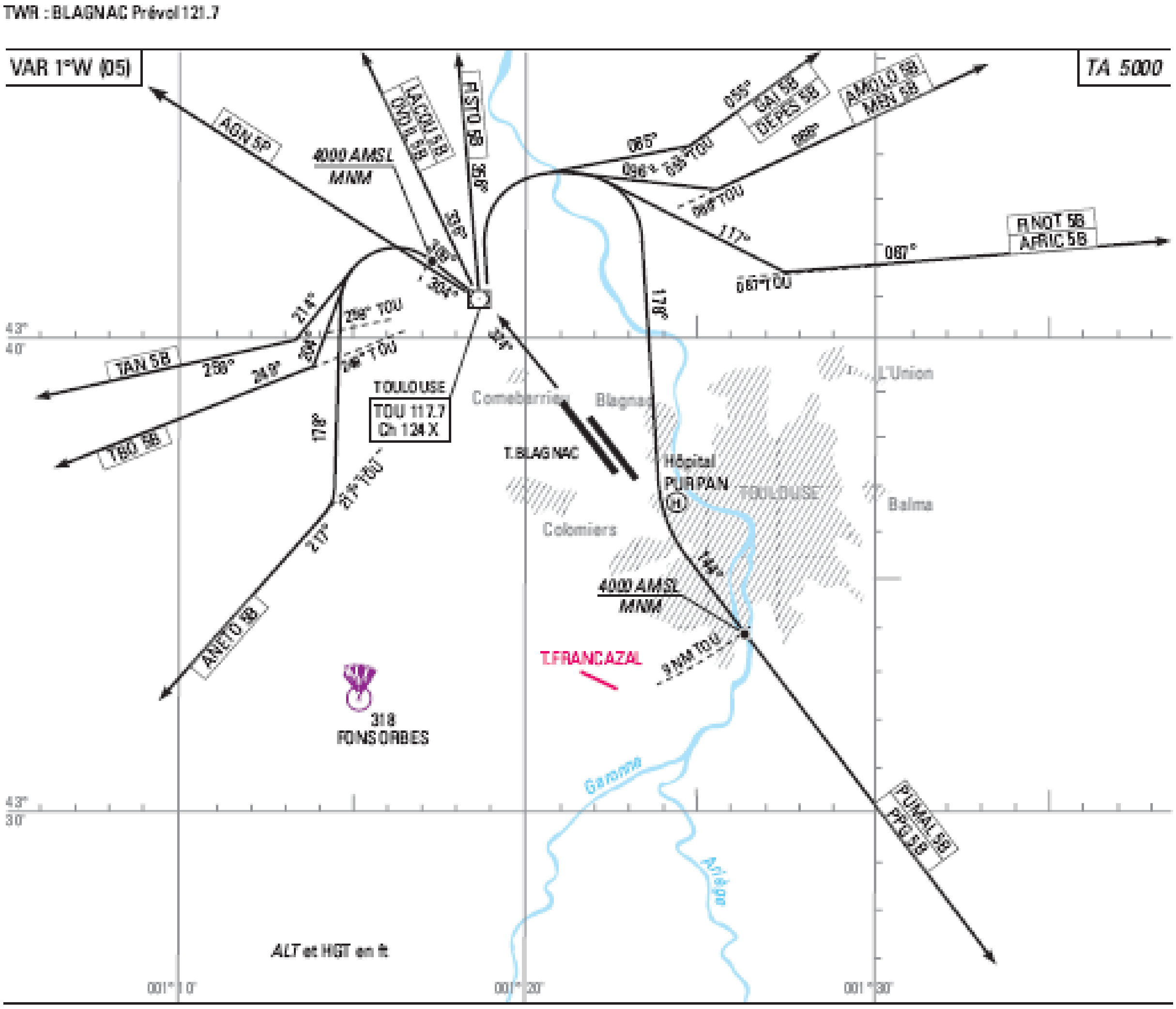


Figure 5-5: SID / STAR 32 L / 32R

5.1.1.4 Traffic characteristics

5.1.1.4.1 Traffic/Schedule Demand

Figure 5-6 shows the evolution of traffic since 2001.

Year	2001	2002	2003	2004
Pax	5 244 465	5 338 707	5 304 922	5.612.638
Commercial movements	86 119	82 260	78 436	77.291

In 2003 and 2004, the Toulouse control centre traffic figures are the following:

Year	2003		2004	
	Tlse airport	App. Centre	Tlse airport	App. Centre
Number of IFR	91 067	109 059	89 376	106 046
Number of VFR	4 339	22 811	3 072	20 572
Total traffic	95 406	131 870	92 448	126 618
Hourly peak*	38	47	35	44
Daily peak*	351	464	348	412
Monthly peak*	8 153	9 884	7 989	9 554

* IFR only

The actual human (controllers), technical (equipment) and organisational (sectorisation, SID/STAR system…) control resources are sufficient to cope with the traffic. From the figures above, it could be stated that the Toulouse airport is not saturated and does not generate traffic delay (except in LVP conditions).

Nevertheless, 80 % of the traffic is coming and departing on a North-South axis (mostly because of Paris connection and links with North European cities such as Frankfurt, Amsterdam, Brussels, London…). This implies that the North-South oriented SID/STAR track system is heavily used by the traffic. This particularity creates from time to time a bottleneck on the SID/STAR track system that will probably be revised in the near future.

On one hand, the Toulouse airport traffic is constant over the year except in August and during Christmas time. On the other hand, it is not regularly spread over the week and the day as shown in Figure 5-7.

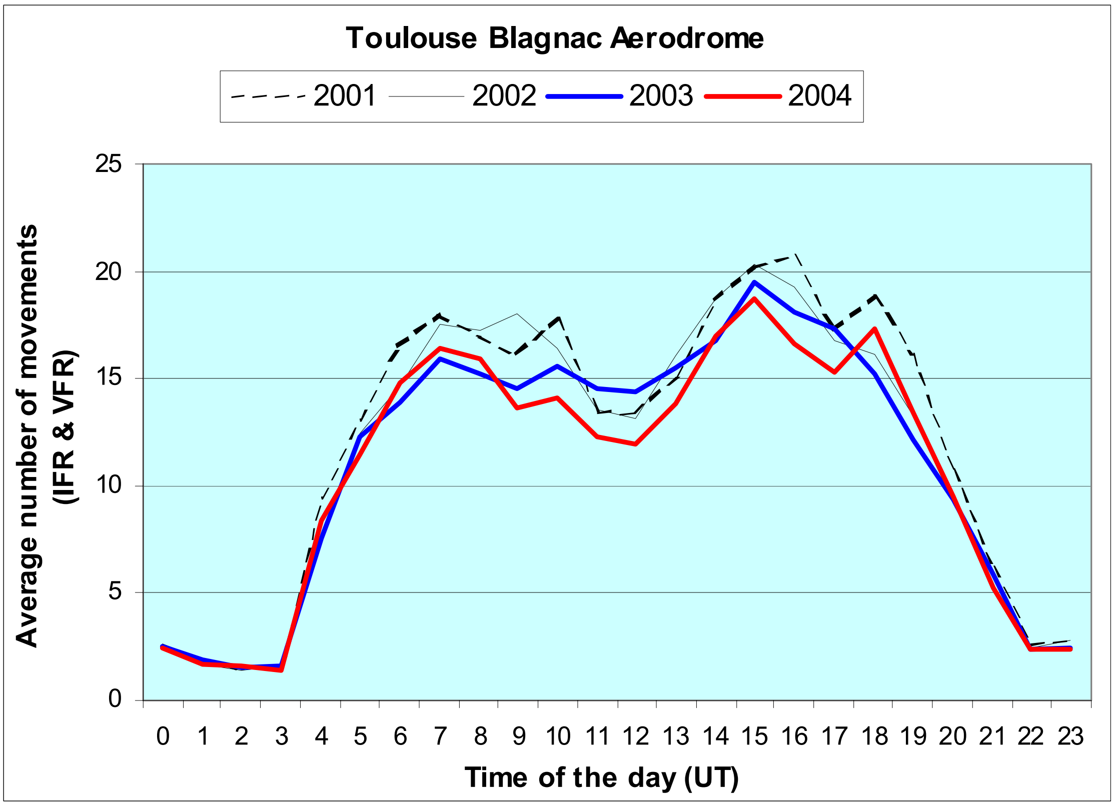


Figure 5-6 Toulouse Traffic Growth

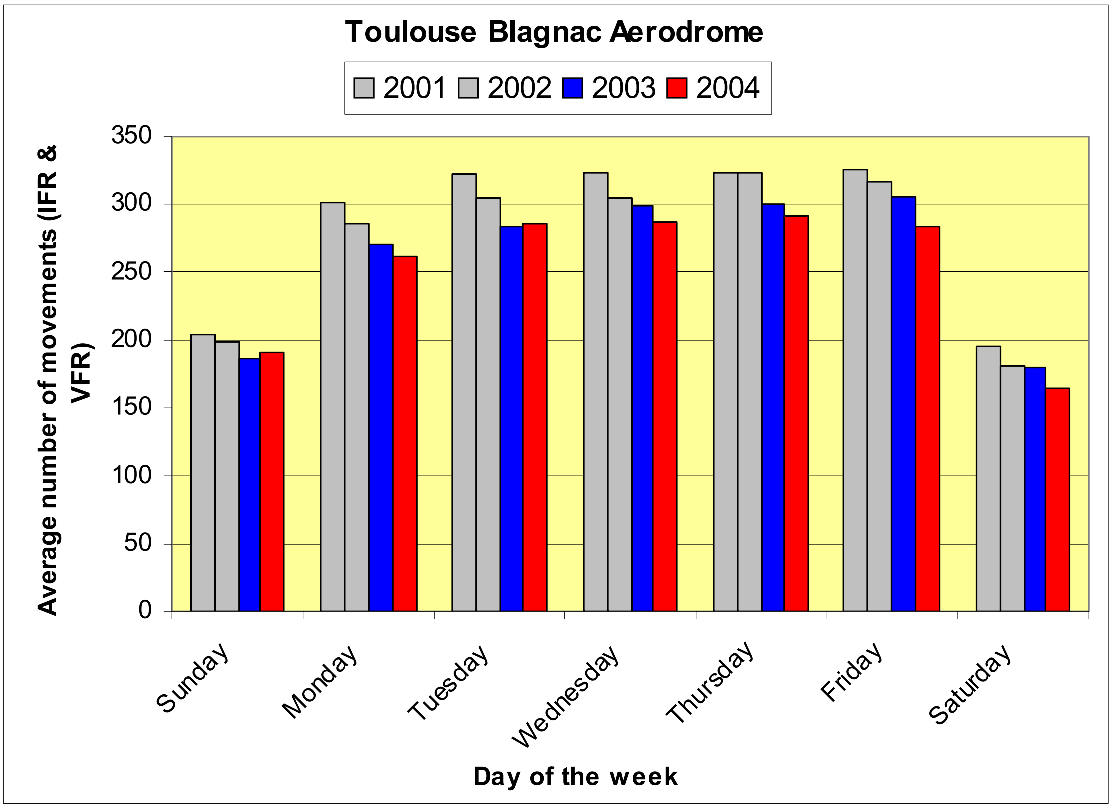


Figure 5-7 Distribution of the traffic per day and per week

5.1.1.4.2 Runway Occupancy

Runway occupancy times for landing aircraft vary from 45 to 80 s, also depending on runway and taxiway configuration and traffic characteristics. Average time interval between two departing aircraft ranges from 60 to 120s but it is also depending on wake turbulence separation minima.
For purpose of inspections and maintenance, vehicles operate on the runways approximately one hour per day. Such operations are co-ordinated with aircraft movements by TWR controllers, and the effect on runway throughput is usually limited.

5.1.1.4.3 Airworthiness Criteria

Normal JAA regulations apply for take-off and landings.

5.1.1.4.4 Air operator Certification

Normal JAA regulations apply for take-off and landings.

5.1.1.5 Vehicle mix

Vehicles operating at the Toulouse-Blagnac airport can be grouped into the main categories of vehicles than operate at other airports [ref. 4.1.1.4; ref. 6.1.1.4]
Furthermore at Blagnac is operating a whole bunch of vehicles belonging to Airbus, those are used for the trials to be performed on site by Airbus, in the EMMA context.

5.1.1.6 Weather conditions

The operational conditions are related to the meteorology:

- VMC : Visual Meteorology Conditions
- IMC : Instrument Meteorology Conditions
- LVP : Low Visibility Procedures

Toulouse airport experiences an average of 20 days per year of LVP (Low Visibility Procedures) conditions. The LVP are triggered upon the occurrence of a visibility less than 1000 meters or a cloud ceiling less than 200 feet. In that case, the ATC capacity is reduced in order to operate safe landings and take-off.

5.1.1.7 Complexity

Toulouse airport presents a complex layout which requests high attention from the air traffic controllers, aircrews and vehicle drivers. Especially in bad weather conditions, the complexity of this airport can provoke high stress situations for the tower controllers and can lead to misinterpretations and false estimations by pilots and drivers. The following elements participate to the complexity of this platform:

- Toulouse airport has more than one runway and these ***runways can not be operated independently***. Specially crossing runways or closely spaced parallel runways request a higher alertness level when they are in operation at the same time;
- A ***runway could also be used as taxiway*** at the same time. This situation occurs when landing or departing aircraft have to do backtracks on the runway when there is no taxiway available at the beginning or at the end of the runway (LVP conditions);
- An ***active runway has always to be crossed*** by aircraft taxiing to or from the parking positions or by vehicles operating on the manoeuvring area;
- Toulouse airport has ***more than one apron***. Several aprons, i.e. for passengers, freight, business, general aviation and sundry aeronautical services, can cause difficult taxi procedures, especially when taxies, runways or another apron have to be crossed. Furthermore, Toulouse airport experiences a high traffic mixture between civilian, training and certification aircraft, VFR and IFR traffic and between passenger and freight flights. Mixing traffic requests high attention when a large apron is divided in different parking zones or when several aprons exist for the different traffic (as shown at Toulouse airport).
- Toulouse airport has a ***taxiway system with a great number of intersections***. Especially in bad weather conditions, a false estimation by pilots or drivers is possible and likely to occur;
- A ***taxiway has to be shared*** by landing and departing aircraft or by aircraft and vehicles at the same time. These situations occur when the airport has an adverse location in reference to the runway.

Another aspect is the ***mix of arriving and departing movements*** on the airport that means crossing flows of aircraft going to and from different aprons or parking. This situation is increasing the risks of conflict on the airport. Here again, there is a strong correlation with the weather conditions. Those increase the size of the problem as they worsen to the limit of VFR operation.

5.1.1.8 CNS Coverage

5.1.1.8.1 Communication

VHF radio communication is the main communication means for controlling aircraft and vehicles. Dedicated channels are used to support TWR communications with aircraft and vehicles. Multiple channels are usually used for controlling different parts of the airport. In addition to voice communications, visual aids such as taxiway lights, intermediate holding points and stop bars are also used to communicate information that is essential to support surface movements.

5.1.1.8.2 Navigation

There are several navigation means installed such as VOR, NDB, VOR-DME, ILS, MLS and GBAS. None of these aids is of any significance to surface navigation. Visual aids used to support movements on the airport include signs, markings and lights. There are different types and configurations of taxiway and runway lights, including centreline and edge lights and stop bars.

5.1.1.8.3 Surveillance

Toulouse control centre is able to provide a 3NM separation thanks to the combination of a mixed radar information coming from:

- a primary radar located in the airport vicinity,
- a SSR radar located close to Toulouse airport,
- several SSR radar located in the South West of France,
- a ground surface radar (operational 2006),
- 3 Magnetic loops for the stop bars,
- Surveillance Camera on runway threshold.

5.1.1.8.4 System failure management

A set of Failure Management procedures, according to the failure categories list, is implemented at Toulouse-Blagnac airport. These Procedures are described in the Aeronautical Information Publication for Blagnac Airport.

5.1.2 AIR Traffic Services

5.1.2.1 ATC Divisions and Responsibilities

The Toulouse Control Centre, situated in Toulouse Blagnac airport provides the following services to airspace users:

- Ground Control,
- Aerodrome Control,
- Approach Control,
- Flight Information and Alert Services.

5.1.2.1.1 Ground controller tasks

<u>In the traffic area:</u>

- Provides information and alert services in the traffic areas with the exception of the area of Saint Martin, where only the alert service is provided when the Saint Martin tower is closed.
- Ensures the information of traffic in interfering movement, when in contact on one control frequency.
- Approves pushback operations.

<u>In the manoeuvring area:</u>

- Authorizes the taxiing and provides air traffic services (Control, Info and Alert).
- Possibly inputs a strip concerning a movement of aircraft / vehicle on this area.
- Organizes efficiently the ground taxiing according to de-icing, slots, aircraft type, SID.
- Coordinates entrance on runway(s) or runway restricted area(s) with the LOCAL.
- Limitation of use of the taxiway M10: coordinates and transfers to the Local Sector on ways P90 or P100 (taxiing clearance limit) any aircraft height superior to 10m, before entrance on taxiway M10.
- Co-ordinates with the Aerodrome controller any intermediate take-off request. Activates the flight plans: IFR, VFR via BRIA (Bureau Régional d'Information et d'Assistance au Vol), the Information and flight support Regional office, with the estimated take-off time (t~+4 ')
- Checks the correspondence of the transponder code with that of the pending strip.
- Assumes responsibility for aircraft leaving the apron (managed by CCIT, airport manager).
- Gives clearance for taxi to apron.

5.1.2.1.2 Aerodrome controller tasks

Taxiing Of Aircraft:

- Vacates the critical areas of the ILS.
- Reminder:
    - The taxiway M2 is in the critical area of the GLIDE 32L,
    - The access to the threshold 32R is in the critical area of the GLIDE 32R,
    - The taxiway M8 is in the critical area of the GLIDE 14L,
    - The taxiway M11 is in the critical area of the GLIDE 14R.

Departures:

- Aircraft on TWR frequency contact before any entrance (alignment or crossing) on one of the runways.
- In case the aircraft taxies for the 32L holding point, reminds him that he will have to maintain position before crossing the runway 32R (contractual information).

Arrivals:

- The crews retain full responsibility for the compliance to the marked stop points.
- Recommendation: When possible, and as soon as the speed is controlled, informs the aircraft, if need be, that he will have to remain between both runways (non-contractual information).
- The point of control handover is when both runways are vacated.

IFR Departures:

- Before transfer of the aircraft, ensures that its transponder is working.
- Updated active strip when a clearance requires co-ordination.
- For the departures "4H", makes sure turn has started before transfer.
- In case of late turn, co-ordinates with the concerned TMA sector (departures "4H" and circuits).
- Transfers to the Approach the outbound aircraft separated between themselves and of the local traffic.

IFR and VFR arrivals:

- Transfer aircraft on Ground or St Martin frequency after having delivered runway-crossing clearances.
- If required, inform the aircraft that he will have to remain between both runways.

M10 Use Limitation:

- Ensures the compatibility of a 32R take-off or a 14L landing with an aircraft of height superior than 10m that must borrow the M10 way, either when exiting runway 14R / 32L, or when coming from the “P” taxiways.

Vehicles and tows:

- Except for high-speed runway crossings co-ordinated beforehand with the GROUND Controller, transfers on TWR frequency all vehicles and towed aircraft that must taxi on a runway.
- Touch & go, go-around (VFR / IFR):
- Delivers departure clearance before landing, and if required, activates the flight plan.

VFR:

- Check the transponder working order.
- At the exit of airspaces: asks for transponder to be on "7000, if Alticoder", except for coordinated aircraft.

5.1.2.1.3 Approach Control and flight information services

The approach control services and flight information services are provided to all flights situated in the vicinity of Toulouse Control Centre (see Figure 5-1).

5.1.2.2 Controller Working Position (TWR)

Toulouse tower layout is shown on Figure 5-8.

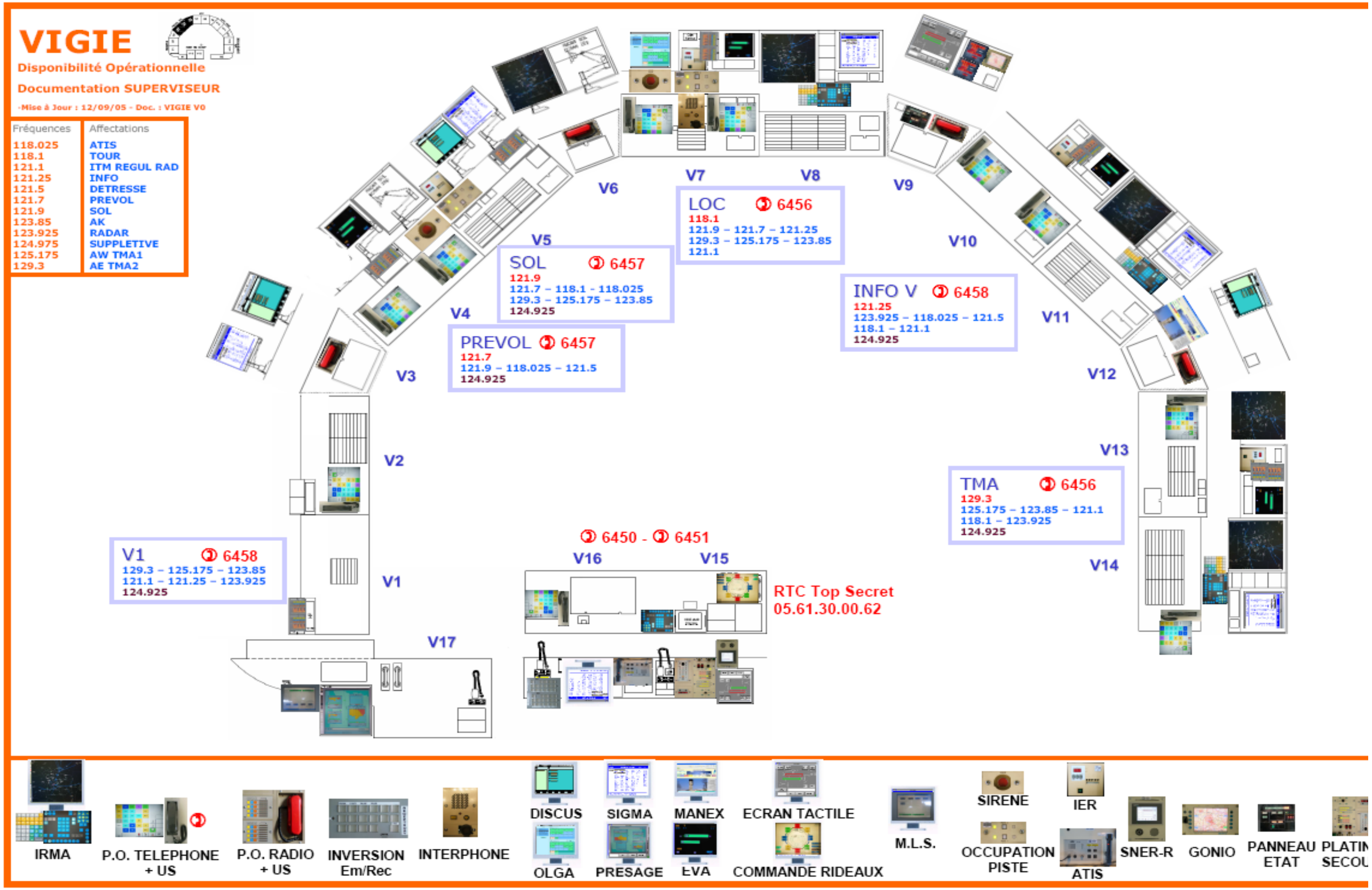


Figure 5-8 Toulouse TWR description

6 main control positions are available :
- CHEF DE QUART : TWR chief
- SOL : ground control
- PREVOL : pre-flight
- LOC 1 &2 : runway control
- ASS. LOC : assistant to runway control

2 additional approach positions (TMA and ASS. TMA) are used during periods of low traffic (closing of IFR room).

In addition to the standard equipment (phone, strip printers, etc.), several tools are available :
- DISCUS : flight management tool (described in D1.2.1)
- OLGA : approach configuration management tool
- SIGMA terminal : meteorological and airport configuration display
- PRESAGE : global en-route flight visualisation tool (1-min refreshment rate)
- IRMA : approach radar HMI

The new SMGCS HMI (Radar sol) also appear on Figure 5-8. These HMI have already been installed in the tower and their operational evaluation by controllers is under progress. They will become operational in April 2006.

The EMMA A-SMGCS HMI will be installed on V2 position.
On this position, the controller has also access to :
- (passive) R/T communication
- a DISCUS terminal (on V3 position), the flight management tool.

From this position, the controller has a view on the main terminal apron area, on part of the main taxiway and of the runway, as shown on the following pictures.

Figure 5-9 Future EMMA position in the tower (V2)

Figure 5-10 View on the main terminal apron area

Figure 5-11 View on the main terminal apron area

5.2 Local Current Operations

5.2.1 Operational Procedures

5.2.1.1 Separation Minima

The surveillance equipment of the Toulouse airport is used by the ATC to separate aircraft established on the same ILS localizer course with a separation minimum of 3NM unless increased longitudinal separation is required due to wake turbulence. In practice, the ATC separates aircraft with a two minutes interval that represents approximately 5 to 6NM longitudinal separation (according with aircraft weight).

On the airport surface, there are no separation minima defined in terms of lateral or longitudinal distances. In good visibility, conflict avoidance is based on visual principles ("see and be seen") and instructions and traffic information issued by ATC. There are restrictions on taxiways and aprons for low visibility conditions when the airport is operating in accordance with a dedicated set of rules referred to as Low Visibility Procedures (LVP). In such conditions restrictions apply. For instance, taxiways are restricted to be occupied by only a limited and fixed number of simultaneous aircraft operations.

5.2.1.2 Outbound flights

Standard operations. See repartition of tasks between controllers [5.1.2.1.2] for detailed description.

5.2.1.3 Inbound flights

Standard operations. See repartition of tasks between controllers [5.1.2.1.2] for detailed description.

5.2.1.4 Vehicles

Standard operations. See repartition of tasks between controllers [5.1.2.1.2] for detailed description.

5.2.2 Low Visibility Procedures

When the visibility is less than 1000 meters, there is only QFU 14R on duty with one possible taxiing trajectory to join QFU 14R as shown in Figure 5-12. The LVP procedures require that two successive arriving planes be separated of at least 10 to 12NM which leads to a separation of 5 minutes between incoming planes. This constraint limits the total number of incoming planes to 12 planes per hour. In the same way, a departing flight should start its rolling before takeoff only if an approaching aircraft is farther than 6NM from its touch point. The combination of these two limitations accounts for a maximum ATC capacity of 24 aircraft per hour instead of 45 to 48 aircraft per hour.
When the visibility is less than 400 meters, the ATC authority prohibits the circulation of the service vehicles on the taxiway and the apron.

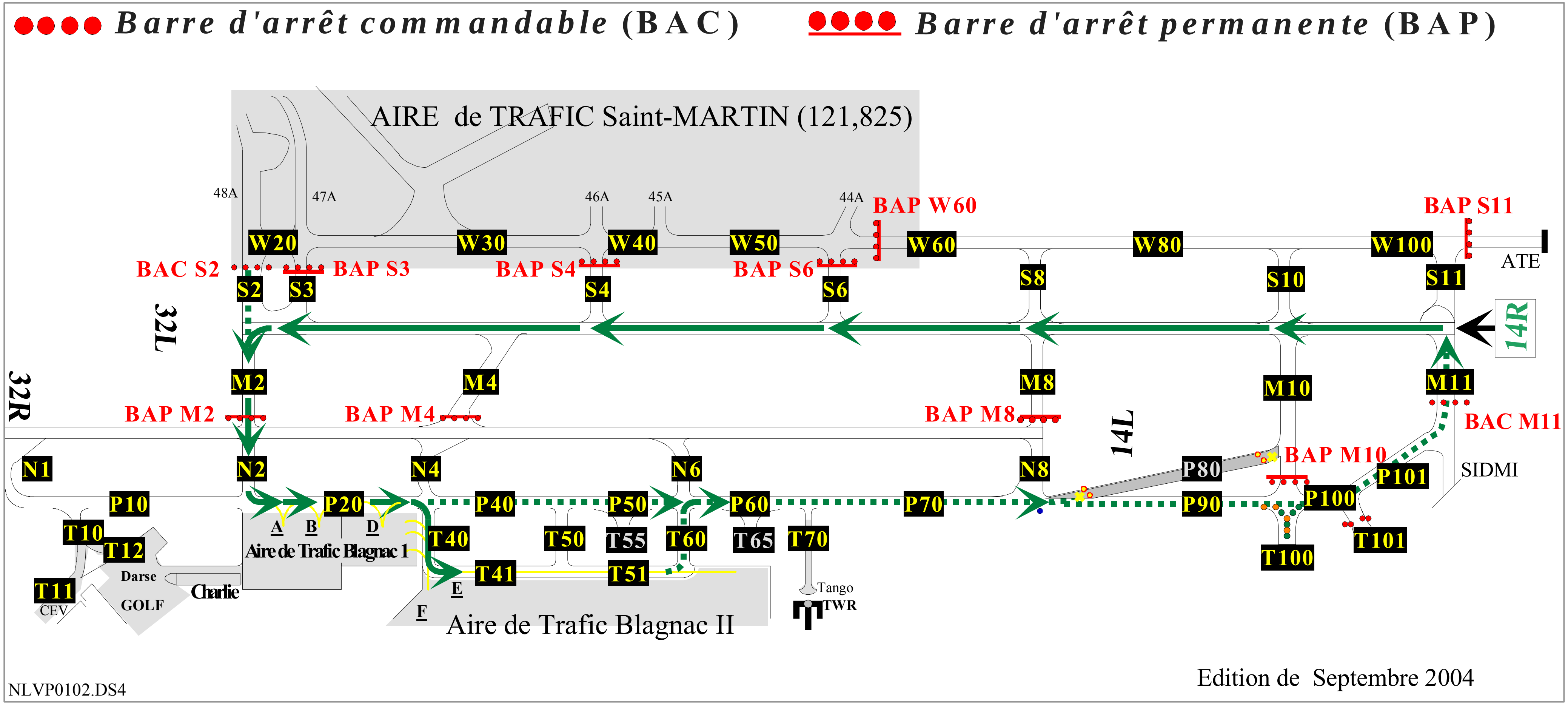


Figure 5-12 Toulouse LVP Configuration

5.3 A-SMGCS Operations (Levels 1 & 2)

Toulouse is currently equipped with no A-SMGCS system. The SMR is under installation and will be operational in April 2006. No A-SMGCS procedure can be defined for Toulouse airport, as the system is still not available : the definition of procedures is performed with the assistance of controllers and requires the actual implementation of the system.
However, SMGCS procedures have been defined by DSNA ATC services for Lyon, Toulouse, Bâle, Marseille and Nice airports. These SMGCS procedures will be specifically adapted to Toulouse airport operations, as soon as the SMR is available.
A-SMGCS procedures for EMMA will be derived from the Operational Requirements Documents and adapted to Toulouse airport, as soon as the full A-SMGCS system is available : this is the scope of the "operational feasibility" validation in the Toulouse test plan. The current document will be updated with Toulouse A-SMGCS procedures when they are defined.
The following sections are extracted from the DNA "Procedures for SMGCS" document. Expected benefits from the A-SMGCS, which will be installed in Toulouse for the needs of EMMA project, are also indicated in italic.

5.3.1 Overview

The SMGCS HMI displays, in real time, the position of mobiles (aircraft and vehicles) on the manoeuvring area and on the apron.
This graphical display complements but does not replace the direct view of the controller on the traffic. It also allows the confirmation of position reports. For this reason, the SMGCS HMI is a precious assistance tool, which helps the controller to safely and efficiently control ground traffic, especially during adverse conditions (night, low visibility, rains, etc.)

5.3.2 Technical limitations of SMGCS system

5.3.2.1 Position accuracy

- The position of mobiles is displayed, using a radar track symbol and/or an analogical plot (raw video).
- The size of the analogical plot does not fully reflect the actual size of the mobile.
- The centre of the analogical plot can differ from the geometrical centre of the mobile.
- **As standards for accuracy margins are currently not defined, taking into account the real size of mobiles, the SMGCS does not provide taxi radar spacing, nor taxi radar guidance.**

Using A-SMGCS, such operations will be allowed. However, standards for radar spacing and for tolerance of precision will have to be defined.

5.3.2.2 Primary detection

- The quality of detection is dependant on the number, on the type, and on the location of the sensors.
- It is also dependant on the airport environment (infrastructure, grass) and on the meteorological conditions (snow, strong rain, etc.).
- For this reason, some areas (building, grass) may be masked to avoid false detection.
- **In these areas, no track will be available. Near these areas, the quality of detection may be altered.**

It is expected that cooperative sensors, such as MLAT and ADS-B will enhance the performance of detection, especially in or near masked areas.

5.3.2.3 Radar tracking and labelling

- The radar tracking is only based on the surveillance data provided by the SMR. No identification information is received. For this reason, the labelling of a track (aircraft id, manual entry or system track number) is only kept as long as the tracking is maintained.

- Unwanted detection can generate unwanted tracks. For this reason, radar tracking is inhibited in areas generating a lot of unwanted reports (fixed targets, vehicle routes, etc.).
- The track can be lost in low detection areas. In this case, the labelling of the track is lost. When the mobile is detected again, a new track is created, labelled with a system track number.
- During the near crossing of two mobiles, a switch of the two labels may occur. The theoretical discrimination distance is 30m.

It is expected that cooperative sensors will solve most of these problems, and will allow to perform seamless radar tracking and mobile identification.

5.3.3 SMGCS procedures

5.3.3.1 Identification and labelling

Reading a report label is not, by itself, an identification **procedure.**

There are five identification methods :
- Correlation between a mobile ground radar position and its visually observed position,
- Correlation between a mobile ground radar position and the pilot's or driver's position report,
- Correlation between a mobile ground radar position and an identified air radar position,
- Handover of radar identification,
- Reading of the label of a report in final approach (the identification is inherited from the en-route FPM system)

The controller carries out the identification of any new mobile, using one the previous identification method.

The controller **maintains** the identification of the mobile using the radar tracking labelling.

If he/she has any doubt, a new identification if performed (e.g. close crossing of two mobiles and suspected switch of labels)

ICAO A-SMGCS manual indicates that, at level III, responsibility for identification is fully transmitted to the system.

5.3.3.2 Use of SMGCS

5.3.3.2.1 Use of Air display

- The aerodrome controller must not use the SMGCS HMI to ensure guidance and radar separation of air traffic.
- The ground controller can use these data to be informed about arriving flights.

5.3.3.2.2 Use of Ground display

The controllers can use the information displayed on the SMGCS HMI to :
- check that mobiles moving on the manoeuvring area respect delivered clearances and instructions,
- confirm that the runway is cleared before giving a take-off or landing clearance,
- provide information on local and nearby traffic,
- confirm the position of mobiles on the manoeuvring area,
- provide guidance service to aircraft traffic on ground, using turn clearances at intersections, when the pilot requests it or when the controller considers it is necessary,
- provide assistance and information to emergency vehicles.

5.3.3.2.3 Use of available data sources and fallback procedures

The raw video is always displayed : it allow to detect mobiles that do not fulfil the radar tracking criteria.

Situation 1 :
Failure of analogical video but synthetic tracks remain available => some mobiles may not be tracked. The responsible person decides if the HMI is still usable, taking into account visibility conditions.

Situation 2 :
Synthetic tracks are not available, but analogical video is still available => switch to "assistance mode"
The system is still usable with synthetic tracks but no labelling is possible. The controller will request additional pilot reports.

Situation 3 :
Synthetic tracks are not available in normal mode and in assistance mode, but analogical video is still available.
The system is still usable with analogical video but keeping radar identification is more difficult. The controller will request additional pilot reports.

5.3.3.3 Low visibility conditions

The use of SMGCS does not modify other regulatory requirements about lighting and taxiways.

5.3.3.3.1 Visibility condition 2

The controller ensures surveillance of ground traffic using pilot's and driver's position reports.
The use of SMGCS may allow to reduce the number of reports and to relax taxiing constraints.

5.3.3.3.2 Visibility condition 3

Pilots are not able to ensure their own separation with other aircraft. The controller ensures surveillance and separation of ground traffic using pilot's and driver's position reports.
The use of SMGCS may allow to increase the number of aircraft and vehicles and to relax taxiing constraints.

5.3.3.3.3 Visibility condition 4

No operation is allowed.

5.3.3.4 Failure of stop bars

If RVR < 150m, only one aircraft is allowed on the manoeuvring area. The number of vehicles shall also be minimal on the manoeuvring area.

6 Annex III - Milan-Malpensa Airport

6.1 Airport global description

6.1.1 Airspace and Airport configuration characteristics

6.1.1.1 Airport areas and aerodrome characteristics

Milan Malpensa airport is one of the major airports in Europe (ranked 15th in 2001 in terms of passengers). It is the second airport in Italy after Rome Fiumicino and the first airport in Milan before Linate. It is 21,58 NM far from Milan in the NW direction. Malpensa airport is opened H24.The ARP (Airport Reference Point) has the following coordinates:

Frame of reference	LAT	LONG
ED50	45°37’51’’N	08°43’27’’E
WGS84	45°37’48’’N	08°43’23’’E

Table 6-1 Airport Reference Point Coordinates

The Elevation of the airport is 767 FT and the Reference Temperature 27,9°C.

There are two passenger terminals at Malpensa:

1. Terminal 1, opened in 1998, is mainly used by scheduled aircraft operators. It is currently equipped with two satellites and a third one is under construction.
2. Terminal 2, enlarged in 1994, is mainly used by charter aircraft operators.

Runway configuration

There are two parallel runways in Malpensa, 35R-17L and 35L-17R. They are both 3920 x 60 m long,. These are their main parameters:

RWY number: 17L

Magnetic bearing:	169	
Dimensions of RWY (M):	3920×60	
Strength and surface of RWY:	PCN60 Asphalt	
THR coordinates - ED50:	45°38’ 34”,75 N	08°43’ 52”,62 E
WGS84:	45°38’ 31”,39 N	08°43’ 48”,83 E
THR elevation:	745 FT	
TDZ highest elevation of precision approach runway:	745 FT	

RWY number: 35R

Magnetic bearing:	349	
Dimensions of RWY (M):	3920× 60	
Strength and surface of RWY:	PCN60 Asphalt	
THR coordinates - ED50:	45° 37’ 00”,0 N	08° 44’ 18”,78 E
WGS84:	45° 36’ 56”,7 N	08° 44’ 14”,99 E
THR elevation:	690 FT	
TDZ highest elevation of precision approach runway:	708 FT	

RWY number: 17R

Magnetic bearing: 169
Dimensions of RWY (M): 3920× 60
Strength and surface of RWY: PCN60 Asphalt
THR coordinates - ED50: 45°38’47”,02 N 08°43’11”,20 E
WGS84: 45°38’43”,66 N 08°43’07”,41 E
THR elevation: 764 FT
TDZ highest elevation
of precision approach runway: 764 FT

RWY number: 35L

Magnetic bearing: 349
Dimensions of RWY (M): 3920× 60
Strength and surface of RWY: PCN60 Asphalt
THR coordinates -ED50: 45°36’55”,23 N 08°43’42”,09 E
WGS84: 45°36’51”,85 N 08°43’38”,32 E
THR elevation: 696 FT
TDZ highest elevation
of precision approach runway: 714 FT

The following table summarises the declared distances for Milan/Malpensa runways:

RWY Designator	TORA M	TODA M	ASDA M	LDA M
17R	3920	3920	3920	3920
Start Point A	3005	3005	3005	NIL
35L	3920	4120	4040	3515
Start Point A	3515	3715	3635	NIL
Start Point B	2550	2750	2670	NIL
17L	3920	4040	3920	2977
Start Point A	2970	3090	2970	NIL
35R	3920	4080	3920	3920

Table 6-2 RWYs Declared Distances

Figure 6-1 The Milan-Malpensa Airport Layout

The spacing between the two runways, 808 m, makes it possible parallel dependent operations.

When RWY 35 is in use, the arriving traffic is split as follows:

- 70 % on RWY 35R,
- 30 % on RWY 35L.

During the two main arrival peaks, i.e.: in the morning and in the evening, both RWYs 35R and 35L are used for arrivals and only one is used for departures.

The preferential QFU is QFU 35 (up slope) and both RWYs 35R and 35L are CAT IIIB equipped. But for the time being, according to a current NOTAM9, the ILS10 of RWY 35R is used as CAT II only. RWYs 17R and 17L (down slope) are equipped with a mobile ILS.

Runway utilisation and criteria for runway selection

Taking into account provisions as in AIP Italy, RAC 4 section (Radial/track departure scheme and Noise Abatement Procedures), RWY utilisation will be selected by ATC according to the following wind components:

- MAX 10 KT steady and measured tail wind component (CAA provision N° ENAC/UCEA/285/TRAF dated 24 May 2002)

Due to visual aids maintenance RWY 35/17 are closed daily except for infrastructural, meteorological and safety reasons, as follows:

- *RWY 35R/17L:* from 0100 to 0200 (0000-0100)
- *RWY 35L/17R:* from 0200 to 0300 (0100-0200)

Due to periodic inspections, RWY 35/17 are closed daily as follows:

- *RWY 35R/17L*: 0515 - 0530 (0415 - 0430), 1030 - 1045 (0930 - 0945), 1445 - 1500 (1345 - 1400)
- *RWY 35L/17R*: 0535 - 0550 (0435 - 0450), 1050 - 1105 (0950 - 1005), 1515 - 1530 (1415 - 1430)

Due to ILS ground check, RWY 35/17 will be closed every Tuesday, except for possible limitations within the manoeuvring area, meteorological and safety reasons, as follows:

- RWY 35R/17L: from 2200 to 2300 (2100-2200)
- RWY 35L/17R: from 2100 to 2200 (2000-2100)

The following table summarises the runway use of Milan-Malpensa airport.

RWY	Characteristics	
17L-35R	3920 x 60 m	35R ILS - Cat II
		17L ILS - Cat I
17R-35L	3920 x 60 m	17R Only Visual approaches
		35L ILS - Cat III B

Table 6-3 Milan Malpensa Runways Landing Facilities

Terminals and Aircraft parking stands

There are two passenger terminals at Malpensa:

1. Terminal 1 (West), opened in 1998, is mainly used by scheduled aircraft operators. It is currently equipped with two satellites and a third one is under construction.
2. Terminal 2 (Nord), enlarged in 1994, is mainly used by charter aircraft operators.

A total of 128 parking stands are available in Malpensa, depending on the aircraft type and size. It is distributed as follows:

- 84 to 97 stands (both contact and remote) at or around Terminal 1,
- 24 to 29 stands (both contact and remote) at or around Terminal 2.

Amongst those, there are 60 push back stands.

There are 31 contact stands with passenger boarding bridges, distributed as follows:

- 20 at Terminal 1 distributed in 10 Schengen and 10 non-Schengen stands. It is planned to increase to30 when the 3rd finger is completed),
- 5 at Terminal 2.

All contact stands at both terminals are equipped with a docking system. However, the systems are not the same at Terminal 1 and Terminal 2. Both systems are permanently "on", the anticipated type of aircraft is entered via a keyboard located near the stand. At Terminal 1, some of the PBB[1] have double fingers. Under each PBB there is a room equipped with a workstation with access to the AO[2] DCS[3] and a printer, where load documents can be printed.

[1] Passenger Boarding Bridge
[2] Aircraft Operator
[3] Departure Control System

6.1.1.2 Airspace characteristics

A description of the Milan TMA and of local limits will follow. Milan TMA, airspace classification type “A”, has an upper limit at FL 195 and a lower limit depending on orography and VFR sectors. Milan TMA contains seven CTR: Lugano, Malpensa, Milan Linate, Bergamo, Torino, Piacenza and Genova.

In particular, Malpensa CTR is divided into three different zones, with specific airspace class:

- ZONE 1: 2500 FT AMSL / 1500 FT AMSL ‘A’ 1500 FT AMSL / GND ‘D’
- ZONE 2: 5500 FT AMSL / 2500 FT AMSL ‘A’
- ZONE 3: 2500 FT AMSL / 1500 FT AMSL ‘A’

Inside Zone 1 are contained: Cameri military airport and Agusta facilities of Cascina Costa and Vizzola Ticino.

Inside Zone 2 is contained Vergiate ATZ classified as 'G' airspace, extending between ground and 1400 ft AMSL.

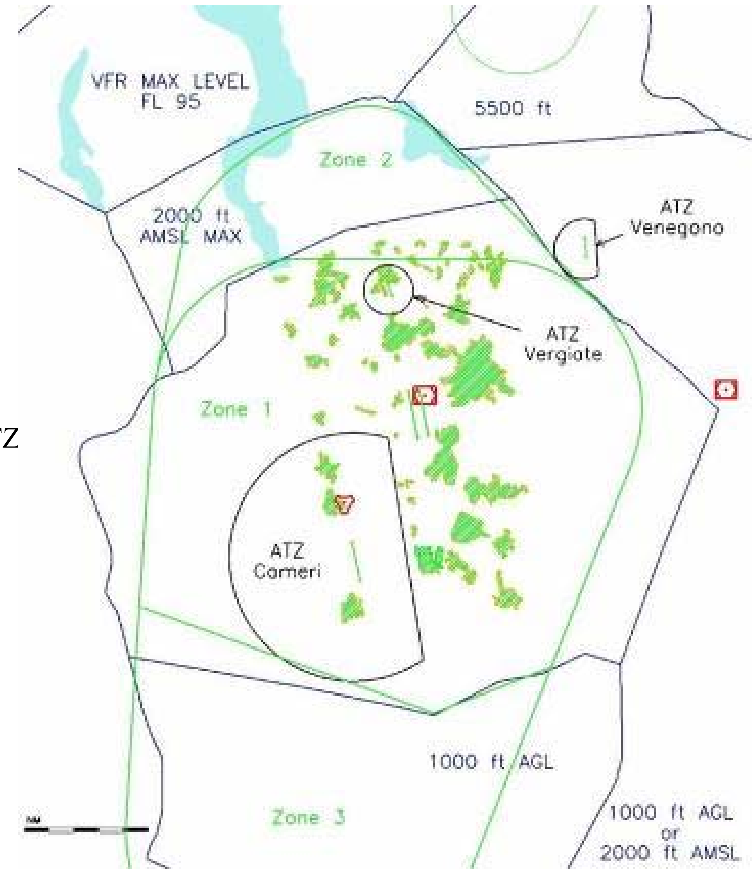


Figure 6-2 Milan Malpensa context

Milan TMA constraints

The Milan TMA presents some constraints affecting significantly the present traffic flows allocation and thus the radar sector capacity. These constraints are:

- Geographical constraints: Alps, in the northern part of the TMA, form a natural wall, limiting airspace availability and the possibility to apply radar vectoring techniques;
- Flows not balanced between entry gates: The main gates used for arrival flows are also used to collect departure flows from surrounding aerodromes (Malpensa, Linate, Bergamo), thus reducing to a minimum extent the possibility to use arrival holdings (VERCE and RIGON) and requiring a high percentage of aircraft to be radar vectored.
- Environmental constraints: Populated areas around the aerodrome put several limitations to arrival and departure flows.

The following figure 6-3 shows Milan multi-radar tracking sectors with minimum altitude for radar vectoring.

The Milan TMA has a lower limit depending on the topographic profile and VFR sectors[4], and an upper limit at FL 195. In the airspace from FL 195 up to FL 295 the Milan ACC provides area control in the western part of Milan FIR. To provide ATS services, the Milan ACC is organised in 14 sectors divided in two main sides:

[4] Refer to AIP Italy RAC 1-8.

- Eight airway sectors;
- Six arrivals and Departures sectors.

Six arrival and departure sectors, collected in the Arrivals and Departures Island (ADI) will be analysed as relevant to APPROVE objectives. The ADI manages arrivals and departures to and from the Malpensa, Linate, Bergamo and Lugano airports. This is a very difficult task, due to the topographic configuration of the area and to the existing interferences with traffics to and from Turin, Genova, Piacenza and Parma.

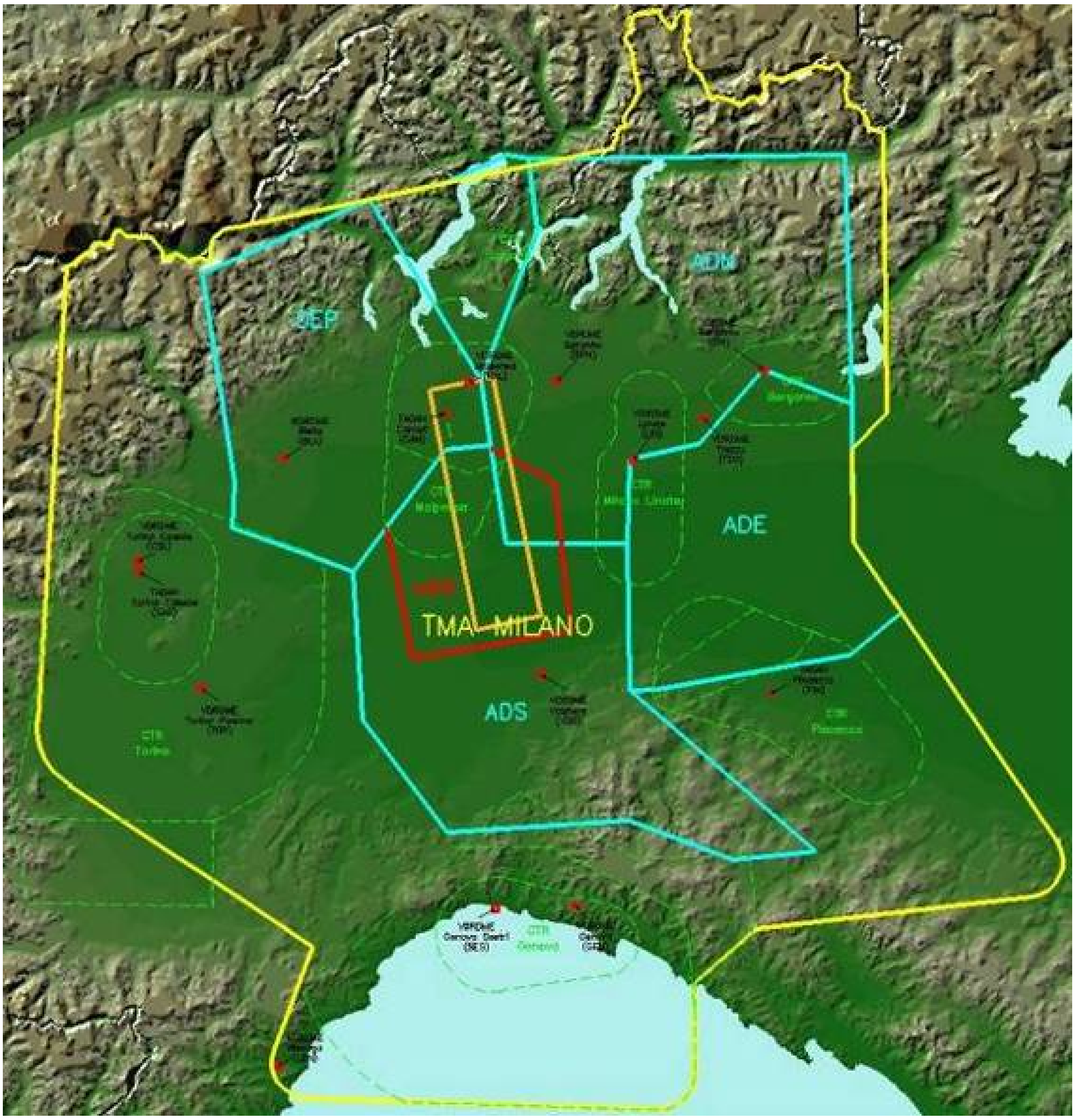


Figure 6-3 Milan Terminal Area

On a typical day, the Milan ACC manages around 2000 IFR movements, 1500 of which are distributed among the above-mentioned airports. Focusing only on Milan Malpensa, the ADI configuration uses several reporting points, "feeding fix", to route Malpensa inbound traffic flows coming from en-route sectors.

The current "feeding fixes" are:

- SRN VORDME (Saronno), collecting traffic coming from the north and northeast.
- VOG VORDME (Voghera), collecting traffic coming from the south and southeast;
- GOLTO FIX, collecting traffic coming from the west.

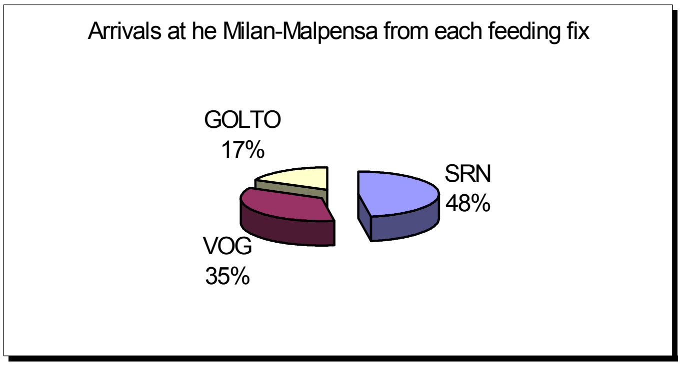


Figure 6-4 Main traffic Arriving Flows

Over the SRN fix, in addition to the inbound traffic for Malpensa, Malpensa departures from runway 35R headed north and northeast, Lugano departures and arrivals, Linate and Bergamo departures toward the east all flow together. On the other hand, over the VOG fix, two main en-route flows converge (from GEN VORDME and KALIK FIX). This requires inter-sector co-ordination for the traffic coming from KALIK bound for Malpensa. Traffic from the south and southwest bound to Linate, Bergamo, and Lugano is also usually routed over the VOG fix. The following figure illustrates the current STAR network and the Saronno and Voghera clusters.

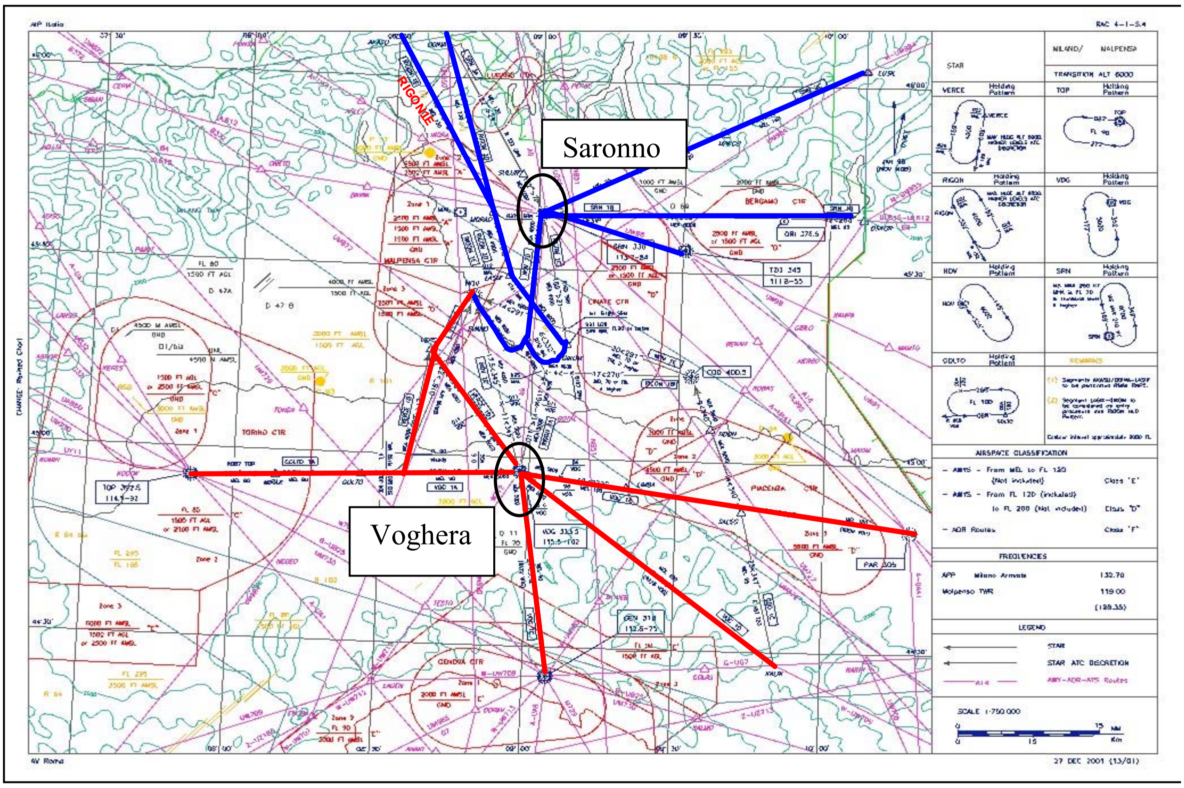


Figure 6-5 Current Arrival Network. Saronno and Voghera Clusters

6.1.1.3 Traffic characteristics

The following figures characterise the airport:

- Traffic for the year 2002:
  - 17,441,250 passengers (-6.1 % in comparison to 2001),
  - 214,886 movements (-9.1 % in comparison to 2001), representing 550 to 600 daily movements (reduced from 700 to 800 after September 11th 2001),
  - 328,241 tonnes of freight and mail (+1.4 %).

Saturday, Sunday and Monday are the busiest days in the week.

177 destinations distributed in 26 domestic, 97 international and 54 intercontinental cities are proposed in Malpensa, 92 aircraft operators (51 scheduled, 36 charters and 5 freighters) operate from Malpensa.

6.1.1.4 Vehicle mix

The Vehicles Fleet operating at Malpensa Airport is categorized as follows:

- Automotive Vehicles and
- Trailer Vehicles

The first group comprises all the vehicles able to move over the Movement Area autonomously; the second one comprises the vehicles which needs a trailer truck to be moved over the Movement area. The following schemes list the main Actors provided with airport Vehicles according to the mentioned above categorization.

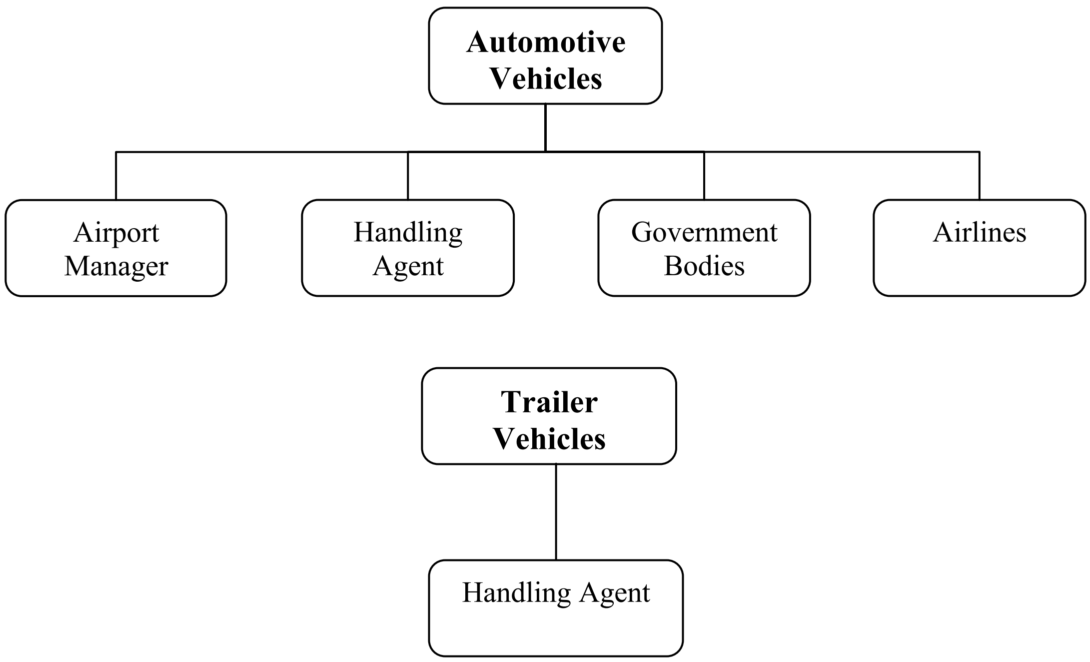


Figure 6-6 Vehicle Categories at Malpensa Airport

The largest vehicles amount is managed by SEA, the Airport Manager: around 2500 vehicles, 350 of which operating at the same time, at most.

6.1.1.5 Weather conditions

The following picture illustrates the occurrences of times during which controllers operate under LVP conditions, due to bad visibility conditions. The period considered is from Oct 2003 till Mar 2004.

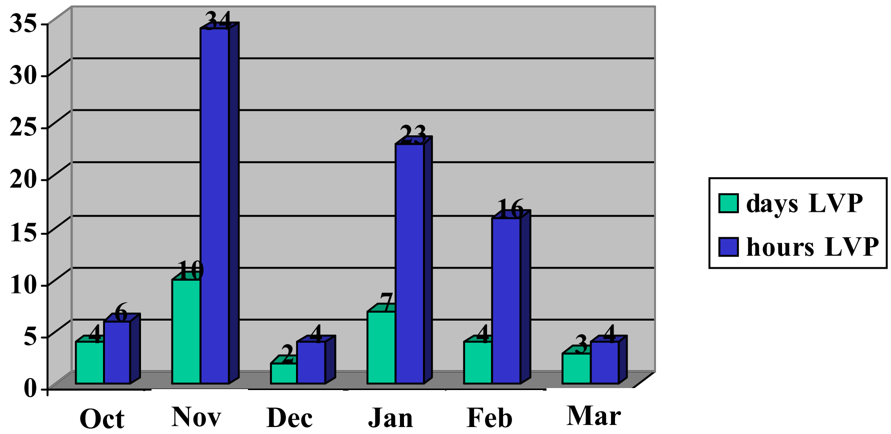


Figure 6-7 Times During Which Controllers Operate Under LVP Conditions

6.1.1.6 Complexity

According to the prescribed configurations and procedures, both RWYs 35L/17R and 35R/17L can be used for take-off and landing. Considering the layout and in particular the Terminal 1 position, it means that more than one configuration involves RWY 35L/17R crossing.

RWY 35L/17R CROSSING PROCEDURES

- Malpensa TWR has normally two radio frequencies associated to the appropriate air controller responsible for:

  1. FREQ 128.350: RWY 35L/17R operations
  2. FREQ 119.000: RWY 35R/17L operations

- Aircraft which are required to cross RWY 35L/17R will be issued instructions which will include a taxi clearance limit, in which the aircraft will be required to hold short of the RWY by:

  1. the ground movement controller, if taxiing out from aprons
  2. the controller responsible for operations on RWY 35R/17L, if landed on RWY 35R/17L

- When approaching the clearance limit specified in the taxiing instructions, the aircraft will be instructed to change frequency to that of the TWR controller responsible for operations on RWY 35L/17R FREQ 128.350

- After crossing the RWY and having reported ‘RWY vacated’ with the TWR controller , the aircraft will be instructed to change frequency to that of the appropriate controller

6.1.1.7 CNS Coverage

6.1.1.7.1 Communication

The operational communication mean is the VHF and the following table contains the operational frequencies in use at the Airport and the Approach Centre located at LINATE.

Service	Call sign	Frequency MHZ	Operational hours
1	2	3	4
Emergency	-	121.500	H24
APP	Milano Arrivals	132.700	0600-2200 (0500-2100) (1)
	Milano Departures	126.300 (S)	0600-2200 (0500-2100) (1)
		126.750 (N)	H24
TWR	Malpensa Tower	119.000 (1) 128.350 (2)	H24 H24
	Planning FREQ (3)	120.900	0600-2200 (0500-2100)
Apron Management	Malpensa Ground West	121.900	H24
	Malpensa Ground North	121.825	0600-2200 (0500-2100)
		121.900	2200-0600 (2100-0500)
ATIS (1)	Malpensa Arrival Information	120.025	H24
	Malpensa Departure Information	121.625	H24

Table 6-4 Operational Frequencies in Use

6.1.1.7.2 Navigation

The following table lists all the Navigation aids deployed at and around Milan Malpensa airport.

Type of aid CAT of ILS (VAR ILS/VOR)	ID	FREQ	Hours of operation	Antenna site coordinates (WGS 84)	Elevation of DME antenna	Designated operational coverage Limitations	Remarks
1	2	3	4	5	6	7	8
SMR (1)	-	-	-	-	-	-	(1) See RAC4 (Milano/Malpensa CTR)
VDF	Malpensa Homer	119.000 121.500 128.350 MHZ	H24 H24 (1)	45°38'45"N 08°43'55"E (2)	-	Limitations at 30 NM: 000°/090° MRA 8000 FT 090°/130° MRA 2500 FT 130°/270° MRA 2000 FT 270°/360° MRA 10000 FT	(1) ATC discretion only (2) Not WGS84 datum
NDB (1)	NOV	292 KHZ	H24	45°25'26.9"N 08°47'37.9"E	-	50 NM Limitations at 25 NM: 000°/360° MRA 4000 FT Limitations beyond 25 NM: 000°/360° NU	(1) MAINT: 3rd Tuesday of each month 0800-1000 (0700-0900)
LO	MAL	364 KHZ	H24	45°32'44.9"N 08°45'22.5"E	-	25 NM Limitations: 100°/275° MRA 4000 FT	NIL
TVOR (0°05'E - 1998.0)	MAL	111.20 MHZ	H24	45°38'33.2"N 08°44'03.9"E	-	25 NM / 10000 FT Limitations at 25 NM: 140°/240° MRA 2000 FT 240°/280° MRA 4000 FT 280°/020° MRA 8000 FT 020°/070° MRA 6000 FT 070°/140° MRA 4000 FT	NIL
DME	MAL	CH49X	H24	45°38'33.6"N 08°44'04.4"E	-	25 NM / 10000 FT Limitations at 25 NM: 140°/240° MRA 2000 FT 240°/280° MRA 4000 FT 280°/020° MRA 8000 FT 020°/070° MRA 6000 FT 070°/140° MRA 4000 FT	NIL
ILS RWY 35R LLZ (1) CAT II (0°40'E - 2003.0)	MLP	109.90 MHZ	H24	45°39'09.5"N 08°43'38.3"E	-	-	(1) Back beam not usable
GP (1)	-	333.80 MHZ	H24	45°37'07.8"N 08°44'18.3"E	-	-	(1) Angle 3° RDH: 17,50 M
OM	-	75 MHZ	H24	45°32'44.4"N 08°45'24.6"E	-	-	NIL
MM	-	75 MHZ	H24	45°36'24.4"N 08°44'24.0"E	-	-	NIL
ILS RWY 35L LLZ (1) CAT III B (2) (0°40'E - 2003.0)	IMA	109.10 MHZ	H24	45°38'52.1"N 08°43'05.1"E	-	-	(1) Back beam not usable (2) RVR minima 75 M
GP (1)	-	331.40 MHZ	H24	45°37'02.6"N 08°43'41.2"E	-	-	(1) Angle 3° RDH: 17,50 M
MM	-	75 MHZ	H24	45°36'20.4"N 08°43'47.0"E	-	-	NIL
DME-P RWY 35L (1) (2)	IMA	CH28X	H24	45°37'00"N 08°43'43"E (3)	-	-	(1) Zero range indication at RWY THR 35L (2) Usable within ILS/LLZ coverage sector (3) Not WGS84 datum
ILS RWY 17L LLZ (1) CAT I (0°40'E - 2003.0)	IAM	109.900 MHZ	H24	45°36'44.0"N 08°44'18.5"E	-	-	(1) Back beam not usable

Tipo di radioassistenza CAT di ILS (VAR ILS/VOR)	ID	FREQ	Orario	Coordinate antenna (WGS 84)	Elevazione antenna DME	Copertura operativa nominale Limitazioni	Note
1	2	3	4	5	6	7	8
GP (1)	-	333.8 MHZ	H24	45°38'22.0"N 08°43'56.9"E	-	-	(1) Angolo 3° RDH 15 M
MM	-	75 MHZ	H24	45°39'09.4"N 08°43'37.2"E	-	-	NIL
L (1)	RMG	337 KHZ	H24	45°37'42.2"N 08°24'23.7"E	-	25 NM Limitazioni: 090°/270° MRA 4000 FT 270°/090° MRA 12000 FT	(1) MAINT: 2° venerdì di ogni mese 0800-0900 (0700-0800)
VOR/DME (1) (0°10' E – 1998.0)	SRN	113.70 MHZ CH84X	H24	45°38'48.5"N 09°01'22.3"E	248.38 M AMSL	100 NM / 50000 FT Limitazioni entro 10NM: 000°/360° MRA 2000 FT Limitazioni oltre 10 NM entro 20 NM: 000°/080° MRA 7500 FT 080°/280° MRA 3000 FT 280°/360° MRA 6000 FT Limitazioni oltre 20 NM entro 40 NM: 000°/070° MRA 13000 FT 070°/090° MRA 10000 FT 090°/270° MRA 4000 FT 270°/360° MRA 12000 FT Limitazione RDL 065 (2)	(1) MAINT: 1° mercoledì di ogni mese 0700-0830 (0600-0730) (2) COV ridotta a 80 M
L (1)	SRN	330 KHZ	H24	45°38'46.0"N 09°01'17.9"E	-	25 NM Limitazioni: 130°/250° MRA 5000 FT 250°/130° MRA 13000 FT	(1) MAINT: 2° mercoledì di ogni mese 0700-1000 (0600-0900)
VOR/DME (1) (0°10' E – 1998.0)	VOG	115.50 MHZ CH102	H24	44°57'52.0"N 08°58'12.8"E	118.20 M AMSL	40 NM / 25000 FT Limitazioni a 40 NM: 040°/080° MRA 5000 FT 080°/100° MRA 9000 FT 100°/170° MRA 11000 FT 170°/230° MRA 8000 FT 230°/250° MRA 6000 FT 250°/040° MRA 4000 FT	(1) MAINT: 2° giovedì di ogni mese 0700-0830 (0600-0730)
NDB	VOG	333.5 KHZ	H24	44°57'49.7"N 08°58'19.4"E	-	50 NM Limitazioni a 50 NM: 020°/110° MRA 3000 FT 110°/150° MRA 12000 FT 150°/180° MRA 10000 FT 180°/230° NU 230°/020° MRA 5000 FT	NIL

Table 6-5 Navigation Aids at Malpensa Airport

6.1.1.7.3 Surveillance

The main operative element of the current system is the SMR subsystem, it is an X Band radar (8700-8900 MHz) with a gain > 34 dB and a circular polarization. It has a Horizontal Beamwidth < 0.44° and a Vertical Beamwidth > 22°.

The antenna performs 60 rpm and transmits the pulses (40 nsec. of duration) by a Pulse Repetition Frequency between 5000 and 10000 Hz. The Range Coverage Clear is 6000 m (5400 m in case of rain) for RCS=1 m^2, and 11000 m (8800) for RCS=10 m^2. Further the SMR is characterized by Azimuth Accuracy of 2.8 m at 3 Km and by Range Accuracy of 0.9 m at 3 Km, both calculated for RCS=1 m^2.

Figure 6-8 SMR-HMI screen shot

6.1.1.7.4 System failure management

A set of Failure Management procedures, according to the failure categories list, is implemented at Milan Malpensa airport. These Procedures are described in the Internal Permanent Instructions and Aeronautical Information Publication for Malpensa Airport.

6.1.2 AIR Traffic Services

6.1.2.1 ATC Divisions and Responsibilities

Approach control

A sector of Milan ACC51 (which is located near Linate) provides approach control service to the three major airports of the Milan area: Malpensa, Linate, and Bergamo. In the near future approach and ACC sectors will be redefined, along with equipment upgrades. Approach controllers have a dual approach / aerodrome radar rating.

6.1.2.2 Controller Working Positions (TWR)

TWR Organisation

The Malpensa ATC tower has the following controller working positions:

- Two tower WPs, one for each runway,
- Up to two ground WP, depending on the traffic load (West and North aprons),
- One coordinator,

- One clearance delivery WP,
- One supervisor.

Description of the controller working positions:

- Clearance delivery:

The delivery WP gives the start up clearance and the SID (which is known around one hour before but finalised at the time of clearance delivery) to the pilot. Pilots call around half an hour earlier, just to get the SID.

The ATC gives information about the CTOT (and possible delay) to the pilot at first contact. The departure sequence is made in real time (30 minutes before) by the clearance delivery WP, taking into account of:

1. CTOT,
2. Location of the parking stand,
3. Runway in use,
4. Aircraft type and performance,
5. First come – first served.

The start up clearance is delivered taking account of the traffic, the taxi time, the stand location, etc.

- Ground control:

This WP issues the push back clearance and controls all the movements on the taxiways and taxilanes. The ground controller can see the stand for arriving aircraft in the BDV before landing (green and yellow statuses). He can call SEA Coordinamento Scali if no stand has been allocated when the aircraft has landed. During daytime, there are three holding points for RWY 35L and one holding point for RWY 35R. The push back time depends on the size and on the position of the aircraft. It takes between three and ten minutes.

- Coordinator / Flight data:

The flight data assistant WP checks all the messages in FDP52. Moreover, he controls all the vehicles

moving on the manoeuvring area (VHF53 radio contact).

- Tower controller A:

This controller WP controls RWY 35L.

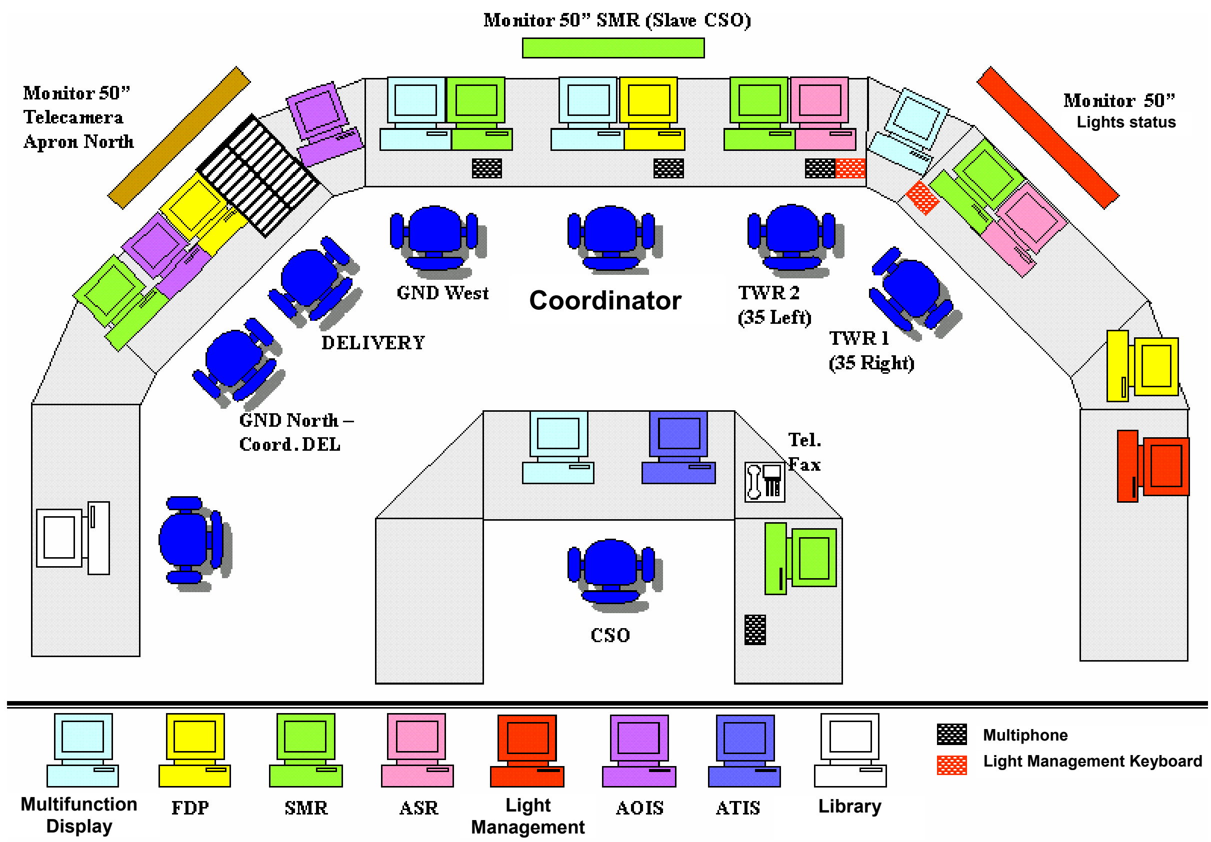
- Tower controller B:

This controller WP controls RWY 35R.

- Supervisor:

The supervisor is responsible for:

1. The overview of the operations,
2. The tower layout,
3. The coordination with Milan FMP54 regarding the airport capacity (possible restrictions),
4. The coordination with the ARO55 and the MET56 Office,
5. The coordination with the Crisis Committee.



In case of crisis the supervisor receives by fax and implements the decisions of the Crisis Committee – i.e.: cancelled flights, reduced airport capacity etc.

Figure 6-9 TWR Layout

6.2 Local Current Operations

6.2.1 Surveillance

The current Surveillance System at Malpensa Airport is based on the SMR described in the section 6.1.1.7.3. The SMR doesn't provide Localization function on the Aprons due to the application of a filtering on those areas: the big amount of non-cooperative targets moving close to each other and simultaneously doesn't allow a clear discrimination above these busy ground areas.

The Aerodrome Control Service mainly aims to determine aircraft and vehicles positions on the manoeuvring area through visual observations and/or reported position by pilots. Information presented on the SMR display, within the predefined operational coverage, are used for powering the visual observation of traffics on the manoeuvring area and performing the surveillance of traffics on those zones of the Manoeuvring area where the visual observation is not possible due to obstacle presence or bad visibility conditions.

At present, the SMR subsystem allows the following functionalities:

- Monitor that aircraft and vehicles on the manoeuvring area are operating in compliance with received clearances and instructions

- Determine that a RWY is clear before giving a take-off or landing clearance.
- Provide essential information about local traffic on or nearly of the manoeuvring area
- Localize aircraft and vehicles positions on the manoeuvring area
- Provide pilots with heading information during taxiing operations when requested by the pilot or considered necessary by the controller. Apart from contingency situations, these pieces of information are not given as heading instructions but using the following phraseology: "TURN (left/right) ON THE TAXIWAY/RUNWAY YOU ARE APPROACHING"
- Provide emergency vehicles with helps and suggestions
- Observe aircraft on manoeuvring area during arrival, departure, taxing, and towing operations.
- Observe aircraft to use runway in accordance with ATC authorization.
- Observe aircraft to start take-off run and/or vacate runway.
- Observe aircraft and vehicles vacated runway 35L after crossing.
- Observe emergency vehicles when so required providing maximum assistance in accordance with tool.

The identification has to be always acquired before giving instructions/information to aircraft or vehicles concerning their positions.

6.2.1.1 Identification

Where the SMR is used, aircraft and vehicles can be identified by one the following procedures:

- Correlating a specific radar position indication with
    1. the position of the aircraft/vehicle observed visually by the controller
    2. the position of the aircraft/vehicle reported by the pilot/driver
    3. a radar identified position indication presented on the screen of a surveillance radar
- Radar Identification
- Using automatic identification procedures

6.2.2 Control

Under Visibility 2 conditions, the ATCO has to perform Procedural Control providing the pilot with possible limitations to the crosses between taxiways and essential traffic information, other than normal limitations instructions he delivers under Visibility 1 conditions. Particular attention is dedicated for obtaining the read back of all provided clearances to enter taxiways and go through them till the holding point.

The SMR is intended as an auxiliary tool for verifying the correct execution of the clearances provided by the ATCO and in a no way it can replace the procedural control of the ground movements.

6.2.3 APRON Management Service

ENAV and SEA (Airport Authority) made an agreement in the 1999 aiming to regulate accesses by aircraft on the parking area, to coordinate exits from the same area with TWR, to guarantee an ordered vehicular traffic and to regulate the air traffic flow in order to prevent collisions between aircraft and between aircraft and obstacles. To increase the safety this service is mandatory for both the Airlines and the ground operators.

6.2.3.1 Apron Management Service Operational Procedures

Within the context of the Apron Management Service (AMS), ENAV manages and coordinates the air traffic keeping radio contact with Malpensa GND. SEA operators manage the people and vehicles traffic keeping radio contact with SEA Operational Centre located in the tower building (downstairs the Operational Room).

- Operational procedures for **Outbound** flights. The pilot asks Malpensa GND for the Push Back and Start Taxiing clearance. The controller before delivering these clearances, has to receive a "Closed Door" confirmation and the information that the "Push Back zone" is obstacles/people free, by SEA, through the ENAV operator in the APRON management room. To guarantee a correct and ordered Push Back sequence, the Push Back operation has to be performed as soon as cleared. During the Taxiing on the Apron Area, instructions/information forwarded to the pilot by the Malpensa GND ATCO concern only the movements of other surrounding traffic. The assumption is that other moving targets are respecting the existing rules (speed, routes, priorities). Possible inobservances of these regulations, representing a potential risk are suddenly reported to the pilot. The Delivery ATCO provides pilot with Start Up clearance when the ENAV Operator from the APRON management room through the FDPS issues this flight, changing the colour of the strip (SCL button).This procedure guarantees that the flight is closed and the surrounding "Push Back-Taxiing" zone is free. During the Taxiing, pilots have to be instructed by the GND ATCO to follow the yellow line on ground (green lights catenaries), designed to guarantee the separation from the obstacles.

- Operational procedures for **Inbound** flights. For the Taxiing phase there are the same rules. Malpensa GND provides flight with the parking number, as soon as received this data from the SEA operator. Vehicles and Ramp operators can get to the stand just when the aircraft has reached the parking stop position and the pilot switched off the engines.

6.2.4 Low Visibility Procedures

When aerodrome Low Visibility Procedures (LVP) are operative, low visibility operations are allowed only to national and international Operators authorized by the relevant Authority of the state of registration of the aircraft, Requirements to the Operators of commercial aviation (public transportation of passengers, goods and mail) are established by ENAC Regulation "All Weather Operations in Italian Airspace" (ref. AIP RAC 1-49). Pilots will be informed by ATC unit when these procedures are in progress.

The low visibility procedures currently in force in Malpensa are regulated by the ENAC ordinance nr. 02/2006 of January the 3rd, 2006.

The following table shows the figures of Runway Visibility Range (RVR) and ceiling for the predisposition, activation, deactivation and cancellation of the low visibility operations.

	PREDISPOSITION	ACTIVATION	DEACTIVATION	CANCELLATION
LVP	RVR ≤ 800 m and/or ceiling = 200 Ft	RVR ≤ 550 m and/or ceiling <200 Ft	RVR > 550 m and/or ceiling ≥ 200Ft	RVR > 800 m

Table 6-6 Figures of RVR and Ceiling for the Predisposition, Activation, Deactivation and Cancellation of Low Visibility Operations

6.2.4.1 Use of the Runways and Taxiways

6.2.4.1.1 Availability of Both Runways

With the exception of what stated in Section 1.2.4.1.2, when the RVR is equal to or less than 550 mt and/or ceiling less than 200 Ft, the runway use is as follows:

- RWY 35R only for Take-offs;
- RWY 35L only for Landings;
- RWYs 17R and 17L not usable.

The use of taxiways is arranged as in the following:

- landing aircraft on the 35L going to the Terminal 1 have to vacate the RWY only via taxiways “L” and “EW” entering the Apron through links 0, 1, 2, 3 and 4;
- landing aircraft on the 35L going to the Terminal 2 have to vacate the RWY only via taxiways “B” and “BA”;
- taking-off aircraft have to reach the holding point “CA” CAT. II/III RWY 35R taxiing only on the taxiway “C” if coming from the Terminal 2;
- taking-off aircraft have to reach the holding point “CA” CAT. II/III RWY 35R taxiing only on the taxiway “W”, apron-taxiway “K” and “Y” (North-South direction) and then via “GW”-“GE” if coming from the Terminal 1;
- aircraft leaving from the Terminal 1 and direct to taxiway “W” have to use the Links 3, 4 (both at discretion of ATC) and 6.

6.2.4.1.2 Single Runways Operations

In case of unavailability of a runway due to infrastructural reasons and when the RVR of the available runway is equal to or less than 600 mt, the following procedures are applied:

6.2.4.1.2.1 RWY 35L Available:

- Landing aircraft have to vacate RWY only via taxiways “L” or “EW” if headed for Terminal 1 and “B” or “BA” if headed for Terminal 2.
- Taking-off aircraft have to reach holding point “GE” CAT II/III RWY 35L taxiing only on Taxiway “C” if coming from Terminal 2.
- Taking-off aircraft have to reach holding points “W8” and “GW” CAT II/III RWY 35L on taxiway “W”, apron-taxiways K and Y (North-South direction) if coming from Terminal 1.

6.2.4.1.2.2 RWY 35R Available:

- Landing aircraft have to vacate RWY only via taxiways “D” or “E” if headed for Terminal 1 and “E” if headed for Terminal 2.
- Taking-off aircraft have to reach holding point “CA” CAT II/III for RWY 35R taxiing only on Taxiway “C” if coming from Terminal 2.

- Taking-off aircraft have to reach holding point “CA” CAT II/III for RWY 35R taxiing only on taxiway W, apron-taxiways K and Y (North-South direction) and then via “GW-GE” if coming from Terminal 1.

6.2.4.2 Ground Movements of Aircraft

6.2.4.2.1 General Principles

For aircraft ground movements are defined the following reference points:

- **runway holding positions CAT II-III:**
  - “W8” – “GW” – “GE” for RWY 35L;
  - “CA” for RWY 35R;

- **intermediate holding positions**:
  - on TWY “C” in direction North/South: “C2”, “C3”, “C4”;
  - on TWY “W” in direction North/South: “W1”, “W2”, “W3”, “W4”, “W5”, “W6”, “W7”;
  - on apron-taxiway “K” in direction North/South: “K1”, “K2” and “K3”;
  - on apron-taxiway “Y” in direction North/South: “Y1” e “Y2” (panel on the left side of the TWY only);
  - on TWY “GE” in direction South/North: “GE1”.

6.2.4.2.2 With SMR Operational

If the RVR of one of the two RWYs is less than 600 mt, the ground movements of aircraft on manoeuvring area and apron are as in the following:

- aircraft movements have to be compliant with instructions and sequences provided by the TWR. The “follow-me” support is provided if requested by the Captain.
- the aircraft separation is ensured by using the reference points of section 6.2.4.2.1, taking into account that those positions ensure lateral and longitudinal separations;
- the above separations can be reduced if the Captain declares to be able to see the traffic and, then, to ensure autonomously his own separation;

6.2.4.2.3 Without SMR Operational

6.2.4.2.3.1 RVR Less Than 600 m and up to 150 m Included

Without SMR and if RVR of one of the two RWYs ranges between 550 mt and 150 mt (included), the ground aircraft movements in Apron and Manoeuvring area are as in the following:

- aircraft movements have to be compliant with instructions and sequences provided by the TWR. The “follow-me” support is provided if requested by the Captain;
- the aircraft separation is ensured by using the reference points of section 1.2.4.2.1, In order to ensure bigger longitudinal separations, non-consecutive positions on the same RWY have to be used.

6.2.4.2.3.2 RVR Less Than 150 mt

Without SMR and if RVR of one of the two RWYs is less than 150 mt, the ground aircraft movements in Apron and Manoeuvring area are as follows:

- use of only RWY 35L for landings and take-offs;

- *Manoeuvring area:* one aircraft movement at a time is allowed. The follow-me support is provided if requested by the Captain;
- *Apron:* one movement at a time is allowed. Follow me support is mandatory.

6.2.4.3 Low Visibility Take-Off (LVTO)

If operations of approaching/landing in CAT II/III were not available, take-offs in low visibility are however allowed according to the current regulation, as long as the low visibility operations were predisposed and activated.

6.3 A-SMGCS Operations (Levels 1 & 2)

6.3.1 A-SMGCS Environment

6.3.1.1 Airport

6.3.1.1.1 Surveillance

Currently, the Apron zone is completely filtered out the SMR coverage area, it means that tracks disappear when moving objects overtake the Apron TWY “K”.

MLAT

The Surveillance function will be widened and improved by the implementation of a Multilateration System that will extend the Surveillance coverage to the Movement Area for all cooperative targets provided with a Mode-S transponder. The Coverage area of the MLAT System is provided by 10 sensors installed at precise locations over the Airport surface and is represented in the following picture together with the sensors’ positions. Each colour is associated with a figure that represents the number of sensors that have each point of the area in line of sight. Most of the Airport surface is visible by 7 sensors simultaneously.

The software dedicated to the data fusion and presenting will be tested off-line by the Operational ATC people in the Test bed, in order to optimise the MLAT system without compromising the Operational System.

The Test Bed will be implemented in the Backup room situated downstairs the Operational room.
The integration of the MLAT in the A-SMGCS at Malpensa airport will be performed through:

- Tuning of the multi sensor fusion algorithm in order to allow the elaboration of data provided by the MLAT Central Processing Subsystem in the same way as the other (SMR, APP Radar, and Linate MRT) to generate a unique track.

- Updating of Data presenting on the CWP. The MSF data will be enriched by the MLAT contribution. The presenting of tracks without MLAT contribution will remain the same as it is now. Where the MLAT contribution is available the data presenting will be as follows:

    - Call-Sign in the label
    - Presentation of two different symbols for aircraft on ground or airborne

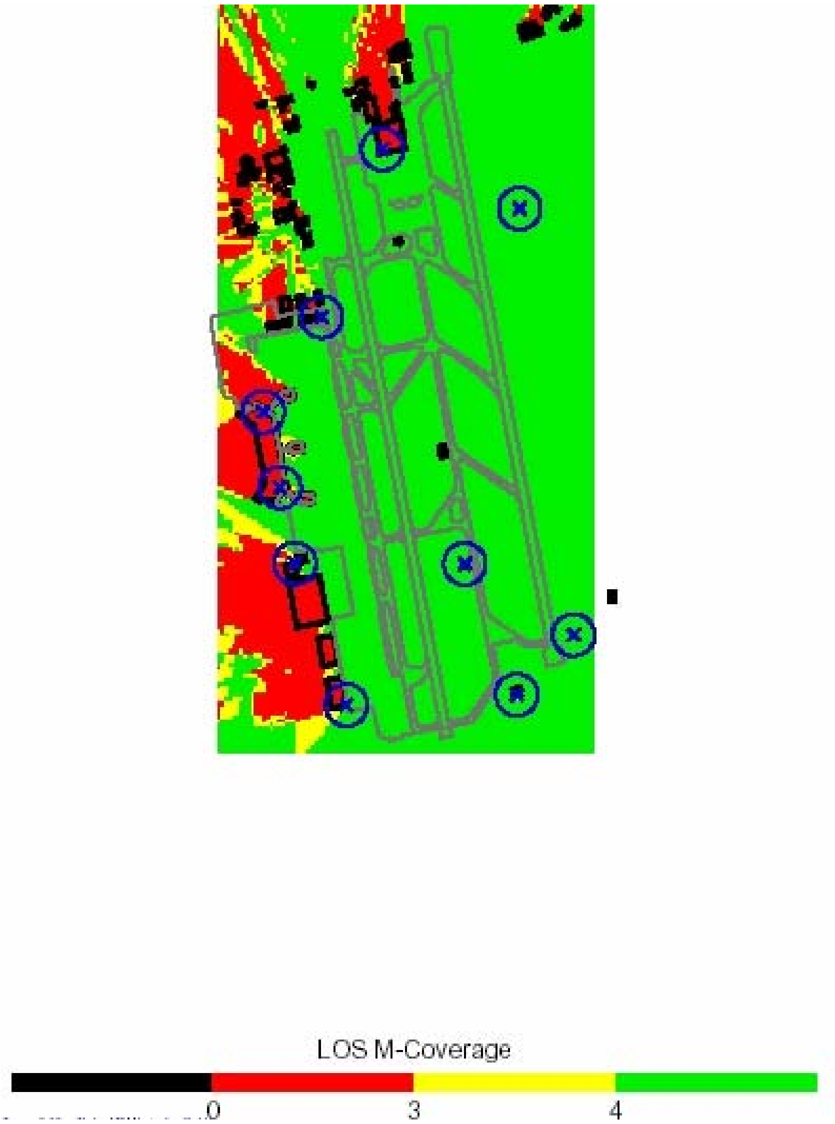


Figure 6-10 MLAT coverage and sensors dislocation at Malpensa Airport

The MLAT system will allow localization and Automatic Labelling of the Mode S equipped aircraft on the Movement Area

AVMS

The Surveillance function in the EMMA timeframe, will receive contribution by the AVMS (Airport Vehicle Management System) system:

The Malpensa airport has a Wireless LAN (WLAN) infrastructure for apron management services and will have a Multilateration System (MLAT) within the EMMA time frame.

The proposed solution for an AVMS in Malpensa within EMMA is as follows:

- MLAT will be used for localization/identification of authorized vehicles in the movement area (albeit with different accuracy in maneuvering area and aprons);
- ADS-B/WLAN will be used for localization/identification of vehicles on the WLAN coverage area (including apron area).

The vehicle fleet could be classified in:

- authorized vehicles which can access the maneuvering area
- not authorized vehicles that normally only operate on the apron area.

One can expect authorized vehicles to be limited in number and equipped with cooperative sensors. The great majority of not authorized vehicle are instead not equipped, although their localization/identification would be of great benefit for safety and fleet management.

Five vehicles will be equipped with cooperative equipment:

- two vehicles, representing the authorized subset, equipped with MLAT + ADS-B/WLAN transponders;
- three vehicles, representing the not authorized subset, equipped with ADS-B/WLAN transponder.

The two authorized vehicles will also be equipped with a graphic display to represent the vehicle on the airport moving map. The GPS will be EGNOS compatible.

The three not authorized vehicles will have an alphanumeric display for basic service messages.

The dual-data link is recommended due to MLAT system limitations in terms of capacity and accuracy in the apron area. The proposed solution therefore fully satisfies requirements of capacity, coverage and accuracy required by ICAO and exceeds the level I/II goals, as defined in EMMA.

The ability to localize vehicles within the apron area provides the opportunity to implement more effective “segregation” control of not authorized vehicles (which would otherwise only be localized, but not identified, by non cooperative sensors). An apron segregation control for not authorized vehicles could be implemented by alerting drivers with an onboard message.

To this new implementing systems will be dedicated testing activities in a test bed at the Malpensa TWR. This testing will be mainly focused on Functional Tests and the main objective will be to have figures about the accuracy and integrity.

6.3.1.1.2 Control

A Surface Conflict Alert (SCA) is currently operational at the Malpensa Airport providing automatically an interpretation of the dynamic situation of targets. The SCA, considering the current status of the Surveillance function, contributes to improve the Situation Awareness and to provide Situation Monitoring and Alerting functionalities.

This tool will be replaced by a new one, the Enhanced-Surface Conflict Alert (E-SCA) that has new and improved options in terms of configurability. It will provide the ATCs with the opportunity to:

- enabling/disenabling a single class of conflicts (Selective Enabling by conflict type)
- enabling/disenabling a class of conflicts on a specified RWY/TWY (Selective Enabling by Conflict Area)
- ability to operate using data provided by the MSF or, when the MSF faults, in DARD (Direct Acces Radar Data) mode, considering data coming from a single surveillance sub-system (SMR or MLAT)
- manage Warning an Alarm situations separately
- have the Warning/Alarm list on the TWR-CWP ordered by priority

The E-SCA will be used as an auxiliary tool to:

1. focus the ATCO’s attention on a particular traffic situation,

2. observe the evolution of this situation
3. enter the eventual resolution

A set of Functional Tests that will be carried out during testing phase at the Malpensa TWR Test Bed, has the main objective to tuning this implementing System collecting figures about probability of Missed Warning/Alarm and False Warning/Alarm mainly, maximizing the operational benefits.

6.3.1.2 Controller Working Position (TWR)

The improvements of the TWR Controller Working Position will be focused on the Surface Conflict Alert and the Interoperability functions.

A Flight plans list will be integrated in the HMI.

Warning and Alarm messages set out in the E-SCA dedicated window will be listed considering their risk priorities.

The status concerning different operational configurations of the interoperable Surveillance system will be presented on the ATCO's HMI. It means that in case of connection failure between the TWR MSF and the ACC MRT and the Airport Surveillance MSF is working stand alone, the controller will get aware.

Handover between ACC e TWR will be carried out by automatic Transfer Of Control (TOC) and Assumption Of Control (AOC) functions. The intent is to reduce ATCOs workload in the TWR.

6.3.2 A-SMGCS Operational Procedures

6.3.2.1 A-SMGCS Surveillance Identification Procedure

A-SMGCS surveillance identification shall be undertaken using the following action:

For Aircraft: Direct recognition of the aircraft identification of a Mode S equipped aircraft in a Surveillance label;

- With the implementation of Mode-S and M-LAT, controllers will have the opportunity to identify departing traffic directly at the gate, before taxi or push-back operations. This is valid also for the vehicles; for those lacking of co-operative sensor they will use the identification procedures already in force (i.e. reporting points).

The aircraft identification feature available in Mode S transponders provides the means to identify directly individual aircraft on surveillance displays and thus offers the potential to eliminate ultimately the recourse to Mode A discrete codes for individual identification. This elimination will only be achieved in a progressive manner depending on the state of deployment of suitable ground and airborne installations

For vehicle: Direct recognition of the vehicle identification of a suitably equipped vehicle in a Surveillance label;

The A-SMGCS surveillance service will display the identity of all vehicles in a label attached to the corresponding target. The automatic labelling of a vehicle implies the use of on-board cooperative surveillance equipment that provides an unambiguous vehicle identity to A-SMGCS. Since there are no ICAO transponders requirements for vehicles, vehicles will be equipped with any one of the system available in the industry, provided that vehicles' identity is not ambiguous.

6.3.2.2 Conditional Clearances and Multiple Line-up

The current way to operate by the RWY ATCOs, concerning both the Line-up on RWYs and the RWY crossing operations, is mainly based on the "HOLD SHORT OF RWY…" instruction for pilots. The implementing E-SCA and the widened and improved Surveillance function represent a significant support to the RWY ATCOs sequencing the ground operations, assuring the opportunities to notice a diversion from the delivered instruction, suddenly. The use of Conditional Clearances, and in particular the use of the "BEHIND…" instruction will be tested in a simulated environment, both for the line-up and the RWY crossing and for the RWY35L particularly. The RWY ATCO will instruct crossing or lining-up pilot on the same hearing frequency of the concerning landing traffic (RWY 35L - 128.35) and only when this approaching traffic is on the short final approach and then in sight. One of the main aspect concerning the operational use of Conditional Clearances is related to the rigorous usage of the Read/Hear Back procedure by pilots and ATCOs. A set of holding points couples (one for each side of the RWY) at main intersections (intersections related to the Line-up and crossing operations that are "F" and RWY 35L-17R THRs) have been defined with support of ENAV operational people. It should be coincident with the Holding position for CATIII operations. The objective is to reduce the waiting time on ground, at the RWY intersection. The pilot already instructed and conscious about the manoeuvre he has to perform once the Approaching traffic vacate the RWY, should give him the opportunity of managing the aircraft inertia in a more efficient way.

Another Operational Procedure under testing phase concerns the Multiple Line-Up on the RWY 35L. Taking into account Aircraft Classes and their jet blasts, and considering the length of the RWY 35L (as defined in the sec. 6.1.1.1) it will be possible for the RWY ATCO, to deliver line-up clearances at two departing aircraft, simultaneously. These aircraft should line-up at the Full-length point (THR) and at the intersection of the "F" exit. Respecting the separation minima, these aircraft can take-off in a reduced span of time that is fundamental during departing Peak-hours. This Operational Procedure has to be tested in the TWR simulator to have a first evaluation of risks and benefits.

Both these Operational Procedures have to be considered applicable under VIS1 conditions.

6.3.3 A-SMGCS Low Visibility Procedures

The current Surveillance System at Malpensa Airport is based on the SMR described in the section 6.1.1.7.3. The SMR doesn't provide Localization function on the Aprons due to the application of a filtering on those areas: the big amount of non-cooperative targets moving close to each other and simultaneously doesn't allow a clear discrimination above these busy ground areas.
As described above, Low Visibility Conditions (LVCs) represent a strong limit for the capacity especially when the RVR is less than 150mt. Considering the new implementing Surveillance technologies and in particular the MLAT system, it will be possible to see co-operative targets while moving on the APRON area. ENAV and SEA have been defining a set of reporting points on the APRON surface and particularly on the APRON taxiways "K". These points will be used to report the position to the GND ATCOs. An operational procedure concerning the use of this points is under construction and its objective is the increasing of the number of movements under this visibility conditions. It means that more than one push back and Taxiing on APRON operations could be performed simultaneously when Visibility 3 conditions occurs. This Operational Procedure will be tested during the Real Time simulations sessions.

6.3.3.1 Transponder Operating Procedures

6.3.3.1.1 Operation of MODE-S transponder when the aircraft is on the ground

I. Aircraft equipped with Mode s transponder

Pilots shall adhere to the following procedure:

a) Departing aircraft, from either push-back or taxi request, whichever the earlier:

− Enter through the FMS or transponder control panel:

- Flight Identification as specified in item 7 of ICAO flight plan form; or
- In the absence of Flight Identification, the Aircraft Registration;

− Select XPDR or its equivalent depending on the specifications of the installed model;
− Select AUTO mode, if the function is available;
− Do not select the OFF or STAND BY functions;
− Set the Mode A code assigned by ATC.

b) Arriving aircraft, after landing until at the stand:

− Select XPDR or its equivalent depending on the specifications of the installed model;
− Select AUTO mode, if the function is available;
− Do not select the OFF or STAND BY functions;
− Maintain the Mode A code assigned by ATC.

c) Moving aircraft on the movement area:

− Select XPDR or its equivalent depending on the specifications of the installed model;
− Select AUTO mode, if the function is available;
− Do not select the OFF or STBY functions;
− Set Mode A code to 1000.

II. Aircraft not equipped with Mode S transponder or with unserviceable Mode S transponder

Pilots shall adhere to the following procedure:

a) Departing aircraft:

− Maintain Mode A + C transponder to OFF until line up;

b) Arriving aircraft:

− Set the Mode A + C transponder to OFF as soon as the runway is vacated;

c) Moving aircraft on the movement area:

− Maintain Mode A + C transponder to OFF for all the duration of displacement.

Warning

TCAS should be selected before entering the runway, after receiving line up clearance; it should be deselected after vacating the runway.

7 Annex IV

7.1 References

[1] ICAO (2003). Manual on advanced surface movement guidance and control systems ((A-SMGCS), AN-Conf/11-IP/4, Montreal 2003.

[2] Klein, K. & Jakobi, J. (2003). BETA Recommendations Report. EC Growth Project BETA, Document 1999-RD.10804, D26 / 2003-05-07.
[3] EMMA (2006). Operational Requirements Document (update), Document D135u, Version 1.0, 2006.

7.2 List of Figures

7.3 List of Tables

7.4 Abbreviations

Abbreviation	Long Name
AEC	Approach Executive Controller
AMIS	Gate management system
AMS	Airport Monitoring System / Apron Management Service
ANS CR	ŘLP ČR, s.p., Řízení letového provozu ČR
APN	Apron, Apron Control
APP	Approach Control Service
ASC	Approach Senior Controller
A-SMGCS	Advanced Surface Movement, Guidance and Control System
ATIS	Automatic Terminal Information System
ATS	Air Traffic Services
BDV	Base Dati Voli
BRIA	Bureau Régional d'Information et d'Assistance au vol
CD	Clearance Delivery
CDD	Clearance Delivery Dispatcher
COM	Communication
ČSL, s.p.	Czech Airport Authority
CTOT	Calculated Take-off Time
E2000	SUR system
ESUP	Flight Data Processing System in Prague
FAF	Final Approach Fix
GAREX	Main Com system
GAT	General Air Traffic
GEC	Ground Executive Controller
GND	Ground Control
IDP	Back-up SUR system
LVC	Low Visibility Conditions
Motorola	COM system
MTOW	Maximum Take-Off Weight
PEC	Director Executive Controller
QFU	RWY in use
RCS	Radar Cross Section
ŘLP ČR, s.p.	Řízení letového provozu ČR
ŘOP	Apron and Gate Management Dispatcher
ŘOS	Apron and Gate Management Unit
RWY	Runway
Rx	Receiver
SAM	Slot Allocation Message
SMC	Surface Mouvement Control
SMR	Surface Mouvement Radar
SQB	Squitter Beacon
SUR	Surveillance
SZZ	Lightning system
TEC	Tower Executive Controller

Technisonic	Back-up COM system
TPC	Tower Planning Controller
TSC	Tower Senior Controller
TWR	Aerodrome Control Tower
TWS	Tower Supervisor
TWY	Taxiway
Tx	Transmitter