Analyzing radar tracks: Michał Lis

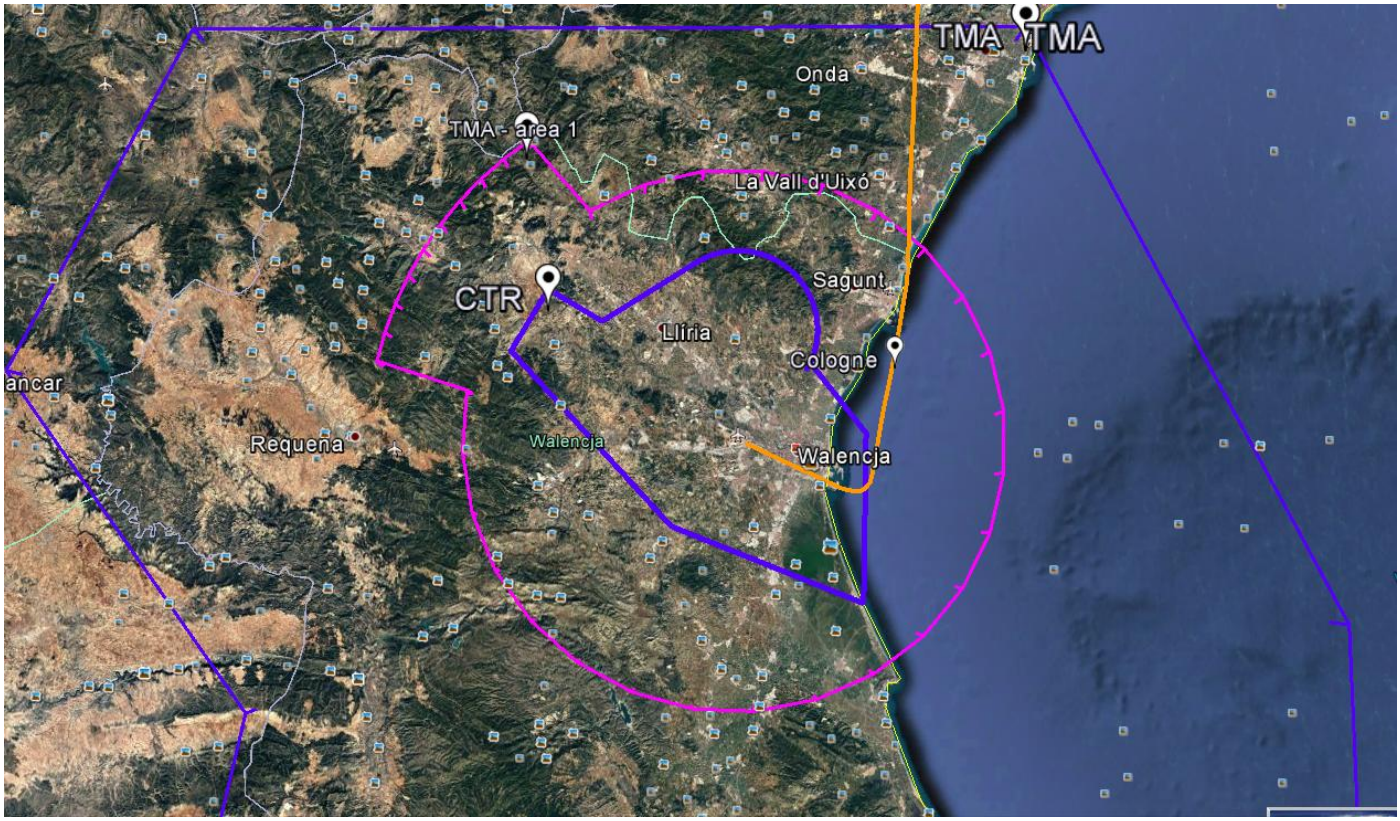
PART I: Excersie I

1. Flight data : 05.01.2017, From Cologne to Valencia
   Callsign: RYR46SR
   Squawk code: 6331
   ICAO hexId: 4CABC2
   Departure airport: Cologne (CGN/EDDK) Arrival airport: Valencia (VLC/LEVC)
   Estimated arrival time: 12:55
   Actual Arrival time: 12:41
   Aircraft model: B738
   The airway preceding STAR Procedure: UN860
   The waypoint where STAR procedure starts: SAURA
   STAR procedure: SAURA3C
   The approach procedure fix:
   IAF : It exists (MULAT), but the plane does not use it because the traffic is not that big and the plane navigation systems permits it to omit the IAF
   IF: PINEDO 039 º 26''15.00"N W000 º 20''47.00"W
   FAP: 6.1 DME ILS, PINEDO 039 º 26''15.00"N W000 º 20''47.00"W
   No missed approach.

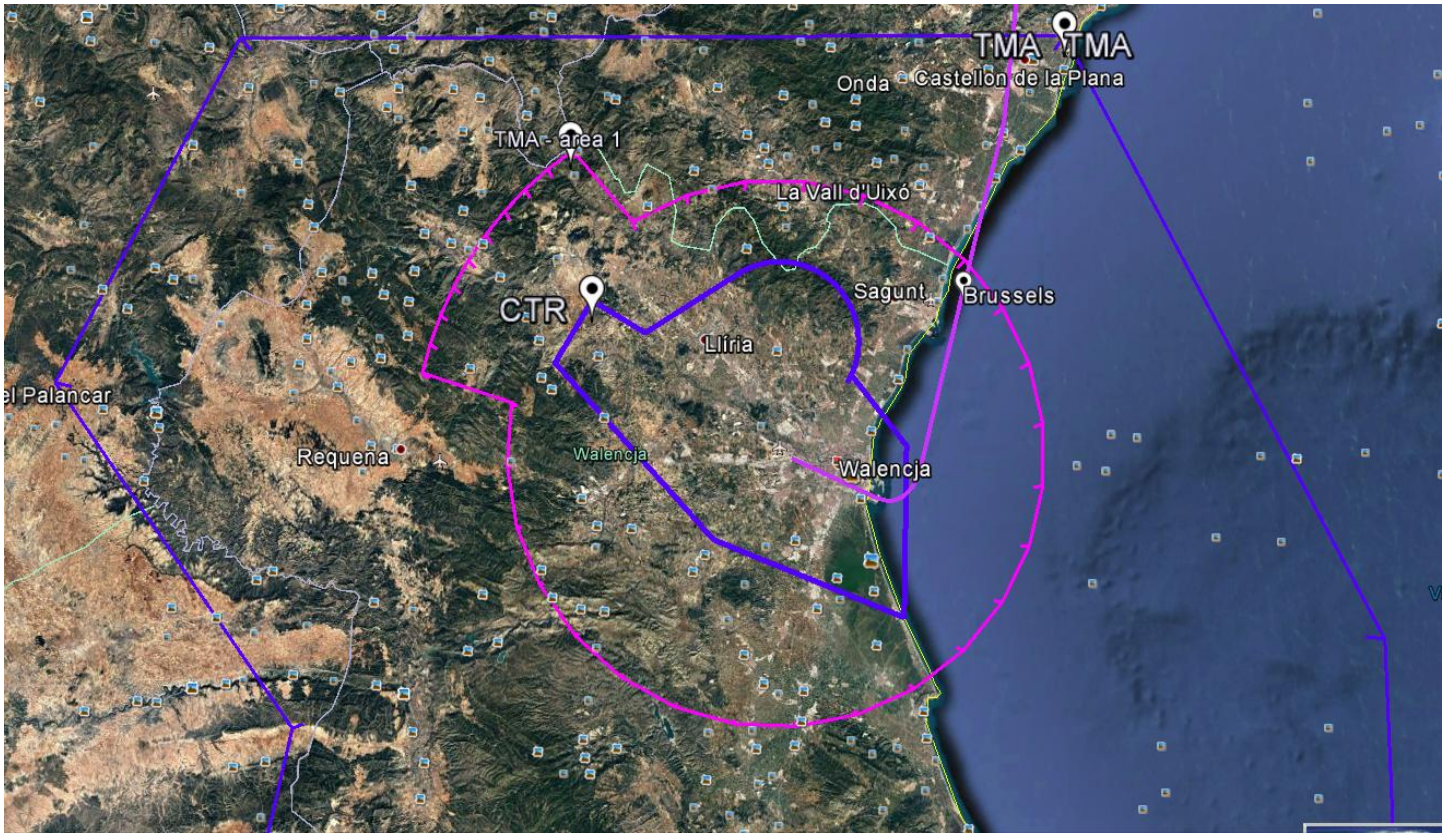
2. Flight data : 05.01.2017, From Brussels to Valencia
   Callsign: RYR88NP
   Squawk code: 7156
   ICAO hexId: 4CA4EE
   Departure airport: Brussels (BRU/EBBR) Arrival airport: Valencia (VLC/LEVC)
   Estimated arrival time: 14:25
   Actual Arrival time: 14:22
   Aircraft model: B738
   The airway preceding STAR Procedure: UN860
   The waypoint where STAR procedure starts: SAURA
   STAR procedure: SAURA3C
   The approach procedure fix:
   IAF : It exists (MULAT), but the plane does not use it because the traffic is not that big and the plane navigation systems permits it to omit the IAF IF: 39 º25''28.00" N, 00º16''08.00" W
   IF: PINEDO 039 º 26''15.00"N W000 º 20''47.00"W
   FAP: 6.1 DME ILS, PINEDO 039 º 26''15.00"N W000 º 20''47.00"W
   No missed approach.

PART I: Excersie II

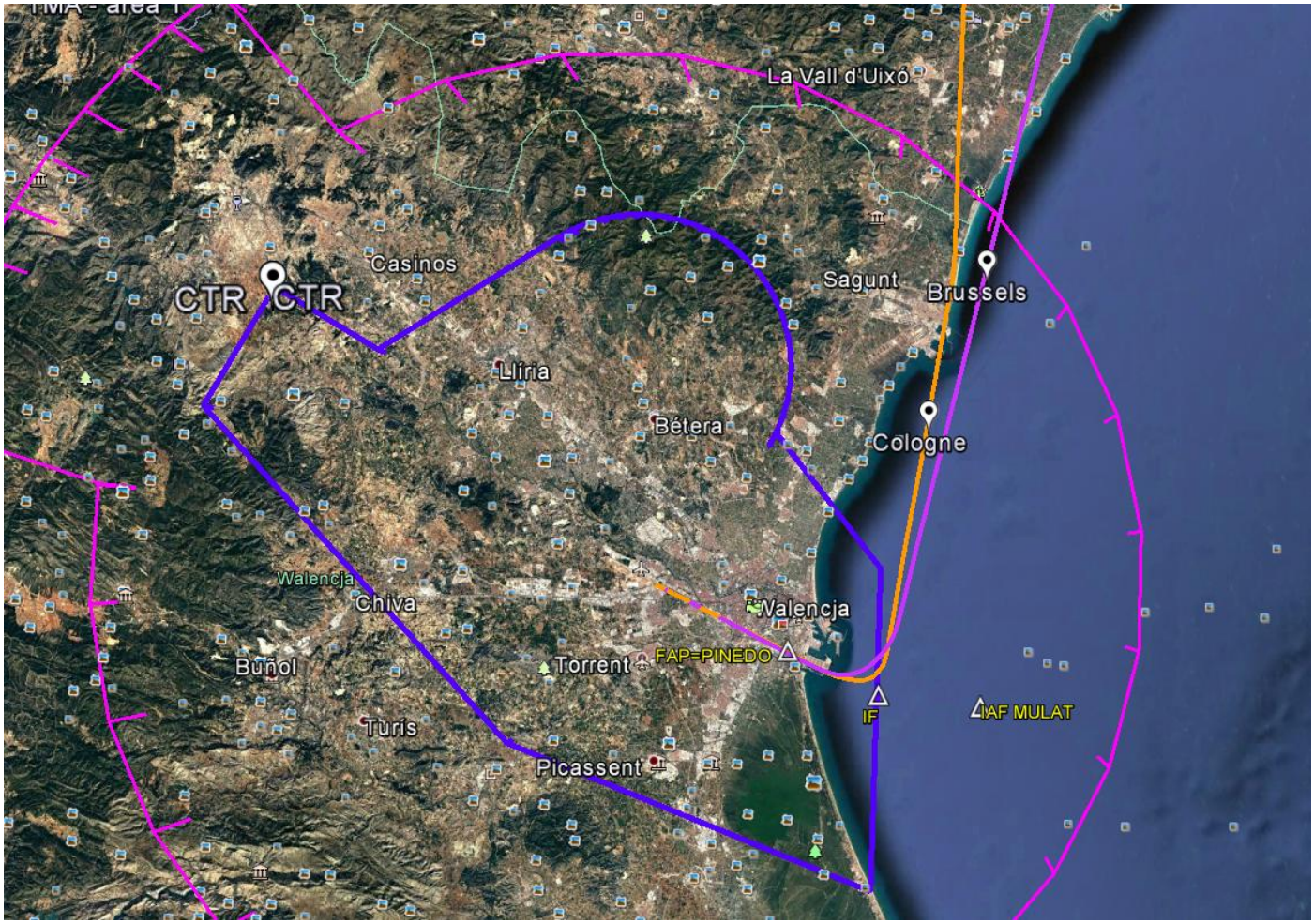
Flight from Cologne



Flight from Brussels



With important waypoints (IAF –MULAT , IF and FAP)



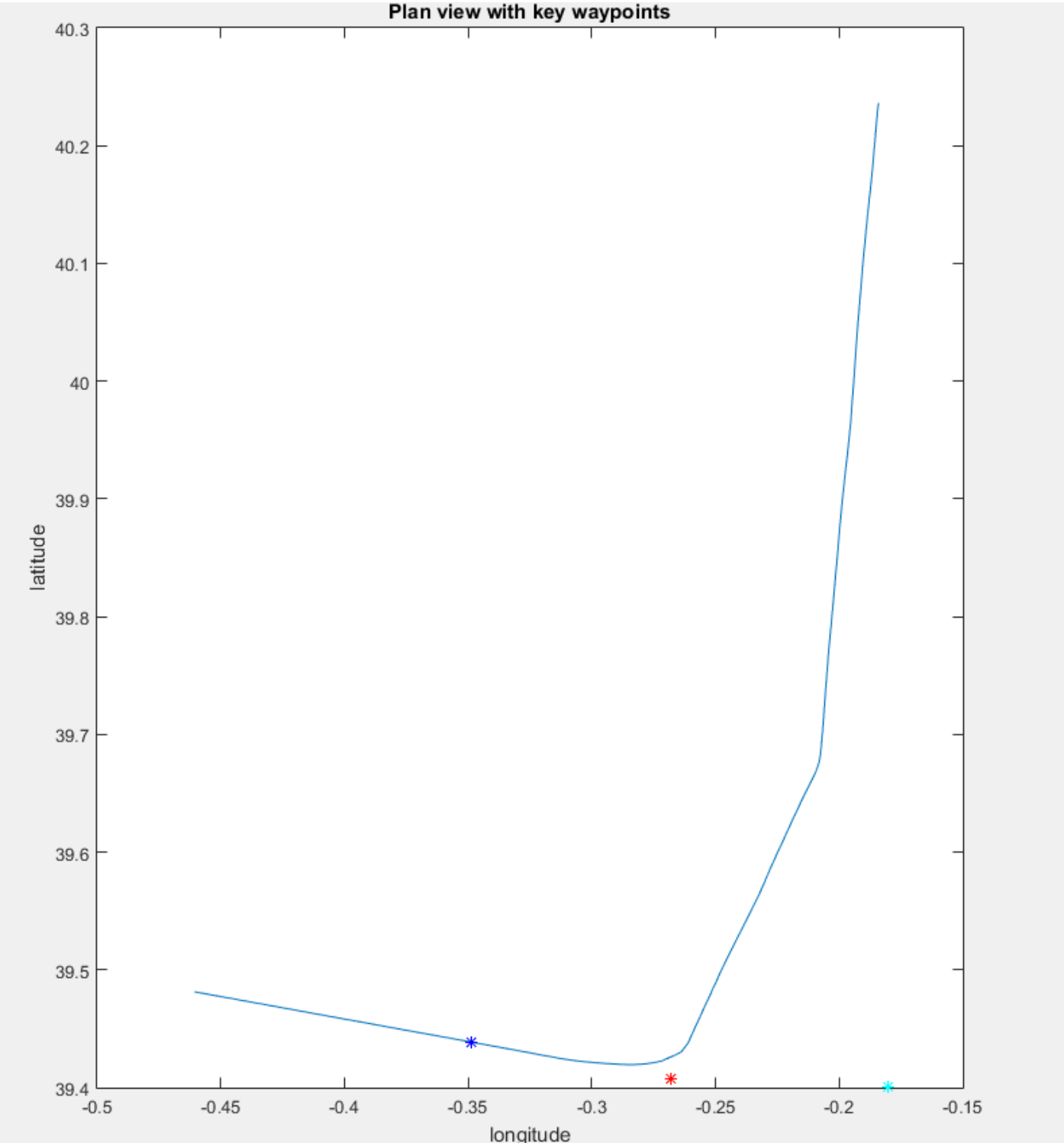
Comment:

With current technology of some airplane navigation, some flights can omit overflying the IAF. When the air traffic is not so intensive and it does not create dangerous situation the ATCO can let the flying plan omit the IAF and go directly to IF. Such situation had place in both our flights. When heading straight to IF our planes than got to the leg of Intermediate Fix (setting out the flaps and reducing velocity) and finally got to the FAP which in our case was PINEDO.

PART I: Excersie III

Plot of vertical profiles of the routes:

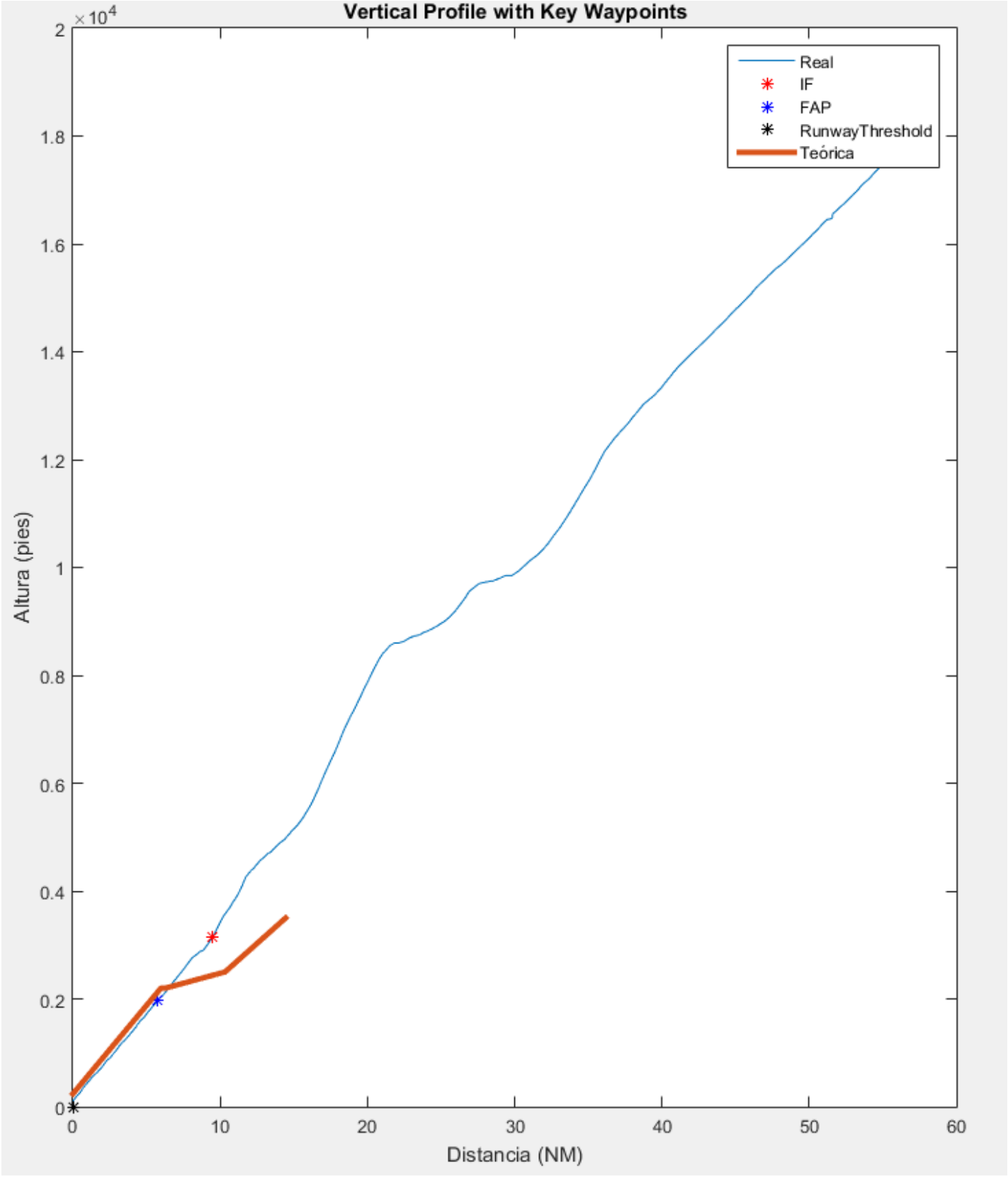
Flight from Cologne:



Comment:

We can see from the diagram that during the procedures there were deviations from the theoretical route. This is because of the “direct to” clearance issed by the ATC. The pilot was given “direct to” IF, letting him to omit the IAF MULAT. The clearance was given by ATCO thanks to the low air traffic at given moment.

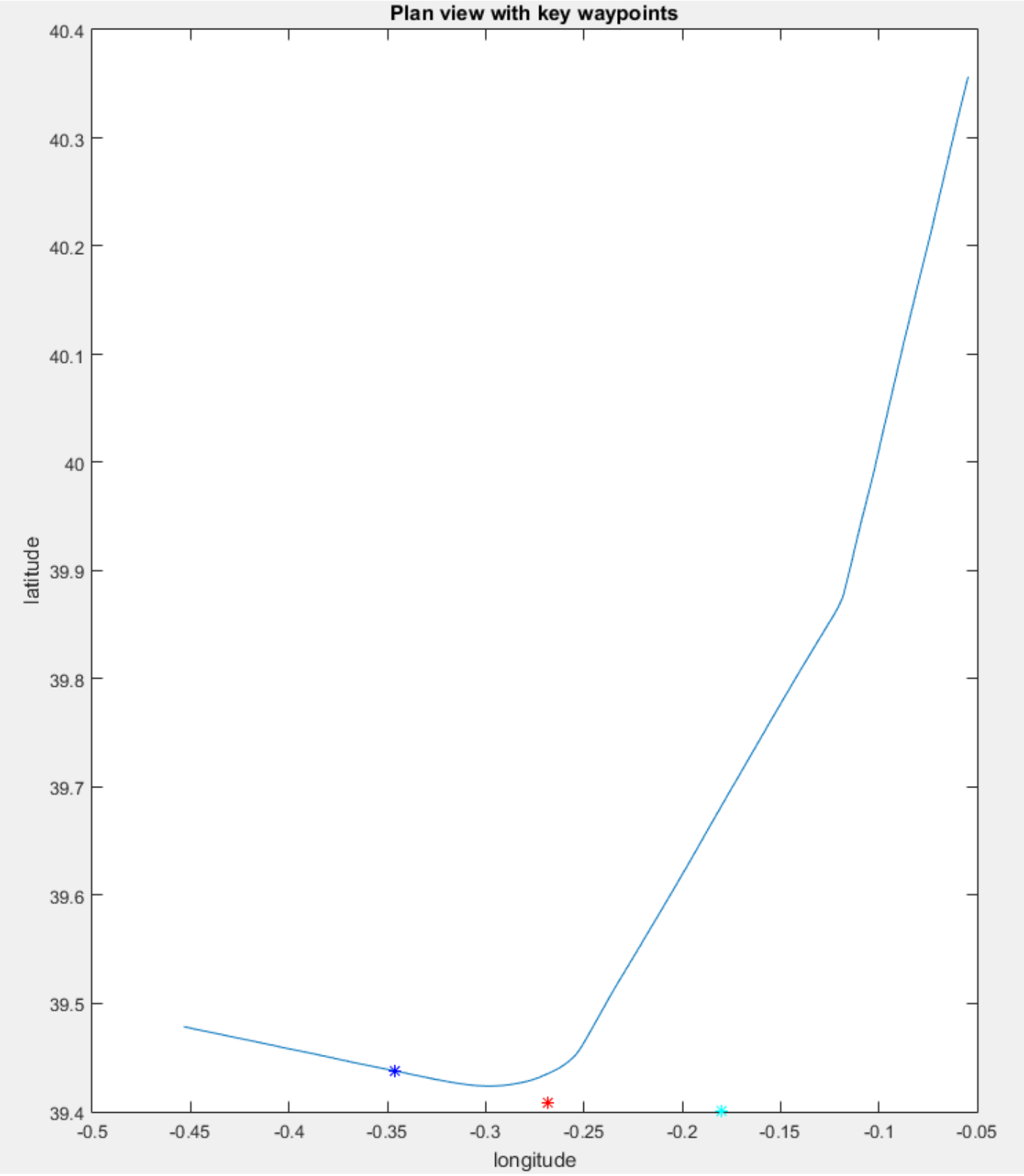
Flight from Cologne:



Comment:

We can see that the pilot met the condition of minimum height in Intermediate flight (the real profile is above the theoretical one) and that after overflying the FAP the flight perfectly sticks to the Glide Slope of 3 º.

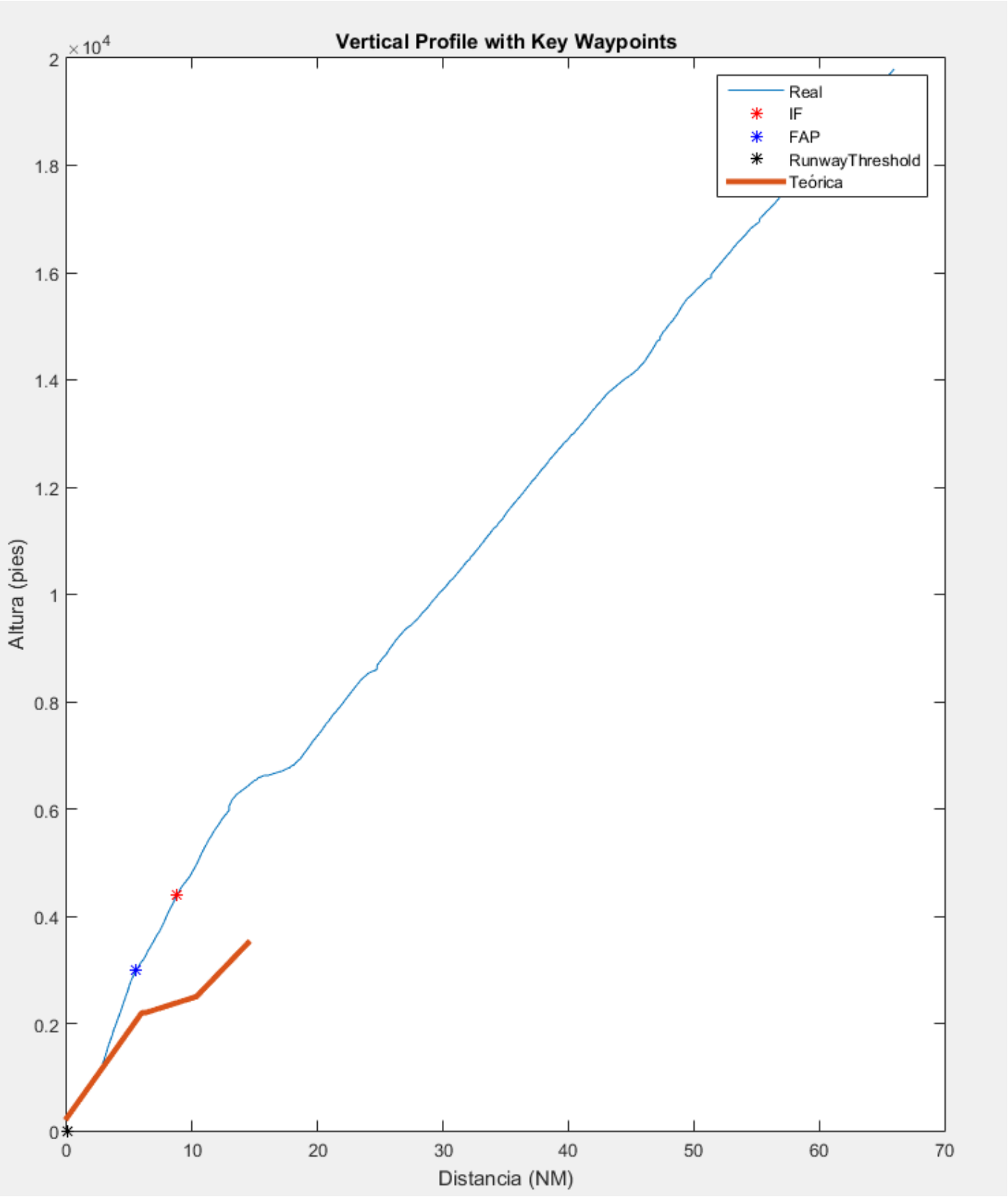
Flight from Brussels:



Comment:

Once again we can see from the diagram that during the procedures there were deviations from the theoretical route. Again, this is because of the “direct to” clearance issed by the ATC. The pilot was given “direct to” IF, letting him to omit the IAF MULAT. Likewise the situation from the Cologne flight here the clearance was again given by ATCO thanks to the low air traffic at given moment.

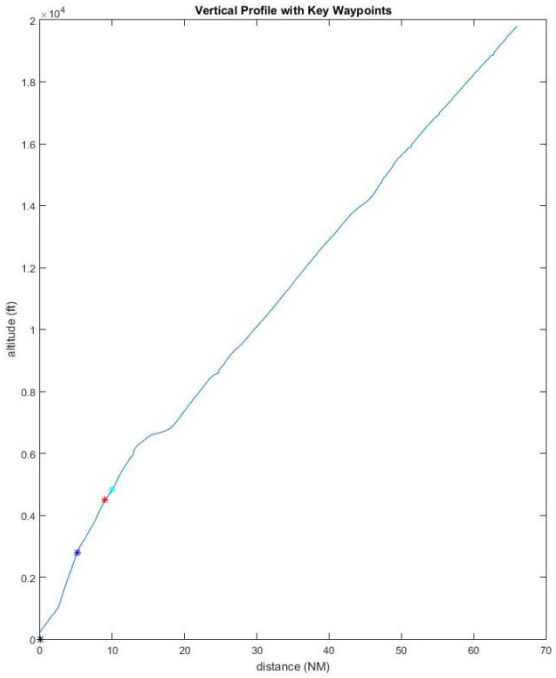
Flight from Brussels



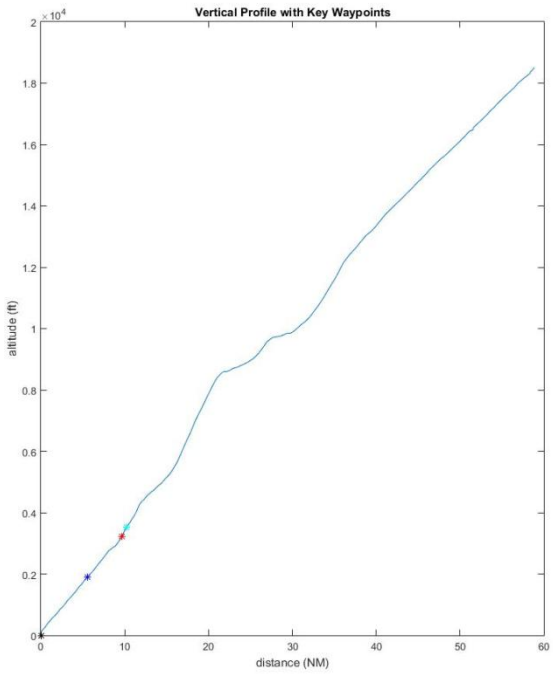
Comment:Here we have a strange deviation (what was it caused by?? Weather, birds, some ATCO command?) because pilot does not meet the FAP with good accuracy. Instead of flying 2200ft he is around 3000ft. What is more he does stick to the 3 º Glide Slope but only from a certain moment (more or less 1100ft), not from the FAP.

Comparing the two profiles:

Brussels

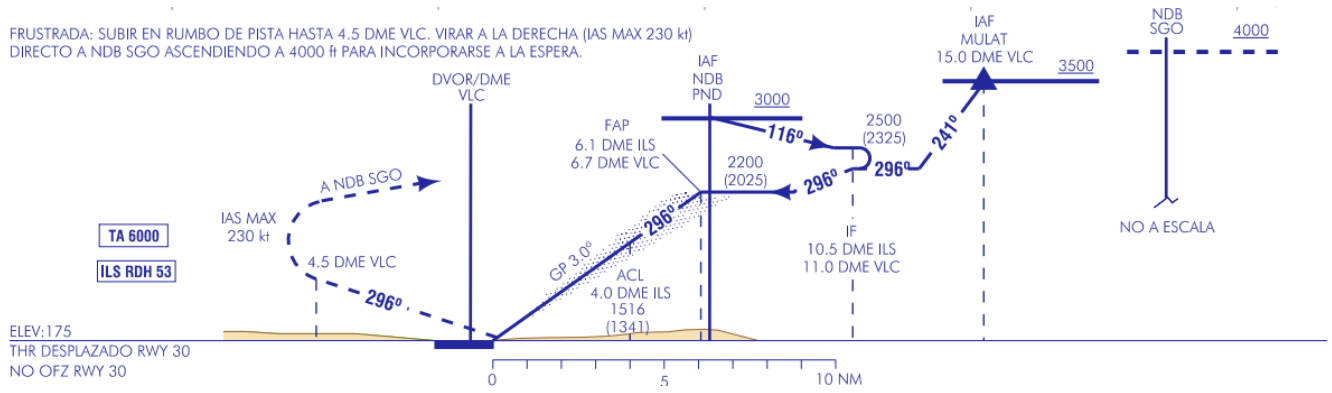


Cologne



FAP (approximate): The same FAP with altitude 2200 feet. The plane from Brussels misses the FAP.

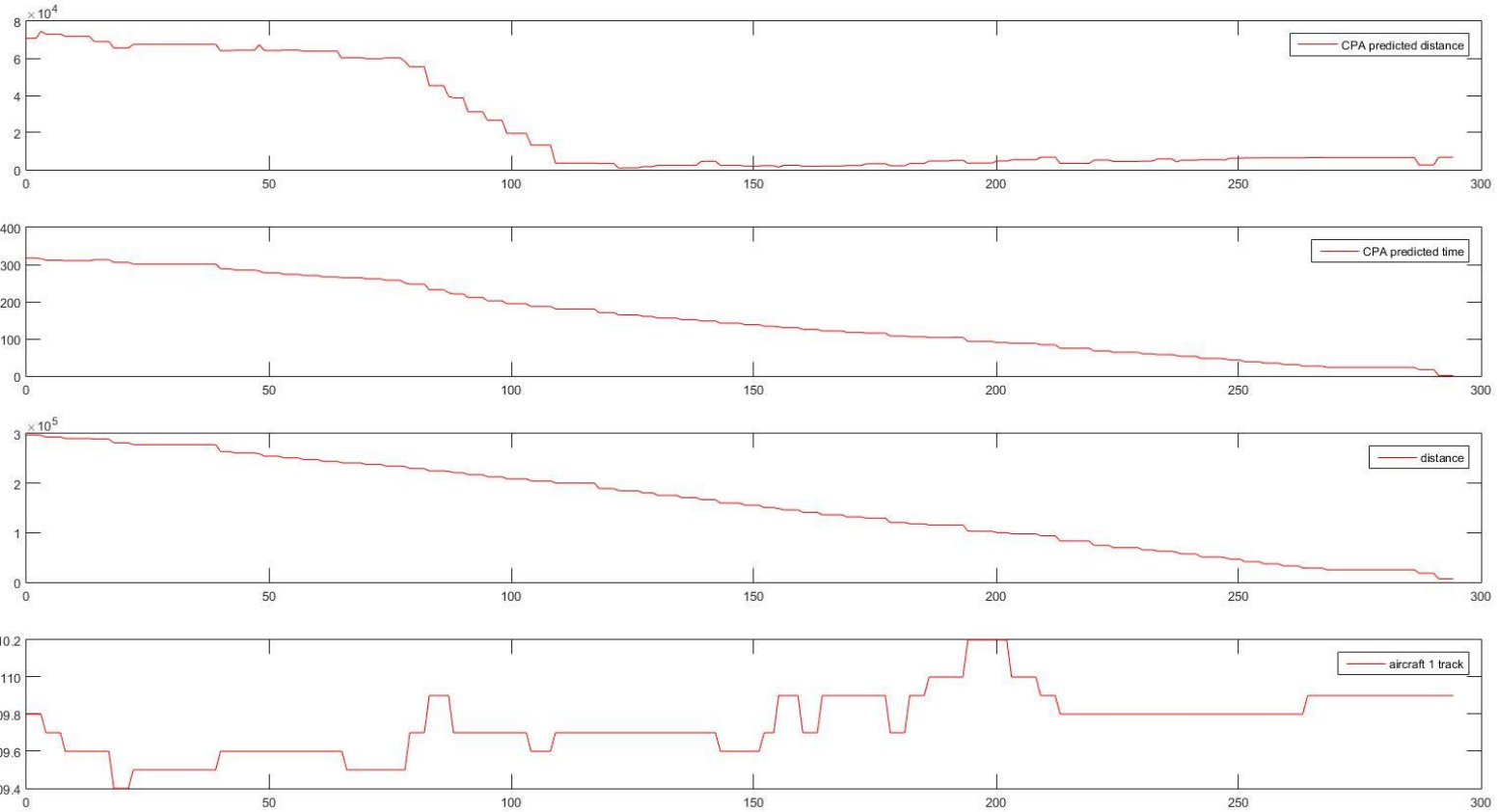
Valencia runway elevation is 240 ft. **<u>These flights had precision procedures</u>** and the FAP location is determined by calculating the distance to the runway threshold and the glide slope which is usually around 3 degrees. The pilot can see that he is in the FAP when DME indicates 6.1.



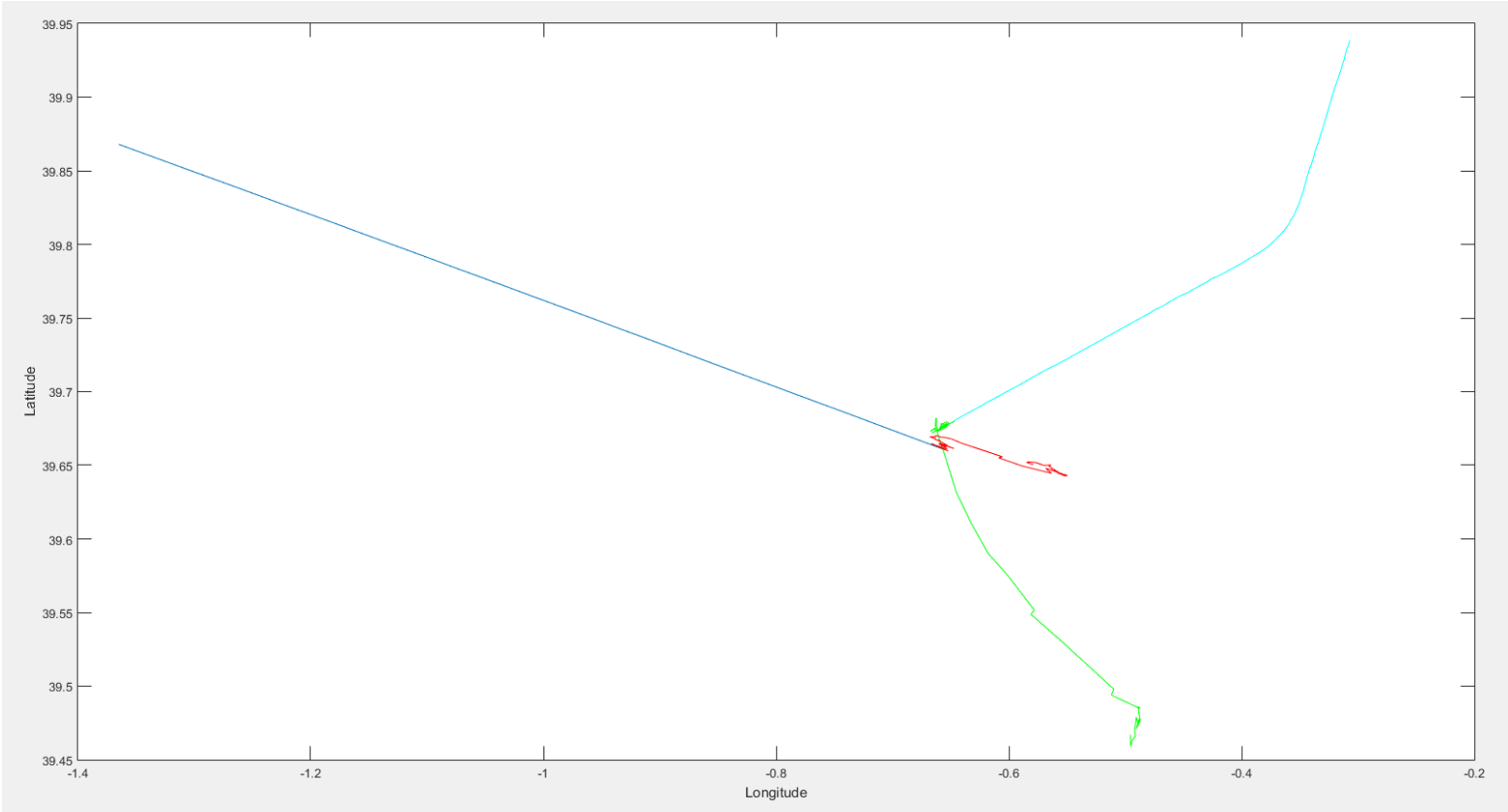
Part II

Excercise III:

The diagrams calculated by Matlab for the CPU predicted distance, CPU predicted time, distance and a track of 1 aircraft. We can see that when one of the aircrafts turns the CPA predicted distance is decreasing much faster



A graphic with the tracks and the different locations of the CPA similar to the one of figure 4. In order to present the graphic I had to cut the beginning of one record of the first track (cutting the time when the tracks did not coincide).



A good a criteria to generate the RA (Resolution Alert) and implement it in Matlab would be a simple if:
CPA predicted distance is smaller than 2.1NM (760ft) -> alert
CPA predicted time is smaller than 25 sec -> alert

For the TA (Traffic Alert):

CPA predicted distance is smaller than 3.3NM (20 051,2ft) -> alert
CPA predicted time is smaller than 40 sec -> alert