Airport ATCC System

CW1

Date: 12/3/2018

By: Ismail Marashi

ID: H00255438

Program: BCS

Campus: Dubai

Table of Contents:

Introduction:

For this coursework, we were assigned to redesign an airports ATCC system to support aircraft departure and landing. Also, we were to replace the old FPS system with and electronics FPS. To do that we need to design appropriate UML diagrams to create such a system.

Assumptions:

- I assumed the CMS only supported communication and not FPS transfer. This means that any kind of file transfer would be done dependently of the cms.
- No possible external intervention is possible and therefor they are unaccounted for.
- Flight checks have already been done, no issues were found.

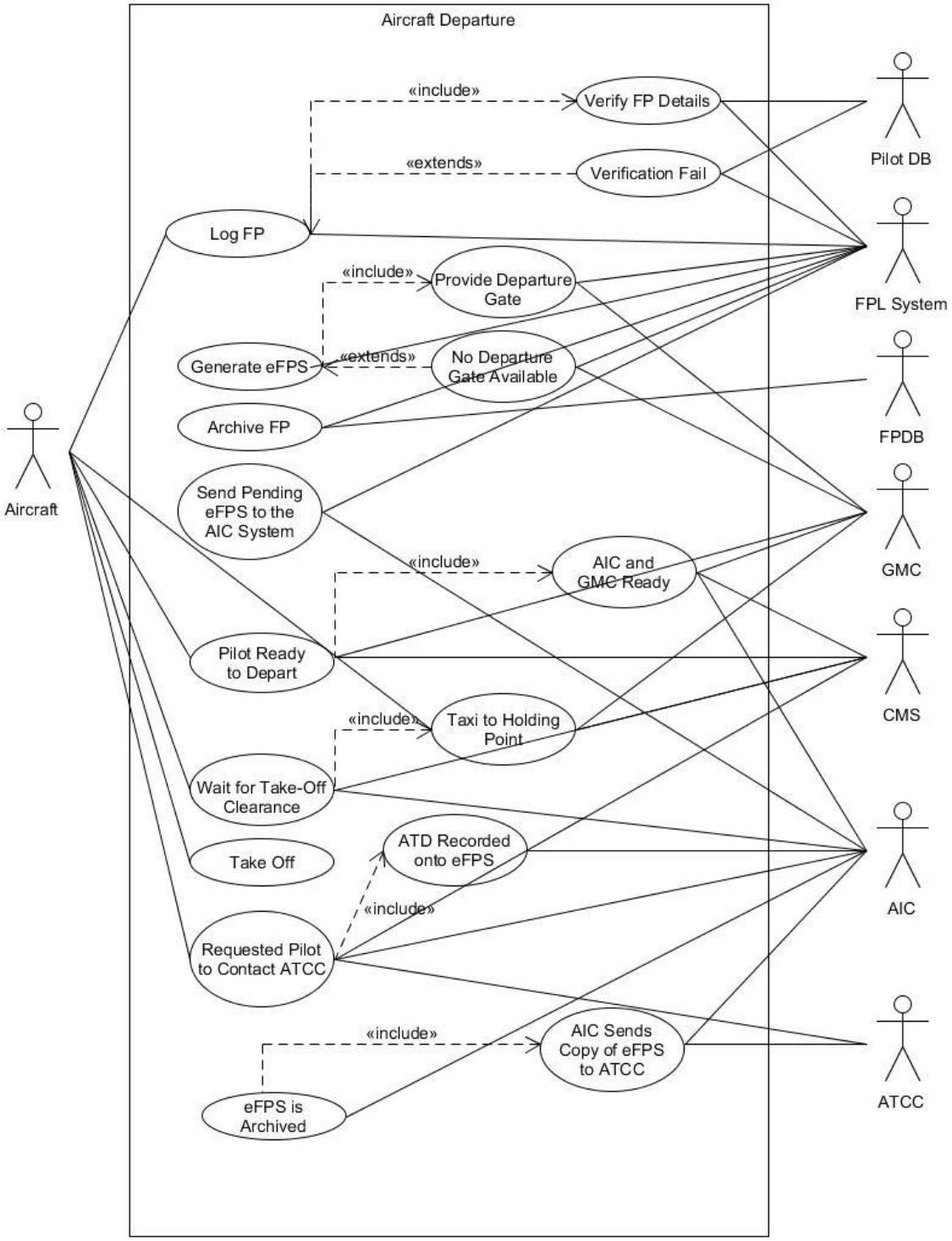
Functional Requirements:

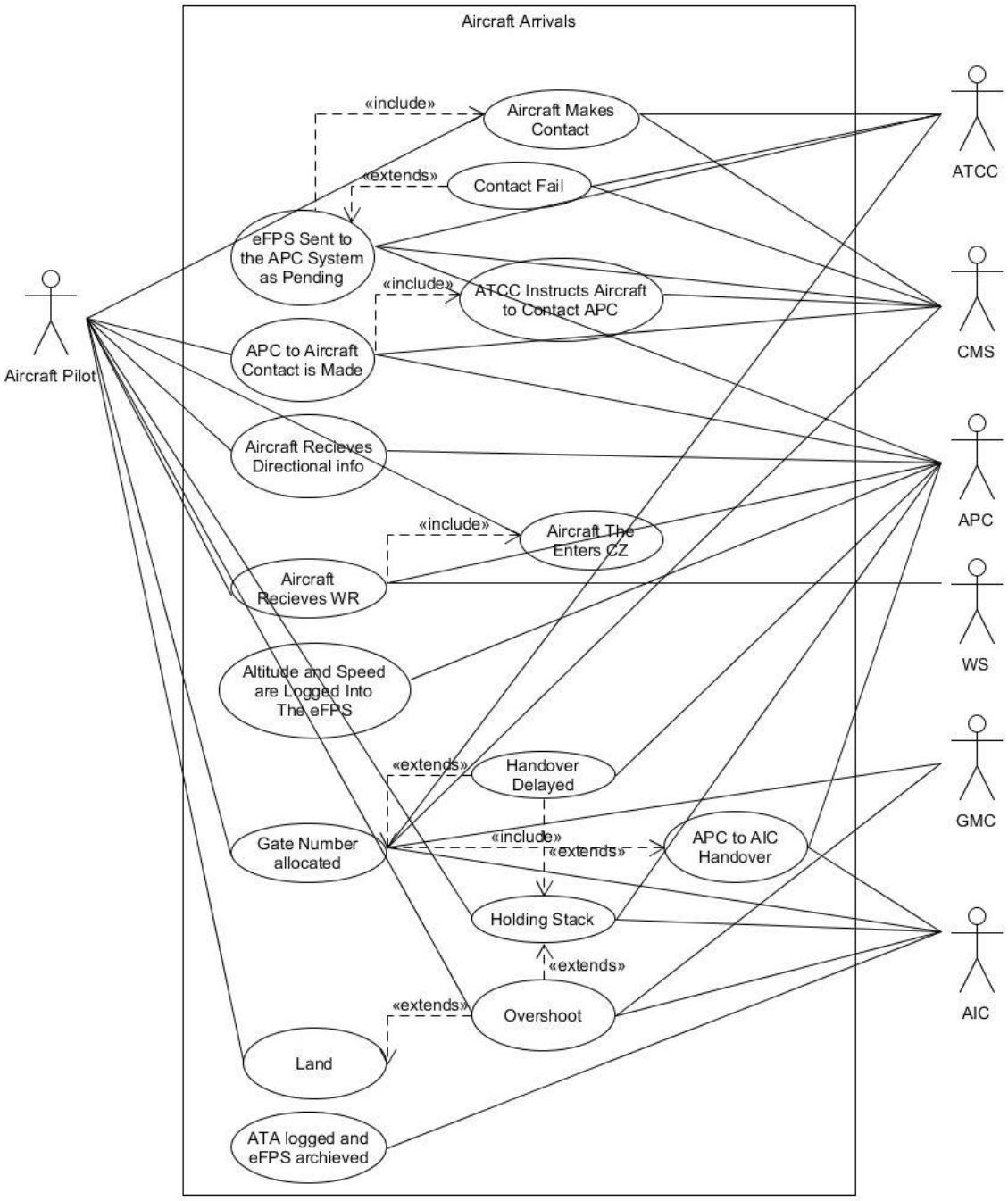
ID	Details	Priority
R1	The ATC system shall use an eFPS instead of an FPS.	M
R2	The ATC system will manage the eFPS of inbound flights and outbound flights.	M
R3	An eFPS will log aircraft type, callsign, altitude, gate number, airspeed.	M
R4	An eFPS will record airspeed, ETA, ATA of inbound flights.	M
R5	An eFPS will record ETD, and ATD of outbound flights.	M
R6	An eFPS will hold route information of outbound flights.	M
R7	A Controllers within the ATCC will communicate via CMS.	M
R8	Pilots will communicate with controllers through the CMS.	M
R9	The CMS use pre-defined messages to communicate.	M
R10	The ATC system supports radio and landline as an alternative to the CMS.	S
R11	Before departure, the FPL system will generate an eFPS and send it to the AIC system and appears as pending.	M
R12	ATC system has a FPL system, the system will allow pilots outside the controlled airspace to log their FPs' electronically.	M
R13	FPs' will log all details of the eFPS, hold records of the names, and license numbers of the pilots	M
R14	ATC system should be able to validate pilot's details on the FP via and external pilots Database PDB	M
R15	FP will receive a departure gate number from the GMC automatically.	S

R16	ATC shall send the FPs' to an external database (flight plan database (FPDB)) when completed.	S
R17	FPL system will generate eFPS and send it to the AIC system and appears as pending.	M
R18	The AIC and APC controllers will manage eFPSs' of flights,	M
R19	The AIC system eFPs shall have three catagories pending, active, and archieved.	S
R20	The AIC system will send their eFPs to the ATCC.	M
R21	The AIC can archieve an eFPS.	S
R22	GMC system maintains records of aircraft call signs and gate numbers without access to eFPS.	M
R22	APC eFPS are split into four categories pending, active, achieved, and holding	M
R23	APC will receive pending eFPS from ATC to inform them of incoming aircrafts.	S
R24	APC will provide aircrafts directional info to locate runway glide paths.	M
R25	APC receives WR every 15 from the WS.	S
R26	APC will provide aircrafts with WR electronically.	M
R27	APC will log aircraft altitude and speed on the eFPs.	M
R28	APC will update WR is the weather changes.	S

ID	Details	Priority
R1	Incoming aircrafts can communicate with aircrafts outside the CZ.	M
R2	ATC system should be able to interact with be able to interact with future ATC subsystems.	S
R3	ATC system should require no more than a couple of weeks of training.	S
R4	eFPS access will be restricted for each subsystem.	S
R5	Aircraft to pilot communication should take no longer than 10ms to reach the receiver.	M
R6	ATC system holds records of previous FPs'	S
R7	The CMS should contain commands to support inbound and outbound flights.	M
R8	CMS communication should be secure and prevent external intervention.	M
R9	CMS should be able to support concurrent communication between its subsystems.	M
R10	ATC system should be able to run without crashing	M
R11	CMS should be easily expandable to include new instructions.	S
R12	eFPS should have timestamps	S
R13	ATC implementation should be able to be expanded to communicate other subsystems.	S
R14	Interaction between the ATC subsystems and external databases should be secure.	M

Use Case Diagrams:




Aircraft Arrivals
Aircraft Pilot
Aircraft Makes Contact
Contact Fail
eFPS Sent to the APC System as Pending
ATCC Instructs Aircraft to Contact APC
APC to Aircraft Contact is Made
Aircraft Recieves Directional info
Aircraft The Enters CZ
Aircraft Recieves WR
Altitude and Speed are Logged Into The eFPS
Handover Delayed
Gate Number allocated
APC to AIC Handover
Holding Stack
Overshoot
Land
ATA logged and eFPS archieved
«include»
«extends»
ATCC
CMS
APC
WS
GMC
AIC

Use Case: Aircraft Departure
ID: 1
Goal: Allow Aircrafts to Depart Safely
Primary actor: Aircraft
Secondary actor(s): Pilot DB, FPL System, GMC, CMS, AIC, ATCC.
Pre-conditions: • Aircraft should be parked inside the airport. • Aircraft has a FP. • Pilot should have a valid pilots license. • All pre-flight checks have been made. • Aircraft has systems to support CMS communications.
Postconditions: • Pilot departs from the airport without any complications.
Main flow: 1. Pilot logs FP to the FPL system. 2. FPL system verifies FP details. 3. Verification success. 4. FPL system generates eFPS for the flight. 5. GMC provides the FPL system with a departure gate. 6. FPL system sends a pending eFPS to the AIC system. 7. FPL sends FP to the FPDB archiving it. 8. Pilot signals his readiness to depart. 9. AIC and GMC are both ready to allow the aircraft to depart. 10. Aircraft is instructed by the GMC to Taxi to the holding point. 11. Aircraft is given take-off clearance from the AIC. 12. Aircraft take-off. 13. ATD recorded onto the eFPS. 14. Pilot is requested to contact the ATCC. 15. AIC sends a copy of its eFPS to the ATCC. 16. AIC archives its eFPS.
Alternative Flow: 1- Pilot logs FP to the FPL system. 2-Verification fail. 3-Aircraft is not given permission to fly. 4- FPL system generates eFPS for the flight. 5-GMC cannot provide departure gate, no gates are available. 6-Wait for a departure gate availability.

Use Case: Aircraft Arrival

ID: 2

Goal: Allow Aircrafts to Land Safely.

Primary actor: Aircraft

Secondary actor(s): WS, AIC, GMC, CMS, AIC, ATCC,APC

Pre-conditions:

- The airport is the aircrafts destination.
- Aircraft has a FP.
- Pilot should have a valid pilots license.
- All communication is done through the CMS.
- Aircraft has systems to support CMS communications.

Postconditions:

- Aircraft lands safely.

Main flow:

1. Aircraft contacts the ATCC.
2. ATCC Receives aircrafts eFPS.
3. eFPS is sent to the APC system as pending.
4. ATCC instructs aircraft to contact the APC.
5. Aircraft contacts the APC.
6. Aircraft receives directional information to guide them to the runway.
7. Aircraft enters the CZ.
8. Aircraft Receives a WR.
9. Altitude and speed are logged into the aircrafts eFPS.
10. APC hands over aircraft to the AIC.
11. AIC requests an arrival gate from the GMC.
12. Aircraft is given clearance to land.
13. Aircraft lands successfully.
14. ATA is logged onto the eFPS and then archived.

Alternative Flow:

1- Aircraft contacts the ATCC.

2-ATCC refuses to allow aircraft to land.

9- Aircraft Receives a WR.

10- APC delays handover.

11- Aircraft is redirected to the holding stack.

12-Aircraft is instructed to overshoot.

13-aircraft is handed from to the APC

14- Aircraft is redirected to the holding stack.

Traceability Matrix:

FR\UC	UC 1	UC 2
R1.	X	
R2.	X	X
R3.	X	X
R4.	X	
R5.		X
R6.	X	
R7.	X	X
R8.	X	X
R9.	X	X
R10.		
R11.	X	
R12.	X	
R13.	X	
R14.	X	
R15.	X	
R16.	X	
R17.	X	
R18.	X	X
R19.		
R20.	X	X
R21.	X	
R22.		
R23.		X
R24.		X
R25.		
R26.		X
R27.		X
R28.		

CRC Model:

Class eFPS	
Responsibility	**Collaborators**
Logs aircraft type	Scribe, FPL
Logs call sign	
Logs altitude	
Logs gate number	
Records airspeed	
Records ETA	
Records ATA	
Records ATD	
Records ETD	

Class **CMS**	
Responsibility	**Collaborators**
Controllers can communicate to other controllers	AIC, APC, GMC, ATCC.
Pilots can communicate to controllers	
Sends alerts	

Class **FP**	
Responsibility	**Collaborators**
Logs all eFPS details	FPL, ATCC
Logs names of pilots	
Logs license numbers of pilots	
Logs Departure gate	

Class **FPL**	
Responsibility	**Collaborators**
Creates a eFPS out of an FP	FP, PDB, GMC, FPDB, AIC.
Creates a FP.	
Validates details via an external database	
Requests departure gate from the GMC system	
Logs departure gate onto an eFPS	
Sends completed FPs' to an external database	
Sends a eFPS to the AIC system	
Changed tags of newly created eFPSs' to pending	

Class **PDB**	
Responsibility	**Collaborators**
Holds records of pilots and their details.	FPL

Class FPDB	
Responsibility	**Collaborators**
Holds records of all completed FPs'.	FPL

Class **ATCC**	
Responsibility	**Collaborators**
Submits FP	FP, FPL

Class **GMC**	
Responsibility	**Collaborators**
Maintains records of aircraft call signs	eFPS
Maintains records gate numbers	

Class **WS**	
Responsibility	**Collaborators**
WR are sent every 15 min to the APC	WR, APC.

Class **AIC**	
Responsibility	**Collaborators**
Logs eFPS	Scribe, eFPS, GMC, ATCC.
AIC logs Gate Number onto the eFPS	
AIC logs ATA to eFPS on touchdown.	
eFPS is archived.	
Edits eFPSs'	
Manages eFPSs'	
Splits eFPS under 3 headings. (pending, active, and archived.)	
request a gate number from the GMC	
sends their eFPS to the ATCC	
AIC can alter tags of the eFPS.	
Archive eFPS	

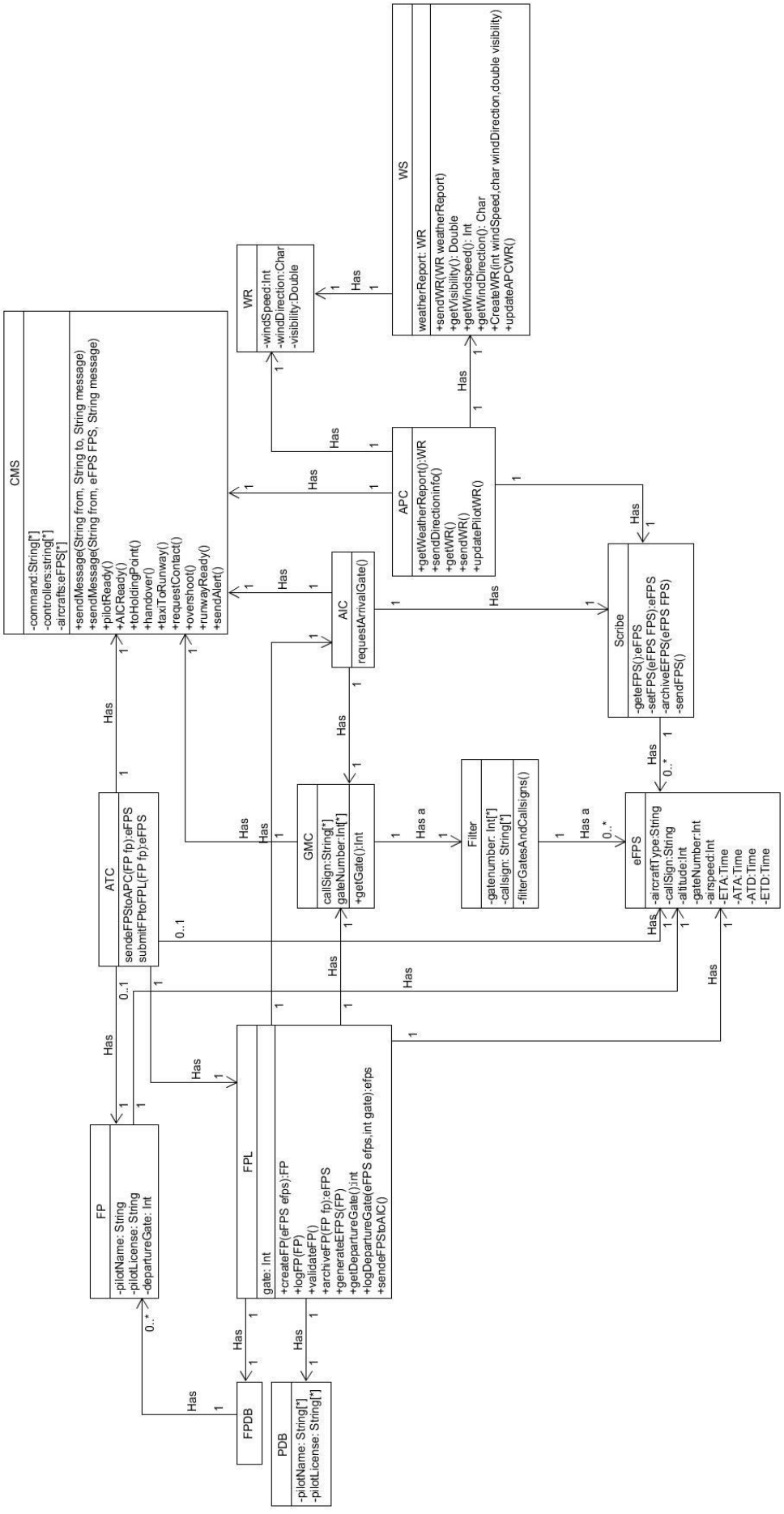
Class **APC**	
Responsibility	**Collaborators**
Manage eFPSs'	Scribe, CMS, WS, ATC.
Have scribes	
eFPS are split into four categories pending active, achieved, and holding.	
APC provides the aircraft directional info to locate the glide path for the runway	
APC provides aircraft with a WR electronically as is enters the CZ	
APC logs the aircraft altitude and speed on the eFPC	
APC updates aircraft WR	
APC can handover aircraft to ATC	

Class **GMC**	
Responsibility	**Collaborators**
Maintains records of aircraft call signs	eFPS
Maintains records gate numbers	

Class **WR**	
Responsibility	**Collaborators**
Logs speed direction	WS
Logs wind direction	
Logs visibility	

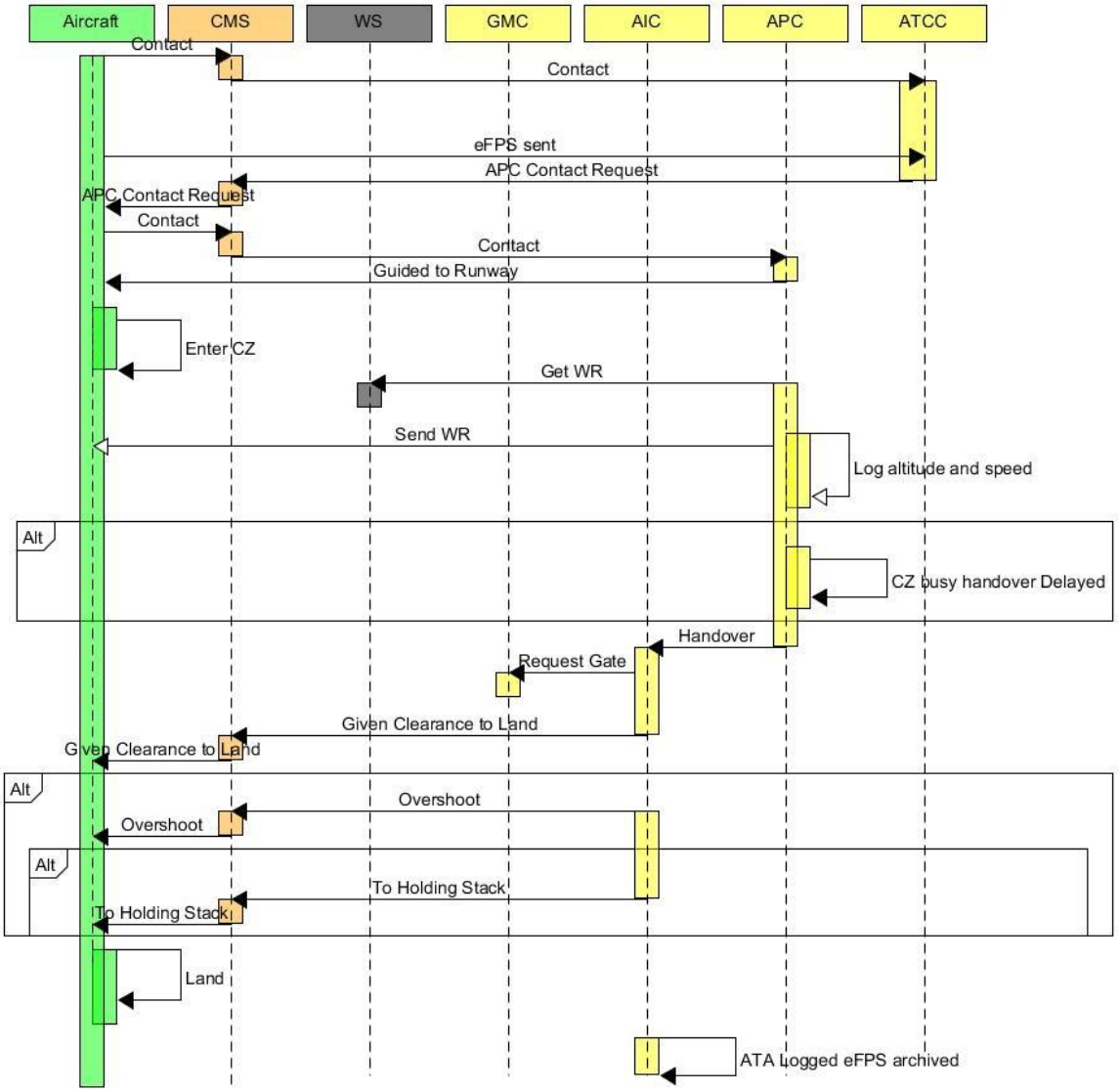
Class **Scribe**	
Responsibility	**Collaborators**
Display FPS	AIC, APC, eFPS.
change information of eFPS	
Display eFPSs' under headings	

Class Diagram:

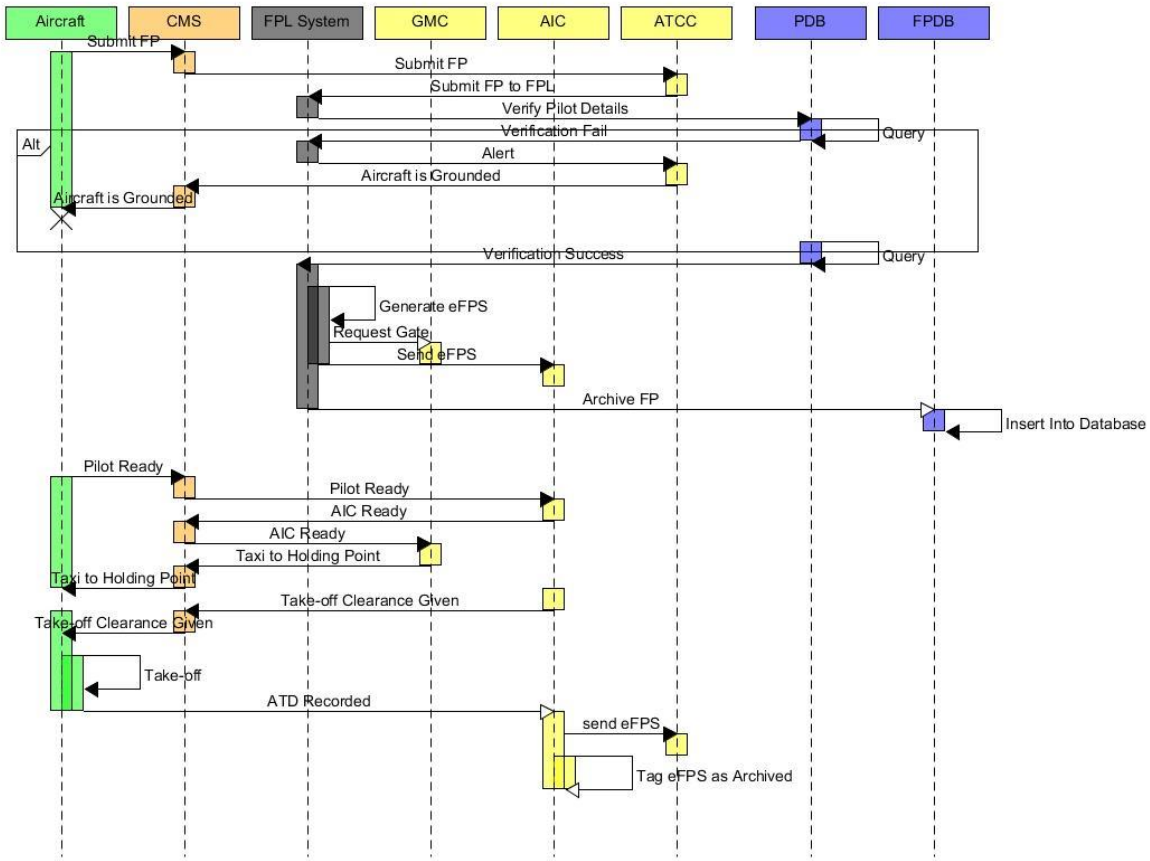


Sequence Diagrams:

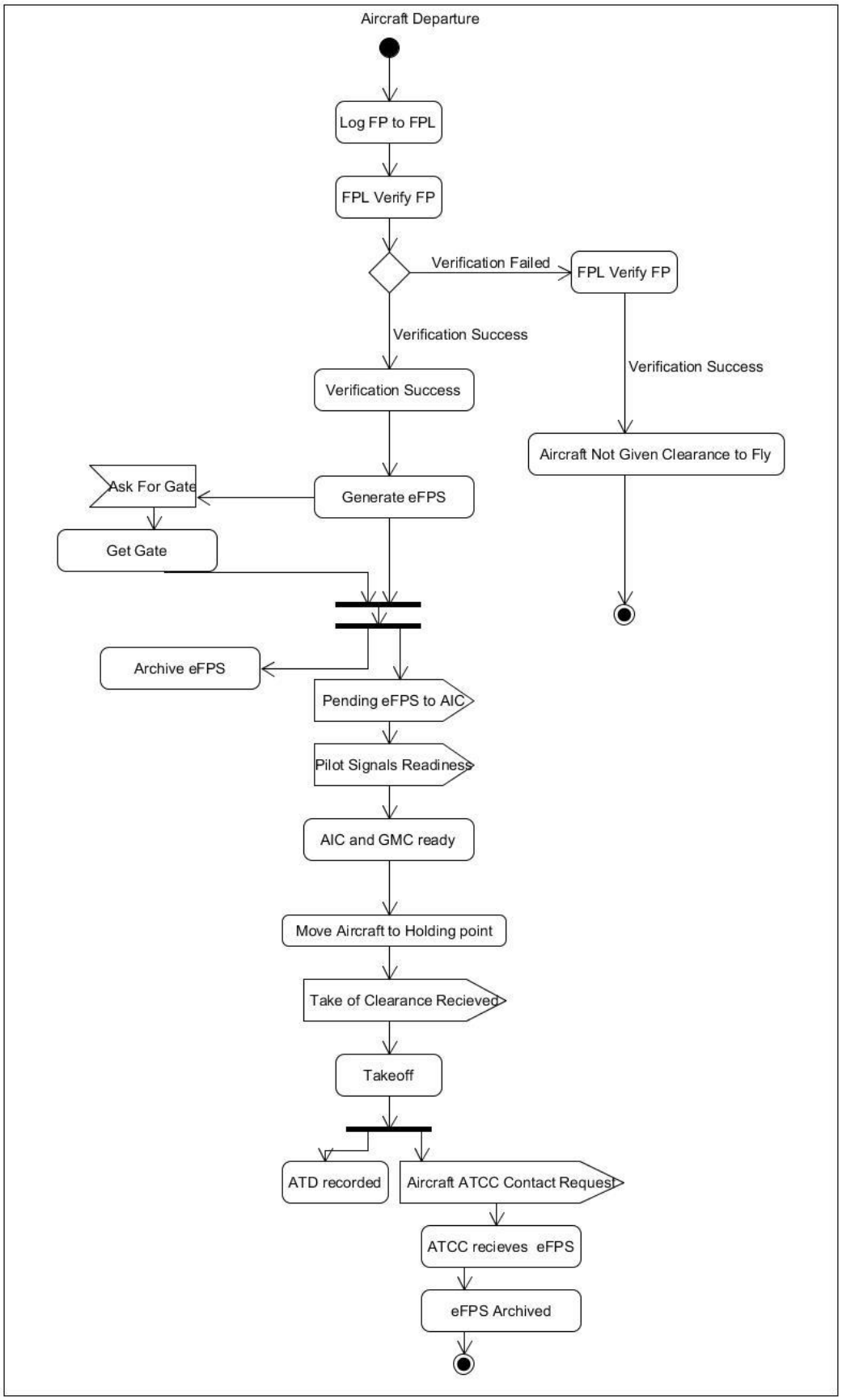
- Aircraft Departure



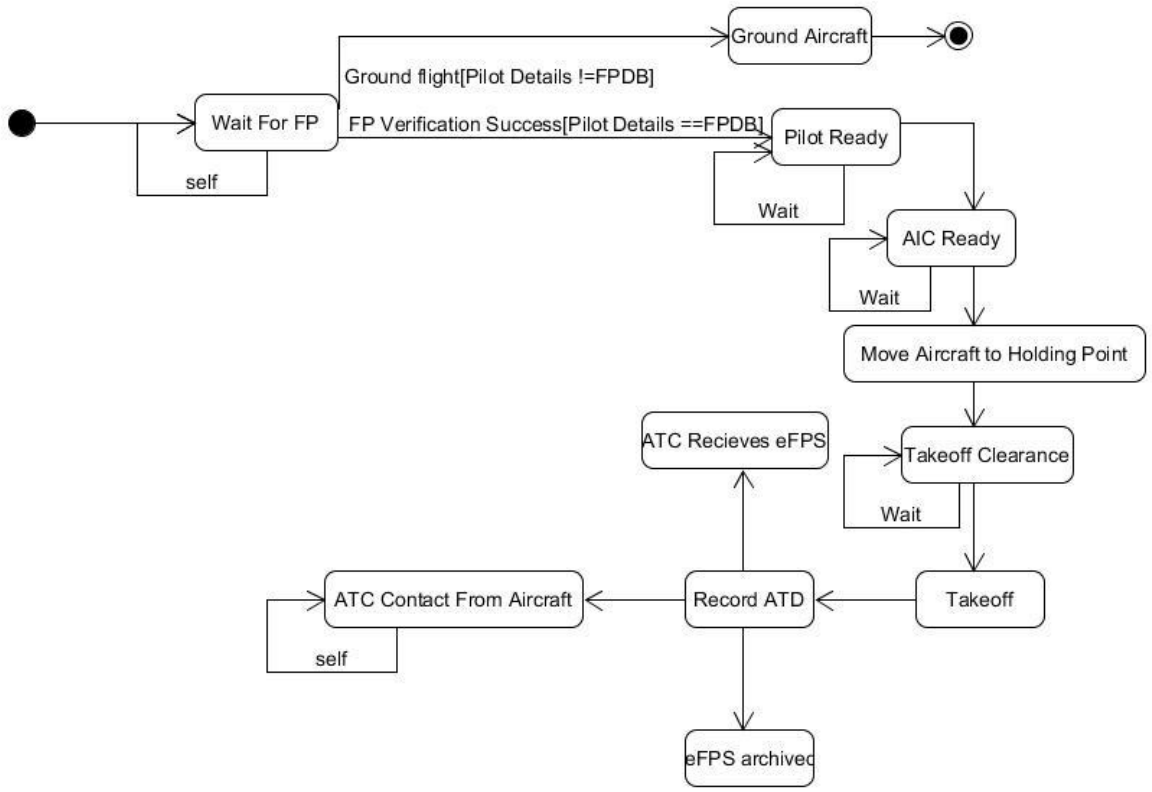
- Aircraft Arrival



Activity Diagram:



State Machine Diagram:



Advantages and Disadvantages of UML:

While UML is a Great Modelling tool for large organizations, for smaller organizations producing simpler codes, it is not required and takes time a lot of time to develop. Also, UML helps organize and synchronize code development when the code being written is complex and difficult to grasp. In addition, UML is very flexible however it does require some training and practice. Also, when using modern designing techniques, UML modeling may become more of a hindrance to change and develop over every iteration.