

Requirement	Requirement Description	UML Reference	Module	
1	The flight simulation system shall facilitate the management of flight plans and adjustments to the aircraft's control systems, control surfaces, and monitoring systems via a user interface accessible to pilots.	Management Panel, Hazard Panel, Console Panel, Sensor Data Panel, Plane On Map Panel, Autopilot Panel	GUI package	
2	It shall simulate flight plan administration, autopilot manipulation, display of sensor data, provision of hazard alerts, and emulation of engine thrust dynamics. Stakeholders shall primarily include pilots, who will serve as the system's end users.	Sensor Data Panel, Hazard Panel	SensorDataPanel.java, HazardPanel.java	
3	Additional stakeholders will include engineers and regulatory authority.	System Requirement	System Requirement	
4	System will be focusing on the Boeing 737-800 for our unit requirements.	Plane Component	Plane.java	
5	The system shall include an input field for entering latitude, longitude, altitude, speed restrictions, and expected arrival times at each waypoint which it will accurately store.	Management Component	ManagementPanel.java	
6	The system should update and display airspeed, altitude, attitude (raw etc.) and engine thrust of the aircraft and maintain it within limits - max thrust 125 kN, min thrust is 10% drop from max at idle.	Sensor Data Panel, Sensor Component	SensorDataPanel.java, SensorSimulation.java	
7	A visual display map shall be provided to show the aircraft's current position, planned route, and waypoints so pilots can visualise their flight path.	Plane On Map Panel	PlaneOnMapPanel.java	
8	The system should control the activation of airspeed, altitude, and attitude based on engine thrust to assure aircraft safety and efficiency.	Not Implemented	Not Implemented	
9	Implement logic to ensure changes in altitude based on thrust settings and weight of aircraft. Logic will dynamically adjust rate of altitude change and current altitude in response to variations in thrust levels and aircraft weight to ensure efficient altitude transitions -> this will obviously depend on each aircraft.	Not Implemented	Not Implemented	
10	System must detect failure in airspeed, altitude and attitude sensor which it should then put the sensors into a safe state (2oo3)	Not Implemented	Not Implemented	
11	Buttons should be available to engage and disengage the autopilot so pilots can control the automated flight system and control aircraft.	Autopilot Panel	AutopilotPanel.java	
12	Buttons should also be available to set and activate flight plans.	Management Panel	ManagementPanel.java	
13	The Autopilot's state must be displayed clearly (engaged, disengaged, fault)	Autopilot Panel	AutopilotPanel.java	
14	The indicator lights on the autopilot control panel will change to communicate to the user whether the autopilot is currently engaged or disengaged, it will also change to indicate to the pilot that there is a fault condition.	Autopilot Panel	AutopilotPanel.java	
15	The Autopilot must send control signals regularly at a set interval to each sensor's engine components.	Autopilot Panel	AutopilotPanel.java	
16	If the autopilot indicates a fault condition, the autopilot system should disengage	Autopilot Panel	AutopilotPanel.java	
17	Audible and visual alerts shall warn pilots of immediate hazards to ensure timely response in a critical situation.	Management Panel	ManagementPanel.java	
18	Sensors shall simulate airspeed (in nautical miles per hour), altitude (in feet above mean sea level), attitude (in degrees), and engine parameters (thrust in pounds-force).	Sensor Data Panel	SensorDataPanel.java	
19	The system should respond appropriately to extreme sensor values to mitigate risks with sensor malfunctions or anomalies.	Hazard Panel, Console Panel	HazardPanel.java / ConsolePanel.java	
20	Execution check parameters shall be established to ensure the proper functioning of the program.	Whole diagram	SRC (all code)	
21	Add variables/inputs that the system will need at the start at each flight - what the system should have in order to operate (start location, waypoints, finish location, min/max speed)	Management Panel	Has default values in ManagementPanel.java	
22	The system shall feature digital readouts for airspeed, altitude, pitch, roll, yaw, and engine parameters.	Sensor Data Panel	SensorDataPanel.java	

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23	Functional tests confirm that all user inputs and sensor outputs meet specified criteria	Sensor Data Panel, Autopilot Panel, Management Panel	SensorDataPanel.java / AutopilotPanel.java / ManagementPanel.java	
24	Design the system with modular components to facilitate easy troubleshooting and maintenance.	Whole diagram	SRC (all code)	
25	Data being displayed should be frequently updated every 500ms	Sensor Simulator Component	SensorSimulator.java	
26	When autopilot is active, control signals sent every 400ms	Autopilot Panel	AutopilotPanel.java	
27	The architecture for airspeed, altitude and attitude sensors will be 2oo3.	Not Implemented	Not Implemented	
28	The system shall operate reliably under extreme conditions, with minimal downtime and robustness against failures.	Console Panel, Sensor Simulator Component	ConsolePanel.java / SensorSimulator.java	
29	Visual indicators for the status of autopilot as well as alerts.	Autopilot Panel	AutopilotPanel.java	
30	Fail-safe mechanisms, fault detection, fault tolerance, shall be incorporated to handle sensor faults and mitigate potential hazards.	Partially Implemented in whole diagram	Partially Implemented throughout SRC (all code)	
31	JUnit tests verify system performance, usability, and reliability under simulated extreme conditions.	Whole diagram	SRC (all code)	
32	System should constantly/continuously monitor -> airspeed, altitude, attitude and engine thrust to prevent errors.	Console Panel, Hazard Panel	ConsolePanel.java / HazardPanel.java	
33	The system should promptly communicate both the status of the system and any alerts to the user in the event of sensor or engine failures or abnormalities.	ConsolePanel, Hazard Panel, Autopilot Panel, Management Panel	ConsolePanel.java / HazardPanel.java / AutopilotPanel.java / ManagementPanel.java	
34	For Airspeed: If airspeed falls below a threshold of 40 knots, the system shall activate audible and visual stall warning alerts to prompt the pilot to take corrective action.	Management Panel	ManagementPanel.java	
35	If airspeed exceeds a maximum operating speed of 453 knots, the system shall trigger overspeed warnings to alert the pilot to reduce speed and avoid potential structural damage to the aircraft.	Management Panel	ManagementPanel.java	
36	For Altitude: If altitude decreases below a specified minimum altitude of 1000ft, the system shall activate terrain proximity warnings to alert the pilot of potential collision with the ground. If altitude increases above maximum altitude of 37000, the system shall trigger altitude overspeed alerts to warn the pilot of exceeding safe operating limits and potential risks for passengers on board due to factors such as decreased pressure/oxygen.	Management Panel	ManagementPanel.java	
37	For Attitude: -> go into specifics about different attitudes (roll, pitch, yaw).	Not Implemented	Not Implemented	
38	Pitch values sourced from https://skybrary.aero/articles/recovery-unusual-aircraft-attitudes (these are considered 'unusual attitude' for large transport aircrafts as defined by)	Not Implemented	Not Implemented	
39	If nose up pitch attitude greater than 25 degrees show warning light with instructions for getting the nose up pitch attitude less than 25 degrees.	Not Implemented	Not Implemented	
40	If nose down pitch greater than 10 degrees show warning light with instructions for getting the nose down pitch attitude less than 10 degrees.	Not Implemented	Not Implemented	
41	Yaw must be 0 during takeoff and landing. But slight deviations close to 0 can occur because of crosswinds, asymmetric thrust and aerodynamic forces.	Not Implemented	Not Implemented	
42	If outside of the specified 'value' (altitude, attitude, speed), show warning light with instructions for getting the plan back into correct 'value'. If sensor has failed then 2oo3 will switch to 1oo2. If two or more fail then emergency procedure with respective system lights/communication. The threshold for roll attitude is between 0 and 40 degrees.	Not Implemented	Not Implemented	

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43	For Immediate Hazards: The system shall implement audible and visual alerts that promptly and clearly indicate potential risks. These alerts should be triggered in real-time based on sensor data thresholds, so that pilots can be promptly informed of critical situations to take immediate action.	Console Panel, Management Panel, Hazard Panel, Autopilot Panel	ConsolePanel.java / ManagementPanel.java / HazardPanel.java / AutopilotPanel.java	
44	Regression tests ensure new updates do not unsettle previously tested and validated functionalities	Not Implemented	Not Implemented	
45	Interface effectively describes various tasks (navigation, autopilot controls, data) in a clear refined format that is easy for the user to interpret.	whole diagram	Src/GUI/readme.md	
46	Hazard alerts take priority on the interface and are prompted to the user immediately. Alerts overthrow the rest of the interface components.	Hazard Panel, Management Panel	HazardPanel.java / ManagementPanel.java	
47	FLIGHT DISPLAY: responsible for route planning and navigation	Plane On Map Panel	PlaneOnMapPanel.java	
48	AUTOPILOT DISPLAY: manages aircraft control inputs based on sensor response and pilot.	Autopilot Panel	AutopilotPanel.java	
49	SENSOR DISPLAY: sensor data display/detection presents reliable flight data to pilot that is clear and easy to interpret and formatted correctly for the user.	Sensor Data Panel	SensorDataPanel.java	
50	HAZARD DISPLAY: when hazards are present they are prompted through its respective light and instructions on how to mitigate.	Hazard Panel	HazardPanel.java	
51	Code written in Java (think we said this)	whole diagram	SRC (all code)	
52	UI provides management display for handling inputs from the user.	Management Panel	ManagementPanel.java	
53	UI provides module to display sensor data	Sensor Component	Sensor.java	
54	UI provides module to display alerts and hazards that are visually displayed through lights and sound	Console Panel, Hazard Panel	ConsolePanel.java / HazardPanel.java	
55	Sensors are handled and implemented in Zoo3 architecture	Not Implemented	Not Implemented	
56	Validate input data format and range for latitude, longitude, altitude, and speed restrictions.	Management Panel	ManagementPanel.java	
57	Define threshold values for sensor data for when the program should trigger responsive actions	Sensor Component	Sensor.java	
58	Integrate sound and visual cues for immediate hazard alerts based on sensor data thresholds.	Management Panel, Console Panel	Visual cues - ManagementPanel.java ConsolePanel.java	