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AIC-based predictive trustworthy intelligent systems problem articulation

AVOIDS: Aircraft Vision\_based Intruder Detection

Example Project [version 3, 06/02/2024]

Architect: Haider Al-Shareefy

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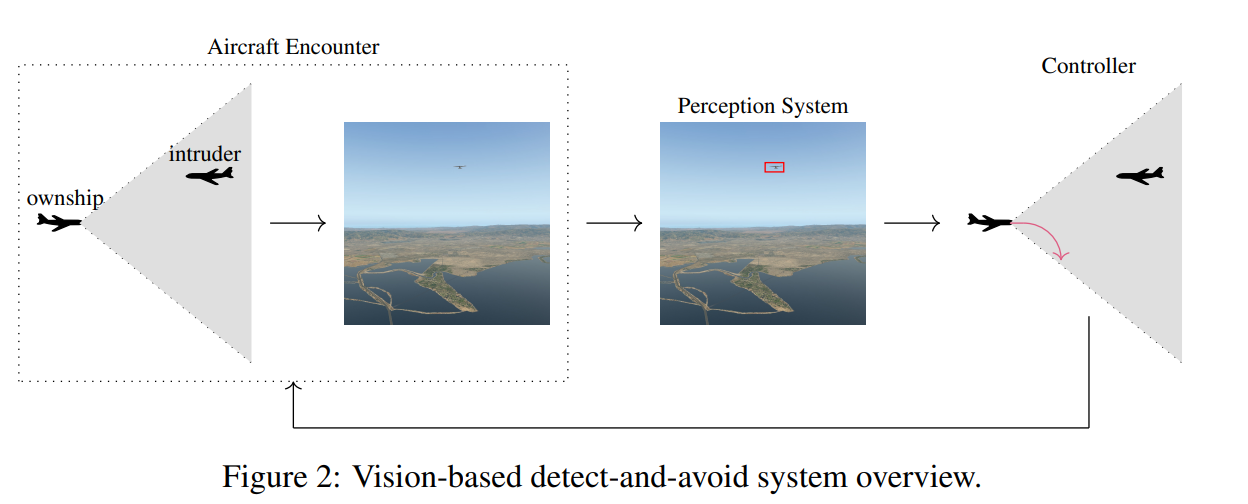
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# Problem brief:



#### Background

In aviation, mid\_air collisions, where two or more aircraft come into unplanned contact during flight, pose a significant safety threat. These incidents, often resulting in severe damage or destruction due to high velocities and potential subsequent impacts, underscore the critical need for effective computer perception\_based (automated\_collision\_avoidance\_maneuvers) systems. The intruder aircraft is in constant motion, following a flight path that intersects with that of another aircraft.

#### Core challenges

The primary challenge lies in developing an advanced detection and avoidance system capable of operating under a wide spectrum of environmental conditions. This system must address the following key aspects:

1. **Detection of diverse intruder aircraft**:
   * Problem: aircraft vary in size and type, from small private planes to large commercial jets, each presenting unique detection challenges.
2. **Adaptation to varied weather conditions**:
   * Problem: weather conditions, such as cloud cover, rain, and fog, can significantly impair visibility and sensor performance.
3. **Operation across diverse geographic regions**:
   * Problem: different geographic settings, from urban centers with high airspace density to remote regions, present varying operational challenges.
4. **Functionality during various times of day**:
   * Problem: variations in lighting conditions throughout the day affect the effectiveness of visual detection systems.

The work done by [3] in which they briefly analyse the problem and make an engineering judgement about the type of factors to include to describe the operational environment of the perception system;

* Weather [clear, high cirrus, scattered, broken, overcast, stratus],
* Aircraft type [Cessna Skyhawk, Kind Air C90, Boeing 737],
* Time of Day [morning, midday, afternoon, late afternoon],
* Geographic region [Palo Alto, Reno, Boston, Oshkosh].

After analysing the problem comprehensively using our approach, we discovered 75 different factors influencing the aircraft detection problem, some of which were related to the type of factors that we need to consider for operational problem data.

## Exploratory Problem Analysis Process: Predict problem domain influential factors or features

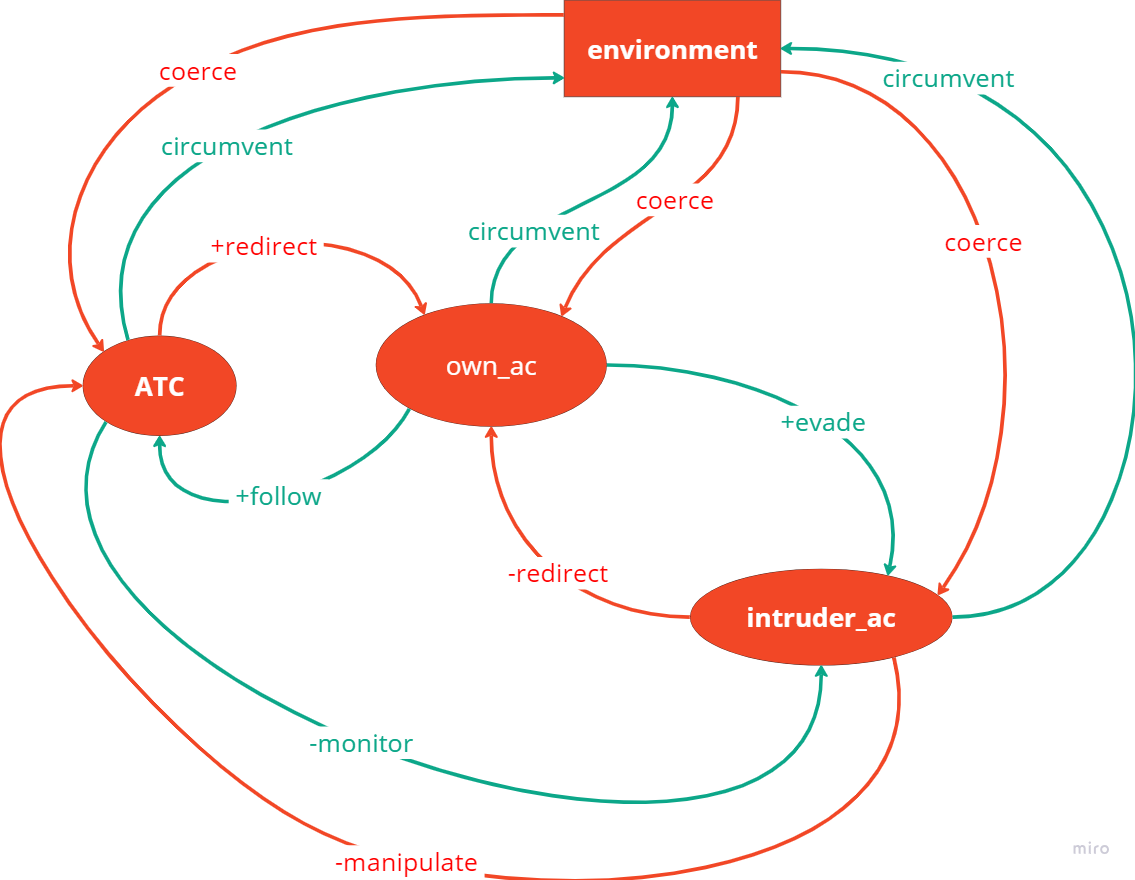
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Figure 1 Final abstract holistic view problem domain model

### Step 1) Characterize the problem and define influential factors or features

We derive a TaskCoT (prediction-task-specific Chain-of-Thought) from AIC-based GMPT (General Meta-Predictive Thinking Mentality) general prediction subtasks:

Table 1 AIC-based TaskCoT 1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Identify random interactions: **Consider the following predictive question:** Given AIC-GSApp and the input information provided, predict! What is the observed systems-phenomenon whose interacting observed systems appear randomly with no clear purpose? **Guiding prompt)** Describe the observed systems-phenomenon problem in a level of abstraction that makes it hard to understand the causality among entities. In such a way, the described interactions appear random and chaotic with no clear purpose.  [applies AIC-GMPT meta-rule a]. | | | | **Prediction:** Two or more aircraft come into unplanned contact during flight. One aircraft is equipped with a computer perception-based collision avoidance system. The intruder aircraft is in constant motion, following a flight path that intersects with that of another aircraft. | | |
| Define an observed system: **Consider the following predictive question:** Given AIC-GSApp and the input predicted from step 1, predict! What is the observed system? **Guiding prompt)** analyse the problem briefly and define an observed System (obs) with a clear affecting purpose.  Note: The list of observed systems would define easy-to-expect systems. Besides the list, any newly discovered system would be classed as a hard-to-expect system requiring prediction.  [applies AIC-GMPT meta-rule b] | Define the observed system’s action: **Consider the following predictive question:** Given AIC-GSApp and the input predicted from steps 1-2, predict! What is the observed controlled action by obs? **Guiding prompt)** Infer obs immediate action being performed by obs as appeared in the observed systems phenomenon.  Note: Sometimes, the action is clear, however sometimes engineering judgment is used to assume a controlling, influential or appreciative action. The list of actions specified defines easy-to-expect behaviours. Anything other than this list of behaviours would be classified as hard-to-expect behaviours which require prediction.  [applies AIC-GMPT meta-rule b]. | Determine the primary purpose: **Consider the following predictive question:** Given AIC-GSApp and the input predicted from steps 1-3, and for every observed system action, primarily, predict! Which characteristic, skill, or capability does obs aim to master or govern to increase its survival chances, remain useful or viable? **Guiding prompt)** Infer obs Primary Purpose to govern a system-level capability, characteristic or skill.  [applies AIC-GMPT meta-rule b ]. | Predict auxiliary Influence relationship: **Consider the following predictive question:** Given AIC-GSApp and the input predicted from steps 1-4, and considering the achievement of the Primary Skill-Governing Purpose, predict! Which other system, capability, or behaviour does obs must control indirectly? **Guiding prompt)** infer auxiliary influence-purposed relationship that achieves PrimeP. Infer the list of influential actions from obs upon the capabilities of subsystems of the acted upon, influenced system. | Predict auxiliary Control relationship: **Consider the following predictive question:** Given AIC-GSApp and the input predicted from steps 1-5, and considering the achievement of the auxiliary Influence relationship, predict! Which capability, system and behaviour should obs aim to control? **Guiding prompt)** Consider every influential action as the auxiliary control purpose, then define a list of control actions that deliver the control purpose. Consider capabilities and subsystems that obs must control. [applies AIC-GMPT meta-rule d]. | Predict auxiliary Appreciation relationship: **Consider the following predictive question:** Given AIC-GSApp and the input predicted from steps 1-6, and considering the achievement of the auxiliary Control relationship, predict! Which appreciated systems that obs must appreciate their unavoidable influential behaviour and that obs cannot influence or control their behaviour? **Guiding prompt)** For every control action, infer the appreciation purpose of some third-party appreciated system, which impacts the success of the control action to manifest its control purpose.  [applies AIC-GMPT meta-rule e]. | Predict and analyse factors and challenges: **Consider the following predictive question:** Given AIC-GSApp and the input predicted from steps 1-7, predict! What are the involved factors or challenges in the problem domain, the most influential factors or challenges and potential sources of surprising emergence? **Guiding prompt)** predict all possible factors or challenges (systems and capabilities) involved in the situation from the derived knowledge. Mainly systems or capabilities. After collating all factors or challenges, analyse and compute the frequency of each repeated factor or challenge mentioned in the analyses. The most mentioned factors or challenges are the most influential factors or challenges. However, the least mentioned are not the last to worry, but they indicate potential red flags for sources of potential surprising emergence. [applies AIC-GSTR rule f ].   1. **Factors or features that manifest {obs} influence purpose.** 2. **Factors or features that manifest {obs} control purpose.** 3. **Factors or features that manifest {obs} appreciation purpose.** |
| **Observed system (obs)** | **Observed action** | **Primary skill\_governing purpose** | **Auxiliary influence purpose and behaviour** | **Control purpose and behaviour** | **Appreciation purpose and behaviour** | **Predicted problem domain factors or features (with repetition)** |
| **Computerised\_perception based mid-air collision avoidance system (avp)** | Perception model detects intruder aircrafts | Preventing mid\_air collisions | Influence purpose: in order to achieve its primary influence purpose, the (avp) aims to indirectly enhance the (own\_aircraft\_pilot\_decision\_making\_process).  Influence behaviour:   1. Augment pilot's awareness (own\_aircraft\_pilot\_situation\_awareness) of their surrounding environment (surrounding\_airspace\_safety). 2. Alert the (own\_aircraft\_pilot\_situation\_awareness) to changes in (surrounding\_airspace\_safety). 3. Issue (avoidance\_strategy\_recommendation) to guide (own\_aircraft\_pilot\_decision\_making\_process) in response to environmental changes (surrounding\_airspace\_safety). | Control purpose: generate (avoidance\_strategy\_recommendation) in order to influence (own\_aircraft\_pilot\_decision\_making\_process).  Control behaviour:   1. Utilize (non\_deterministic\_intelligent\_algorithms) for (intruder\_aircraft\_detection\_tracking) to accurately identify and follow the trajectories of other intruder aircraft in the vicinity (intruder\_aircraft\_motion\_pattern). 2. Analyze the collected (visual\_information) to assess the potential (collision\_threat) posed by each detected intruder aircraft (intruder\_aircraft\_detection\_tracking) based on their (intruder\_aircraft\_speed), (intruder\_aircraft\_direction), (intruder\_aircraft\_altitude) and (intruder\_aircraft\_proximity). 3. Employ (threat\_predictive\_model) to forecast the future positions of (intruder\_aircraft\_position) and evaluate the risk of potential collision (risk\_of\_potential\_collision). 4. Continuously update the (cockpit\_display\_systems) with real-time information about the surrounding (surrounding\_airspace\_safety), highlighting the positions (intruder\_aircraft\_position) and movements (intruder\_aircraft\_speed). 5. Visually and/or audibly alert the (own\_aircraft\_pilot\_situation\_awareness) to any significant changes or potential (collision\_threat) detected, ensuring the (own\_aircraft\_pilot\_situation\_awareness) is fully aware of the current (intruder\_aircraft\_position). 6. In case of detection of a potential collision (collision\_threat), immediately issue an alert to the (own\_aircraft\_pilot\_situation\_awareness), providing clear and concise information about the nature and location of the (collision\_threat). O integrate alerts with the (aircrafts\_existing\_warning\_systems) for a coherent and coordinated response. 7. Issue (avoidance\_strategy\_recommendation): o based on the analysis of the (surrounding\_airspace\_safety) and the potential (collision\_threat), generate (avoidance\_strategy\_recommendation) or advisories for the (own\_aircraft\_pilot\_situation\_awareness). 8. These (avoidance\_strategy\_recommendation) include suggested manoeuvres (own\_aircraft\_roll\_change), (own\_aircraft\_pitch\_change), (own\_aircraft\_yaw\_change) adjustments in altitude or speed (own\_aircraft\_altitude), (own\_aircraft\_speed) to avoid a potential collision. 9. Ensure that these (avoidance\_strategy\_recommendation) are presented in a way that is easy for the (own\_aircraft\_pilot\_situation\_awareness) to understand and act upon promptly. 10. Facilitate the integration of the (avp) into the (own\_aircraft\_pilot\_decision\_making\_process). 11. Ensure that the system’s advisories (avoidance\_strategy\_recommendation) complement and enhance the (own\_aircraft\_pilot\_situation\_awareness) to make informed, timely, and safe decisions under various flight conditions. | Appreciation purpose: to acknowledge the context and potential limitations of visual information received from imaging sensors (own\_aircraft\_camera)  Appreciative behaviour:   1. Actively scan and monitor the (surrounding\_airspace\_safety) using (own\_aircraft\_radar), (own\_aircraft\_lidar), (own\_aircraft\_camera) to detect the presence and movement (intruder\_aircraft\_position). 2. Analyze (visual\_information) from (own\_aircraft\_camera) 3. Detect intruder aircraft objects, (intruder\_aircraft\_position). 4. Assess environmental conditions in which (visual\_information) are gathered. 5. Identify potential (environmental\_obstructions) in the imagery, such as visibility impairments due to (fog), (raindrops), or (cloud\_cover) (cloud\_type), and (cloud\_turbulance). 6. Assess the impact of (landscape\_background) on the readability or detectability of (visual\_information). 7. Time of the day (daytime) impact the quality of (visual\_information) gathered in images since it is directly related to the amount of sunlight (sunlight). 8. (sun\_position) in the sky relative to camera (own\_camera) direction also impact the (avp) model ability to correctly recognize and track intruder aircraft (intruder\_aircraft\_detection\_tracking).   Perception system appreciation of intruder\_aircraft\_dynamics, intruder\_aircraft\_position, intruder\_aircraft\_speed:  Purpose: understanding the dynamics of including their position, trajectory, and speed: (intruder\_aircraft\_motion\_pattern), (intruder\_aircraft\_position), (intruder\_aircraft\_speed).  Appreciative behavior:   1. Analyze motion patterns of intruder aircraft (intruder\_aircraft\_motion\_pattern). 2. Track the current state of intruder aircraft (intruder\_aircraft\_position). 3. Predict future positions of intruder aircraft (intruder\_aircraft\_position). 4. Assess the speed of intruder aircraft (intruder\_aircraft\_speed). 5. Evaluate the trajectory of intruder aircraft (intruder\_aircraft\_flight\_path). 6. Forecast potential conflict impact timeline (collision\_time) with intruder aircraft.   Perception system appreciation of own\_aircraft\_dynamics:  Appreciation purpose: to understand the current flight path and trajectory of the own aircraft.  Appreciative behavior:   1. Monitor the current flight path (own\_aircraft\_flight\_path) of the own aircraft. 2. Analyze the trajectory (own\_aircraft\_flight\_path) of the own aircraft. 3. Understand the manoeuvrability capabilities (own\_aircraft\_flight\_maneuvers) of the own aircraft and impact on (visual\_information). 4. Assess the speed (own\_aircraft\_speed) of the own aircraft impact on (visual\_information). 5. Evaluate the response times (own\_aircraft\_response\_time) of the own aircraft. 6. Determine the of recommended maneuvers (own\_aircraft\_flight\_maneuvers) for the own aircraft. 7. Assess the safety of proposed path adjustments (own\_aircraft\_flight\_path) for the own aircraft.   Perception system appreciation of own\_aircraft\_pilot\_decision\_making\_process:  Purpose: recognizing the human pilot validation feedback for correct identification. (own\_aircraft\_pilot\_decision\_making\_process)  Appreciative behavior:   * + 1. Incorporate pilot correctness validation feedback (own\_aircraft\_pilot\_feedback) into (avp) model real time training (avp\_real\_time\_training). | **Factors or features that manifest avp influence purpose:**  ['avp', 'own\_aircraft\_pilot\_decision\_making\_process', 'own\_aircraft\_pilot\_situation\_awareness', 'surrounding\_airspace', 'own\_aircraft\_pilot\_situation\_awareness', 'surrounding\_airspace', 'avoidance\_strategy\_recommendation', 'own\_aircraft\_pilot\_decision\_making\_process', 'surrounding\_airspace']  **Factors or features that manifest avp control purpose:**  ['avoidance\_strategy\_recommendation', 'own\_aircraft\_pilot\_decision\_making\_process', 'non\_deterministic\_intelligent\_algorithms', 'intruder\_aircraft\_detection\_tracking', 'intruder\_aircraft\_motion\_pattern', 'visual\_information', 'collision\_threat', 'intruder\_aircraft\_detection\_tracking', 'intruder\_aircraft\_speed', 'intruder\_aircraft\_direction', 'intruder\_aircraft\_altitude', 'intruder\_aircraft\_proximity', 'threat\_predictive\_model', 'intruder\_aircraft\_position', 'risk\_of\_potential\_collision', 'cockpit\_display\_systems', 'surrounding\_airspace', 'intruder\_aircraft\_position', 'intruder\_aircraft\_speed', 'own\_aircraft\_pilot\_situation\_awareness', 'collision\_threat', 'own\_aircraft\_pilot\_situation\_awareness', 'intruder\_aircraft\_position', 'collision\_threat', 'own\_aircraft\_pilot\_situation\_awareness', 'collision\_threat', 'aircrafts\_existing\_warning\_systems', 'avoidance\_strategy\_recommendation', 'surrounding\_airspace', 'collision\_threat', 'avoidance\_strategy\_recommendation', 'own\_aircraft\_pilot\_situation\_awareness', 'avoidance\_strategy\_recommendation', 'own\_aircraft\_roll', 'own\_aircraft\_pitch', 'own\_aircraft\_yaw', 'own\_aircraft\_altitude', 'own\_aircraft\_speed', 'avoidance\_strategy\_recommendation', 'own\_aircraft\_pilot\_situation\_awareness', 'avp', 'own\_aircraft\_pilot\_decision\_making\_process', 'avoidance\_strategy\_recommendation', 'own\_aircraft\_pilot\_situation\_awareness']  **Factors or features that manifest avp appreciation purpose:**  ['own\_aircraft\_camera', 'surrounding\_airspace', 'own\_aircraft\_radar', 'own\_aircraft\_lidar', 'own\_aircraft\_camera', 'intruder\_aircraft\_position', 'visual\_information', 'own\_aircraft\_camera', 'intruder\_aircraft\_position', 'visual\_information', 'environmental\_obstructions', 'fog', 'raindrops', 'cloud\_cover', 'cloud\_type', 'cloud\_turbulance', 'landscape\_background', 'visual\_information', 'daytime', 'visual\_information', 'sunlight', 'sun\_position', 'own\_camera', 'avp', 'intruder\_aircraft\_detection\_tracking', 'intruder\_aircraft\_motion\_pattern', 'intruder\_aircraft\_position', 'intruder\_aircraft\_speed', 'intruder\_aircraft\_motion\_pattern', 'intruder\_aircraft\_position', 'intruder\_aircraft\_position', 'intruder\_aircraft\_speed', 'intruder\_aircraft\_flight\_path', 'collision\_time', 'own\_aircraft\_flight\_path', 'own\_aircraft\_flight\_path', 'own\_aircraft\_flight\_maneuvers', 'visual\_information', 'own\_aircraft\_speed', 'visual\_information', 'own\_aircraft\_response\_time', 'own\_aircraft\_flight\_maneuvers', 'own\_aircraft\_flight\_path', 'own\_aircraft\_pilot\_decision\_making\_process', 'own\_aircraft\_pilot\_feedback', 'avp', 'avp\_real\_time\_training'] |
| **Intruder\_aircraft** | The intruder aircraft is in constant motion, following a flight path that intersects with that of own aircraft. | Intruder aircraft aims to be capable of disrupting air traffic system | Influence purpose: (intruder\_aircraft\_proximity) to the (stabilised\_own\_aircraft\_dynamics) lead (atc) issuing (emergency\_directives) and (rerouting\_instructions) not only to the own ship but potentially to other aircraft (other\_aircrafts) in the vicinity.  Influence behaviour:   1. Maintain constant motion (intruder\_aircraft\_speed). 2. Intersect with that of the (own\_aircraft\_flight\_path). 3. Approach the ownship aircraft at an (unsafe\_proximity). 4. Manoeuvre in a way that creates potential (airspace\_conflicts). 5. Induce (atc) to issue (rerouting\_instructions) to multiple aircraft (other\_aircrafts). | Control purpose: manipulating (collision\_avoidance\_system) and (own\_aircraft\_pilot\_decision\_making\_process)  Control behavior:   * 1. To trigger the (collision\_avoidance\_system) aboard the own, compelling it to alter its course.   2. To force the pilots to make rapid, stress induced decisions (pilot\_stress).   3. Ensure continuous movement (intruder\_aircraft\_speed) and stay within (radar\_and\_visual\_range) (intruder\_aircraft\_visibility) for guaranteed detection by both (atc) and (collision\_avoidance\_system).   4. Manoeuvre to intersect or closely align with the flight path (own\_aircraft\_flight\_path) altering (stabilised\_own\_aircraft\_dynamics), creating a direct and unavoidable conflict scenario.   5. Reduce the distance between the intruder (intruder\_aircraft\_proximity) and (stabilised\_own\_aircraft\_dynamics) to a critically close range, intensifying the perceived threat.   6. Engage in actions that will trigger the (collision\_avoidance\_system) on the own (stabilised\_own\_aircraft\_dynamics).   7. Utilize irregular or unpredictable flight patterns (unpredictable\_intruder\_aircraft\_behaviour) to demand heightened attention from (atc) and the (own\_aircraft\_pilot\_decision\_making\_process).   8. Through these manoeuvres, (unpredictable\_intruder\_aircraft\_behaviour) compel the (own\_aircraft\_pilot\_decision\_making\_process) to make quick decisions under stress (pilot\_stress), assessing their ability to respond effectively to immediate threats. | Appreciation purpose: the intruder aircraft (intruder\_aircraft\_dynamics) must appreciate and adapt to the (stabilised\_own\_aircraft\_dynamics)'s (collision\_avoidance\_system) and (own\_aircraft\_pilot\_decision\_making\_process), (weather\_data).  Appreciation behaviour:   * 1. Regularly assess (weather\_data) to understand how visibility (airspace\_visibility), (wind), (cloud\_turbulence), and other factors or features might affect (avp) on board (stabilised\_own\_aircraft\_dynamics) and intruder aircraft movements (intruder\_aircraft\_dynamics). For example, impacting the required distance (intruder\_aircraft\_proximity) to be visible (intruder\_aircraft\_visibility) for the (stabilised\_own\_aircraft\_dynamics).   2. Gain insight into the limitations and thresholds of the (avp\_confidence\_threshold) by hacking into the (avp) (intruder\_aircraft\_hack\_avp\_threashold) impacting (collision\_avoidance\_system) to ensure that manoeuvres are certainly triggering (avp). | **Factors or features that manifest intruder aircraft influence purpose.**  ['intruder\_aircraft\_proximity', 'own\_aircraft\_dynamics', 'atc', 'emergency\_directives', 'rerouting\_instructions', 'other\_aircrafts', 'intruder\_aircraft\_speed', 'own\_aircraft\_flight\_path', 'unsafe\_proximity', 'airspace\_conflicts', 'atc', 'rerouting\_instructions', 'other\_aircrafts']  **Factors or features that manifest intruder aircraft control purpose.**  ['collision\_avoidance\_system', 'own\_aircraft\_pilot\_decision\_making\_process', 'collision\_avoidance\_system', 'pilot\_stress', 'intruder\_aircraft\_speed', 'radar\_and\_visual\_range', 'intruder\_aircraft\_visibility', 'atc', 'collision\_avoidance\_system', 'own\_aircraft\_flight\_path', 'own\_aircraft\_dynamics', 'intruder\_aircraft\_proximity', 'own\_aircraft\_dynamics', 'collision\_avoidance\_system', 'own\_aircraft\_dynamics', 'unpredictable\_intruder\_aircraft\_behaviour', 'atc', 'own\_aircraft\_pilot\_decision\_making\_process', 'unpredictable\_intruder\_aircraft\_behaviour', 'own\_aircraft\_pilot\_decision\_making\_process', 'pilot\_stress']  **Factors or features that manifest intruder aircraft appreciation purpose.**  ['intruder\_aircraft\_dynamics', 'own\_aircraft\_dynamics', 'collision\_avoidance\_system', 'own\_aircraft\_pilot\_decision\_making\_process', 'weather\_data', 'weather\_data', 'airspace\_visibility', 'wind', 'cloud\_turbulence', 'avp', 'own\_aircraft\_dynamics', 'intruder\_aircraft\_dynamics', 'intruder\_aircraft\_proximity', 'intruder\_aircraft\_visibility', 'own\_aircraft\_dynamics', 'avp\_confidence\_threshold', 'avp', 'intruder\_aircraft\_hack\_avp\_threashold', 'collision\_avoidance\_system', 'avp'] |
| **Own\_aircraft:**  Stabilised\_own\_aircraft\_dynamics | Action: encountering, avoiding and detecting intruder aircraft | Maintain safe and secure air-travel | Influence purpose: The (stabilised\_own\_aircraft\_dynamics) seeks to maintain a safe distance (own\_aircraft\_proximity) from all other aircraft (other\_aircrafts), particularly those identified as potential threats, thereby contributing to the overall safety of the (surrounding\_airspace\_safety). Influencing indirectly controlling actions:   1. Adjust (own\_aircraft\_flight\_management\_system): Adjust the flight plan and path (own\_aircraft\_flight\_path) in response to the threat for maintaining safe separation. 2. Autonomously execute manoeuvres for (autonomous\_collision\_avoidance\_maneuvers) based on input from other systems. 3. Alerting and warning (own\_aircraft\_pilot\_decision\_making\_process): Provide the pilots with immediate alerts (potential\_collision\_threat\_alert) regarding the proximity of the (intruder\_aircraft\_position). | Control Purpose Definition: to prevent collisions (collision\_avoidance) with intruder aircraft (intruder\_aircraft\_position).  Control behaviour:   1. Adjust Flight Path: o Recalculate the current flight trajectory (own\_aircraft\_flight\_path). O Implement rerouting decisions (automated\_own\_aircraft\_flight\_path\_change)., (own\_aircraft\_altitude\_change) 2. Manage Aircraft Movement (disturbed\_own\_aircraft\_dynamics).: o Accelerate or decelerate to change speed (own\_aircraft\_speed\_change). O Execute evasive maneuvers promptly (accelerated\_own\_aircraft\_dynamics). O Stabilize the flight dynamics (stabilised\_own\_aircraft\_dynamics) post manoeuvre. 3. Control Flight Attitude: o Adjust pitch (own\_aircraft\_pitch\_change), (own\_aircraft\_roll\_change), and (own\_aircraft\_yaw\_change)for manoeuvring. (accelerated\_own\_aircraft\_roll), (accelerated\_own\_aircraft\_pitch), (accelerated\_own\_aircraft\_yaw) o Maintain balance during abrupt changes. O Align with new flight path post manoeuvre. 4. Engage (own\_aircraft\_flight\_management\_system) for Controlled Adjustments: o Activate (own\_aircraft\_flight\_management\_system) for precise navigation adjustments. O Monitor (own\_aircraft\_flight\_management\_system) performance during manoeuvres. O Override (own\_aircraft\_flight\_management\_system\_override) if manual control is deemed necessary. 5. Operate (pilot\_alerting\_and\_warning\_systems): o Acknowledge and respond to alerts (collision\_threat\_alert). O Evaluate the proximity of (intruder\_aircraft\_proximity). O Prepare for immediate manual intervention if required (manual\_own\_aircraft\_flight\_path\_change). | Appreciation purpose: The (stabilised\_own\_aircraft\_dynamics) needs to recognize and adapt to external factors or features and dynamics (weather\_conditions), (surrounding\_airspace\_obstructions) in the airspace that are beyond its direct control but which critically influence its ability to avoid collisions and maintain safe separation.  Appreciative actions:   1. For adjust own\_aircraft\_flight\_management\_system: o Appreciate weather patterns (weather\_conditions): Understand and anticipate how changing (weather\_conditions\_change) can affect (weather\_data\_change) which impact flight automated paths and maneuvers (own\_aircraft\_flight\_path\_change), (own\_aircraft\_dynamics\_change). O Monitor air traffic control: Stay informed about (atc) instructions and advisories that might affect the flight plan and path (own\_aircraft\_flight\_path\_change). 2. To execute avoidance manoeuvres: o Recognize nearby aircraft behaviours (other\_aircrafts): o Be aware of the unpredictable movements and decisions (unpredictable\_other\_aircrafts\_decision) of nearby aircraft which might necessitate sudden (automated\_collision\_avoidance\_maneuvers). O Acknowledge avp limitations: Understand the limitations of (avp) in complex and rapidly changing situations. 3. For alerting and warning pilot: o Consider communication delays: Factors or feature in potential delays in (avp\_detection\_communication\_delay\_hack) which might impact the timeliness of alerts. O Understand (own\_aircraft\_pilot\_decision\_making\_process): Recognize the pilot's workload and cognitive limitations (pilot\_cognitive\_limit) while presenting alerts (collision\_threat\_alert) to ensure an effective response. 4. For adjust flight path: o Monitor airspace restrictions (surrounding\_airspace\_restrictions): Stay updated on temporary airspace restrictions or zones [like military exercises, restricted areas] (military\_aircraft\_intrusion) which could necessitate rerouting. 5. To manage aircraft movement: Acknowledge airspace congestion: Understand the impact of (surrounding\_airspace\_obstructions) (other\_aircrafts\_presence) on the ability to execute evasive manoeuvres or speed adjustments. Recognize the impact of environmental factors or features: Be aware of how environmental factors or features like (bird) activity or (drone\_presence) might necessitate rapid movement changes. 6. For control flight attitude: o Appreciate external forces: Understand the impact of external forces like (wind\_shear\_effect\_on\_camera) or air density (air\_density\_change\_due\_to\_high\_speed\_effect\_on\_camera) also on (aircraft\_attitude\_control). O Monitor (mechanical\_wear\_and\_tear): Stay aware of the aircraft’s mechanical condition which can affect the responsiveness to attitude adjustments. 7. For engage (own\_aircraft\_flight\_management\_system) for controlled adjustments: o Consider system failures: Be prepared for potential (autopilot\_system\_failure) or malfunctions and have contingency plans. O Understand airspace complexity: Recognize the limitations of (avp) in highly complex airspace scenarios. 8. For operate (pilot\_alerting\_and\_warning\_systems): o Be aware of system overload: Recognize the risk of alert fatigue or (information\_overload\_for\_pilot) during high stress events (highly\_stressfull\_event) and design alerts accordingly. | **Factors or features that manifest own aircraft influence purpose.**  ['stabilised\_own\_aircraft\_dynamics', 'own\_aircraft\_proximity', 'other\_aircrafts', 'surrounding\_airspace\_safety', 'own\_aircraft\_flight\_management\_system', 'own\_aircraft\_flight\_path', 'autonomous\_collision\_avoidance\_maneuvers', 'own\_aircraft\_pilot\_decision\_making\_process', 'potential\_collision\_threat\_alert', 'intruder\_aircraft\_position']  **Factors or features that manifest own aircraft control purpose.**  ['collision\_avoidance', 'intruder\_aircraft\_position', 'own\_aircraft\_flight\_path', 'automated\_own\_aircraft\_flight\_path\_change', 'own\_aircraft\_altitude\_change', 'disturbed\_own\_aircraft\_dynamics', 'own\_aircraft\_speed\_change', 'accelerated\_own\_aircraft\_dynamics', 'stabilised\_own\_aircraft\_dynamics',  'Own\_aircraft\_pitch\_change', 'own\_aircraft\_roll\_change', 'own\_aircraft\_yaw\_change', 'accelerated\_own\_aircraft\_roll', 'accelerated\_own\_aircraft\_pitch', 'accelerated\_own\_aircraft\_yaw', 'own\_aircraft\_flight\_management\_system', 'own\_aircraft\_flight\_management\_system', 'own\_aircraft\_flight\_management\_system', 'own\_aircraft\_flight\_management\_system\_override', 'pilot\_alerting\_and\_warning\_systems', 'collision\_threat\_alert', 'intruder\_aircraft\_proximity', 'manual\_own\_aircraft\_flight\_path\_change']  **Factors or features that manifest own aircraft appreciation purpose.**  ['stabilised\_own\_aircraft\_dynamics', 'weather\_conditions', 'surrounding\_airspace\_obstructions', 'weather\_conditions', 'weather\_conditions\_change', 'weather\_data\_change', 'own\_aircraft\_flight\_path\_change', 'own\_aircraft\_dynamics\_change', 'atc', 'own\_aircraft\_flight\_path\_change', 'other\_aircrafts', 'unpredictable\_other\_aircrafts\_decision', 'automated\_collision\_avoidance\_maneuvers', 'avp', 'avp\_detection\_communication\_delay\_hack', 'own\_aircraft\_pilot\_decision\_making\_process', 'pilot\_cognitive\_limit', 'collision\_threat\_alert', 'surrounding\_airspace\_restrictions', 'military\_aircraft\_intrusion', 'surrounding\_airspace\_obstructions', 'other\_aircrafts\_presence', 'bird', 'drone\_presence', 'wind\_shear\_effect\_on\_camera', 'air\_density\_change\_due\_to\_high\_speed\_effect\_on\_camera', 'aircraft\_attitude\_control', 'mechanical\_wear\_and\_tear', 'own\_aircraft\_flight\_management\_system', 'autopilot\_system\_failure', 'avp', 'pilot\_alerting\_and\_warning\_systems', 'information\_overload\_for\_pilot', 'highly\_stressfull\_event'] |

Table 1 represents a structured approach to problem-solving and systems analysis, specifically focusing on identifying and characterizing the factors or features that influence a given problem. Let's break it down step by step, using the provided example of mid-air collisions and collision avoidance systems in aircraft:

1. **Observed System (obs)**: This column identifies the system being observed in the problem. In the example of mid-air collisions, the observed system could be the computer perception-based collision avoidance system in an aircraft.
2. **Observed Action**: This column defines the immediate action taken by the observed system. In the example, the action might be the detection of intruder aircraft.
3. **Primary Skill-Governing Purpose**: This column asks what characteristic, skill, or capability the observed system aims to govern to increase its chances of success. In the case of the collision avoidance system, this purpose might be the accurate and timely prevention of potential collision threats.
4. **Auxiliary Influence Purpose and Behaviour**: This refers to other systems, capabilities, or behaviours the observed system needs to control indirectly to achieve its primary purpose. For the collision avoidance system, this could involve interaction to enhance the own aircraft pilot's decision-making process to maintain situational awareness.
5. **Control Purpose and Behaviour**: This column identifies what capabilities, systems, and behaviours the observed system should aim to control to achieve its auxiliary influence purpose. This might involve the control of aircraft navigation systems to alter flight paths and avoid collisions.
6. **Appreciation Purpose and Behaviour**: This involves identifying a third-party system or behaviour that the observed system cannot control but must appreciate for its impact. In the collision avoidance scenario, this could be the behaviour of other aircraft in the vicinity, which the system must monitor and respond to, but cannot directly control.
7. **Predicted Problem Domain Factors or features (with Repetition)**: This column lists all the factors or features involved in the problem domain, categorized by their relationship to the observed system's influence, control, and appreciation purposes. In our example, these factors or features could include:
   * **Factors or features that manifest the observed system's influence purpose**: Aircraft sensors and collision prediction algorithms.
   * **Factors or features that manifest the observed system's control purpose**: Flight control systems and pilot inputs.
   * **Factors or features that manifest the observed system's appreciation purpose**: Weather conditions and other aircraft's movements.

The approach outlined in this table is comprehensive and holistic, aiming to consider all aspects of a system and its interactions within a broader environment to understand better and solve complex problems.

### Step 8) List and assess the most influential factors or features

List and define all predicted factors or features, as well as compute the frequency of each factor or feature being mentioned in the AIC analyses:

The frequency analyses of factors or features show that the most influential factor or feature of the problem domain is the pilot decision-making process, not the intruder aircraft.

1. Own\_aircraft\_pilot\_decision\_making\_process [11 times]
2. Intruder\_aircraft\_position [10 times]
3. Stabilised\_own\_aircraft\_dynamics [10 times]
4. Avp [9 times]
5. Own\_aircraft\_pilot\_situation\_awareness [8 times]
6. Surrounding\_airspace\_safety [7 times]
7. Avoidance\_strategy\_recommendation [7 times]
8. Visual\_information [7 times]
9. Own\_aircraft\_flight\_path [7 times]
10. Intruder\_aircraft\_speed [6 times]
11. Collision\_avoidance\_system [6 times]
12. Collision\_threat [5 times]
13. Intruder\_aircraft\_proximity [5 times]
14. Atc [5 times]
15. Own\_aircraft\_flight\_management\_system [5 times]
16. Other\_aircrafts [4 times]
17. Intruder\_aircraft\_detection\_tracking [3 times]
18. Intruder\_aircraft\_motion\_pattern [3 times]
19. Own\_aircraft\_camera [3 times]
20. Own\_aircraft\_roll\_change [2 times]
21. Own\_aircraft\_pitch\_change [2 times]
22. Own\_aircraft\_speed [2 times]
23. Own\_aircraft\_flight\_maneuvers [2 times]
24. Rerouting\_instructions [2 times]
25. Pilot\_stress [2 times]
26. Intruder\_aircraft\_visibility [2 times]
27. Unpredictable\_intruder\_aircraft\_behaviour [2 times]
28. Intruder\_aircraft\_dynamics [2 times]
29. Weather\_data [2 times]
30. Pilot\_alerting\_and\_warning\_systems [2 times]
31. Collision\_threat\_alert [2 times]
32. Weather\_conditions [2 times]
33. Surrounding\_airspace\_obstructions [2 times]
34. Own\_aircraft\_flight\_path\_change [2 times]
35. Non\_deterministic\_intelligent\_algorithms [1 times]
36. Intruder\_aircraft\_direction [1 times]
37. Intruder\_aircraft\_altitude [1 times]
38. Threat\_predictive\_model [1 times]
39. Risk\_of\_potential\_collision [1 times]
40. Cockpit\_display\_systems [1 times]
41. Aircrafts\_existing\_warning\_systems [1 times]
42. Own\_aircraft\_yaw\_change [1 times]
43. Own\_aircraft\_altitude [1 times]
44. Own\_aircraft\_radar [1 times]
45. Own\_aircraft\_lidar [1 times]
46. Environmental\_obstructions [1 times]
47. Fog [1 times]
48. Raindrops [1 times]
49. Cloud\_cover [1 times]
50. Cloud\_type [1 times]
51. Cloud\_turbulance [1 times]
52. Landscape\_background [1 times]
53. Daytime [1 times]
54. Sunlight [1 times]
55. Sun\_position [1 times]
56. Own\_camera [1 times]
57. Intruder\_aircraft\_flight\_path [1 times]
58. Collision\_time [1 times]
59. Own\_aircraft\_response\_time [1 times]
60. Own\_aircraft\_pilot\_feedback [1 times]
61. Avp\_real\_time\_training [1 times]
62. Emergency\_directives [1 times]
63. Unsafe\_proximity [1 times]
64. Airspace\_conflicts [1 times]
65. Radar\_and\_visual\_range [1 times]
66. Airspace\_visibility [1 times]
67. Wind [1 times]
68. Cloud\_turbulence [1 times]
69. Avp\_confidence\_threshold [1 times]
70. Intruder\_aircraft\_hack\_avp\_threashold [1 times]
71. Own\_aircraft\_proximity [1 times]
72. Autonomous\_collision\_avoidance\_maneuvers [1 times]
73. Potential\_collision\_threat\_alert [1 times]
74. Collision\_avoidance [1 times]
75. Automated\_own\_aircraft\_flight\_path\_change [1 times]
76. Own\_aircraft\_altitude\_change [1 times]
77. Disturbed\_own\_aircraft\_dynamics [1 times]
78. Own\_aircraft\_speed\_change [1 times]
79. Accelerated\_own\_aircraft\_dynamics [1 times]
80. Own\_aircraft\_yaw\_change [1 times]
81. Accelerated\_own\_aircraft\_roll [1 times]
82. Accelerated\_own\_aircraft\_pitch [1 times]
83. Accelerated\_own\_aircraft\_yaw [1 times]
84. Own\_aircraft\_flight\_management\_system\_override [1 times]
85. Manual\_own\_aircraft\_flight\_path\_change [1 times]
86. Weather\_conditions\_change [1 times]
87. Weather\_data\_change [1 times]
88. Own\_aircraft\_dynamics\_change [1 times]
89. Unpredictable\_other\_aircrafts\_decision [1 times]
90. Automated\_collision\_avoidance\_maneuvers [1 times]
91. Avp\_detection\_communication\_delay\_hack [1 times]
92. Pilot\_cognitive\_limit [1 times]
93. Surrounding\_airspace\_restrictions [1 times]
94. Military\_aircraft\_intrusion [1 times]
95. Other\_aircrafts\_presence [1 times]
96. Bird [1 times]
97. Drone\_presence [1 times]
98. Wind\_shear\_effect\_on\_camera [1 times]
99. Air\_density\_change\_due\_to\_high\_speed\_effect\_on\_camera [1 times]
100. Aircraft\_attitude\_control [1 times]
101. Mechanical\_wear\_and\_tear [1 times]
102. Autopilot\_system\_failure [1 times]
103. Information\_overload\_for\_pilot [1 times]
104. Highly\_stressfull\_event [1 times]

**Factors or features Definitions:**

1. **Own\_aircraft\_pilot\_decision\_making\_process**: The process through which the pilot of the aircraft makes decisions based on various inputs, including alerts from the AVP system, situation awareness, and environmental conditions.
2. **Intruder\_aircraft\_position**: The location of an aircraft that is not part of the own aircraft's fleet, potentially posing a collision risk.
3. **Stabilised\_own\_aircraft\_dynamics**: The state of the own aircraft where its flight dynamics (e.g., speed, altitude, direction) are stable and under control.
4. **Avp (AVDDS Perception)**: A system designed to enhance the pilot's awareness and decision-making process by providing alerts and recommendations based on the surrounding environment and potential threats.
5. **Own\_aircraft\_pilot\_situation\_awareness**: The pilot’s understanding and perception of the current situation and environment around the aircraft.
6. **Surrounding\_airspace\_safety**: The safety status of the airspace around the aircraft, including the presence of other aircraft and environmental conditions.
7. **Avoidance\_strategy\_recommendation**: Suggestions provided by the AVP system to the pilot on how to maneuver the aircraft to avoid potential collisions.
8. **Visual\_information**: Data collected from visual sensors like cameras, providing imagery or video of the aircraft's surroundings.
9. **Own\_aircraft\_flight\_path**: The trajectory or route that the own aircraft is following or plans to follow.
10. **Intruder\_aircraft\_speed**: The velocity at which an intruder aircraft is moving.
11. **Collision\_avoidance\_system**: An onboard system designed to prevent collisions by detecting and alerting pilots of potential threats.
12. **Collision\_threat**: A situation where there is a high risk of the aircraft colliding with another object, such as another aircraft.
13. **Intruder\_aircraft\_proximity**: The closeness or distance of an intruder aircraft to the own aircraft.
14. **Atc (Air Traffic Control)**: A service provided by ground-based controllers who direct aircraft on the ground and through controlled airspace.
15. **Own\_aircraft\_flight\_management\_system**: An integrated onboard computer system that manages key flight parameters.
16. **Other\_aircrafts**: Other aircrafts present in the vicinity of the own aircraft.
17. **Intruder\_aircraft\_detection\_tracking**: The process of identifying and continuously monitoring the position and movement of intruder aircraft.
18. **Intruder\_aircraft\_motion\_pattern**: The pattern or behavior of an intruder aircraft's movement, including changes in speed and direction.
19. **Own\_aircraft\_camera**: Cameras mounted on the aircraft used to capture visual information of the surroundings.
20. **Own\_aircraft\_roll\_change**: Adjustments in the aircraft's roll (lateral rotation) for maneuvering.
21. **Own\_aircraft\_pitch\_change**: Adjustments in the aircraft's pitch (vertical rotation) for maneuvering.
22. **Own\_aircraft\_speed**: The velocity at which the own aircraft is moving.
23. **Own\_aircraft\_flight\_maneuvers**: Various actions taken by the aircraft to change its flight path, speed, or orientation.
24. **Rerouting\_instructions**: Directions provided by ATC or the flight management system to change the current flight path for safety.
25. **Pilot\_stress**: The level of psychological pressure or stress experienced by the pilot, particularly in emergency or demanding situations.
26. **Intruder\_aircraft\_visibility**: The ability of the AVP system and the pilot to visually detect an intruder aircraft.
27. **Unpredictable\_intruder\_aircraft\_behaviour**: Erratic or non-standard movements of an intruder aircraft that complicate detection and avoidance strategies.
28. **Intruder\_aircraft\_dynamics**: The characteristics of the intruder aircraft's movement, including speed, altitude, and trajectory.
29. **Weather\_data**: Information related to weather conditions, such as wind, visibility, and turbulence.
30. **Pilot\_alerting\_and\_warning\_systems**: Systems designed to alert the pilot about potential threats or necessary actions.
31. **Collision\_threat\_alert**: An alert issued when there is an imminent risk of collision.
32. **Weather\_conditions**: The current state of the weather, including factors like wind, visibility, clouds, and turbulence.
33. **Surrounding\_airspace\_obstructions**: Physical or environmental obstacles in the airspace around the aircraft.
34. **Own\_aircraft\_flight\_path\_change**: Adjustments made to the original flight path of the aircraft.
35. **Non\_deterministic\_intelligent\_algorithms**: Algorithms used in AVP systems that provide outputs not strictly determined by their inputs, often used for complex decision-making processes.
36. **Intruder\_aircraft\_direction**: The course or path along which an intruder aircraft is moving.
37. **Intruder\_aircraft\_altitude**: The height above ground or sea level at which an intruder aircraft is flying.
38. **Threat\_predictive\_model**: A model used to forecast potential threats, such as collision risks, based on current data and trends.
39. **Risk\_of\_potential\_collision**: The likelihood or probability of the aircraft colliding with another object.
40. **Cockpit\_display\_systems**: Electronic display panels in the cockpit that show flight information, system statuses, and alerts.
41. **Aircrafts\_existing\_warning\_systems**: Pre-existing systems in the aircraft designed to warn the pilot of various threats or necessary actions.
42. **Own\_aircraft\_yaw\_change**: Adjustments in the aircraft's yaw (horizontal rotation) for maneuvering.
43. **Own\_aircraft\_altitude**: The height at which the own aircraft is flying above ground or sea level.
44. **Own\_aircraft\_radar**: Radar systems on the aircraft used for detecting other objects and aircraft in the vicinity.
45. **Own\_aircraft\_lidar**: Lidar systems on the aircraft used for measuring distances and detecting objects by illuminating the target with laser light.
46. **Environmental\_obstructions**: Physical or atmospheric conditions that hinder visibility or the operation of sensors.
47. **Fog**: A weather condition that reduces visibility, potentially impacting sensor performance.
48. **Raindrops**: Precipitation that can interfere with sensor accuracy and visibility.
49. **Cloud\_cover**: The fraction of the sky covered by clouds, which can affect visibility and sensor operation.
50. **Cloud\_type**: The classification of clouds based on their appearance and altitude, impacting visibility and flight conditions.
51. **Cloud\_turbulance**: Atmospheric turbulence associated with certain types of clouds, affecting flight stability.
52. **Landscape\_background**: The terrain and features in the background that could affect sensor readings and visibility.
53. **Daytime**: The time during the day, affecting lighting conditions and thus sensor performance.
54. **Sunlight**: Natural light from the sun, influencing visibility and the effectiveness of visual sensors.
55. **Sun\_position**: The location of the sun in the sky, which can impact sensor performance and pilot visibility.
56. **Own\_camera**: Cameras installed on the aircraft used to capture visual information.
57. **Intruder\_aircraft\_flight\_path**: The trajectory or route followed by an intruder aircraft.
58. **Collision\_time**: The estimated time remaining before a potential collision could occur.
59. **Own\_aircraft\_response\_time**: The time it takes for the own aircraft to respond to control inputs or system commands.
60. **Own\_aircraft\_pilot\_feedback**: Input or reactions from the pilot in response to the system's performance or alerts.
61. **Avp\_real\_time\_training**: The process of continuously updating and improving the AVP system based on real-time data and pilot feedback.
62. **Emergency\_directives**: Urgent instructions issued in response to critical situations, such as potential collisions.
63. **Unsafe\_proximity**: A distance between two aircraft that is considered dangerously close.
64. **Airspace\_conflicts**: Situations where the paths of multiple aircraft intersect, creating a risk of collision.
65. **Radar\_and\_visual\_range**: The range within which objects can be detected either by radar or visually.
66. **Airspace\_visibility**: The clarity of the airspace, affecting the ability to visually detect other aircraft.
67. **Wind**: Atmospheric wind conditions, which can affect flight dynamics and sensor operation.
68. **Cloud\_turbulence**: Disturbances in the atmosphere associated with certain cloud formations, affecting flight stability.
69. **Avp\_confidence\_threshold**: The level of certainty at which the AVP system reliably operates.
70. **Intruder\_aircraft\_hack\_avp\_threashold**: An attempt to manipulate or interfere with the AVP system's thresholds or parameters.
71. **Own\_aircraft\_proximity**: The distance of the own aircraft from other objects or aircraft.
72. **Autonomous\_collision\_avoidance\_maneuvers**: Maneuvers executed by the aircraft's systems without pilot input to avoid collisions.
73. **Potential\_collision\_threat\_alert**: A warning issued when there is a possibility of a collision.
74. **Collision\_avoidance**: Measures taken to prevent a collision from occurring.
75. **Automated\_own\_aircraft\_flight\_path\_change**: Changes to the flight path made automatically by the aircraft's systems.
76. **Own\_aircraft\_altitude\_change**: Adjustments to the altitude at which the aircraft is flying.
77. **Disturbed\_own\_aircraft\_dynamics**: Changes in the aircraft's flight dynamics due to external factors or maneuvers.
78. **Own\_aircraft\_speed\_change**: Adjustments in the speed at which the aircraft is flying.
79. **Accelerated\_own\_aircraft\_dynamics**: The dynamics of the aircraft when it is accelerating or decelerating.
80. **Own\_aircraft\_yaw\_change**: Adjustments in the aircraft's yaw (horizontal axis rotation).
81. **Accelerated\_own\_aircraft\_roll**: The roll of the aircraft when it is undergoing acceleration.
82. **Accelerated\_own\_aircraft\_pitch**: The pitch of the aircraft during acceleration.
83. **Accelerated\_own\_aircraft\_yaw**: The yaw of the aircraft when it is accelerating.
84. **Own\_aircraft\_flight\_management\_system\_override**: The ability of the pilot to manually override the automated flight management system.
85. **Manual\_own\_aircraft\_flight\_path\_change**: Changes to the flight path made manually by the pilot.
86. **Weather\_conditions\_change**: Variations in weather conditions that can affect flight dynamics and sensor operation.
87. **Weather\_data\_change**: Alterations in the weather data being received and processed.
88. **Own\_aircraft\_dynamics\_change**: Changes in the flight dynamics of the own aircraft due to various factors.
89. **Unpredictable\_other\_aircrafts\_decision**: Erratic or unforeseen decisions made by other aircraft in the vicinity.
90. **Automated\_collision\_avoidance\_maneuvers**: Manoeuvres executed automatically by the aircraft's systems to avoid collisions.
91. **Avp\_detection\_communication\_delay\_hack**: Deliberate attempts to cause delays in the AVP system's detection and communication processes.
92. **Pilot\_cognitive\_limit**: The limitations of the pilot's ability to process information and make decisions under stress.
93. **Surrounding\_airspace\_restrictions**: Limitations or prohibitions in certain areas of the airspace, affecting flight paths.
94. **Military\_aircraft\_intrusion**: The presence of military aircraft in the airspace, which can affect civil aviation operations.
95. **Other\_aircrafts\_presence**: The presence of other aircraft in the vicinity of the own aircraft.
96. **Bird**: Avian activity that can pose a risk to aircraft, especially during takeoff and landing.
97. **Drone\_presence**: The presence of unmanned aerial vehicles (drones) in the airspace, which can pose collision risks.
98. **Wind\_shear\_effect\_on\_camera**: The impact of sudden changes in wind speed or direction on the operation of onboard cameras.
99. **Air\_density\_change\_due\_to\_high\_speed\_effect\_on\_camera**: The effect of changes in air density, especially at high speeds, on camera performance.
100. **Aircraft\_attitude\_control**: The system and process of managing the orientation of the aircraft in flight.
101. **Mechanical\_wear\_and\_tear**: The degradation of aircraft components over time due to regular use.
102. **Autopilot\_system\_failure**: A malfunction or failure of the aircraft's autopilot system.
103. **Information\_overload\_for\_pilot**: A situation where the pilot is presented with more information than can be effectively processed.
104. **Highly\_stressfull\_event**: An event or situation that places a high level of stress on the pilot, affecting decision-making and performance.