# RISK MANAGEMENT, AN EXAMPLE OF ENFORCING IT TO PROVIDE FLIGHT SAFETY AND OPERATIONAL CAPABILITIES

**Mădălina DUMITRU**

"Transilvania" University of Brașov, Romania (imdldumitru@gmail.com)

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***Abstract**: The mission of flight safety is to ensure the conditions for the conduct of aeronautical activities at an accepted level of risk. The primary objectives of aviation safety are to avoid loss of life and injury to persons. The following objectives, as a priority, are to avoid material damage and limit the effects of aviation events. As a result, at least two elements of operational capabilities are in the attention of aviation safety processes: personnel (in number and training for combat) and aircraft (in terms of their availability and performance). The fundamental working tool of aviation safety is risk management.*

***Keywords**: operational risk management, operational capabilities, flight safety, human factor, crew resource management*

***Acronyms***

| | | | |
|---|---|---|---|
| *CAS* | *Close Air Support mission* | *COM* | *Communication* |
| *ICAO* | *International Civil Aviation Organization* | *IFF* | *Identification, friend or foe* |
| *NVG* | *Night Vision Goggles* | *NAV* | *Navigation* |
| *RWR* | *Radar warning receive* | | |

## 1. OPERATIONAL RISK MANAGEMENT, A FUNDAMENTAL TOOL FOR AERONAUTICAL SAFETY

Operational risk management is described as a process that has two basic objectives: identifying potential threats / hazards followed by implementing measures to reduce the risks associated with threats. In the Romanian Air Force, risk management is defined by the application of six steps [1], in a model similar to that applied in USAF [5] and ICAO:

- Identifying potential hazards / threats;
- Risk analysis: cause / effect analysis, identification of risk components: severity, probability, exposure;
- Identifying possible risk reduction measures;
- Establishing risk reduction measures: applying the criteria of efficiency, opportunity, feasibility, etc.;
- Implementation of risk reduction measures: who, what, when and by what means, responsibilities;
- Assessing the effect of risk reduction measures and monitoring the evolution of the situation.

It should be emphasized that the basic element in aviation safety is the identification of hazards / threats. This requires information. The need for an effective information / reporting system lies primarily in the need to support the identification of hazards / threats.

All other stages should take place naturally, with the effective participation of staff, at least bound by the fundamental instinct of conservation, specific to the human race.

The major difficulty is the crew's awareness that this tool is helpful and not a new bureaucratic means of loading time to prepare for the mission.

There are several dimensions on which aviation safety can be based:

- Temporal and hierarchical: strategic level, planned, situations in time crisis;
- Prevention strategy: reactive, proactive, predictive;
- Constituent factors of the aeronautical system: human, technical, environmental, management, mission;

It should be emphasized that the whole doctrine and philosophy, the normative documents and the activities should be directed to the pilots, in the procedures of execution of the flight missions and the way of preparation of the missions but especially in the formation, development and maintenance of decision-making and piloting skills.


**FIG. 1** Operational risk management

## 2. MISSION ANALYSIS

### 2.1. The risk management process

The risk management process is initiated by the analysis of the mission and the consideration of the possible contributing factors to the occurrence of aviation events. Combined with "KILL - LIVE CHAIN" [2], threats to the mission and its phases can be established. In the table below are given some elements of analysis to establish the safety measures by applying this mechanism, having as example the elements KILL CHAIN. Taking into account a CAS (Close Air Support mission) [6], we can correlate a number of operational elements with mission-specific security measures. Table no. 1 KILL CHAIN and the contribution of aircraft performance and risk factors to the assessment of operational capabilities [4].

*Table no. 1 KILL CHAIN*

| KILL CHAIN | Operational Element | Factors of influence |
|---|---|---|
| Distance / Target | Flight profile: altitude, speed | Runway condition, Wind, BASH, Obstacle, Fuel on board, Flight to target. |
| Persistence | Flightmode: altitude, speed Fuel on board | Wind. Fuel on board, Combined mng system. |
| Target discovery | Radar, IFF, RWR, NVG system performance | Time, brightness, Visibility, Ceiling |
| Target identification | Radar, IFF, RWR, NVG system performance | Visibility, Day Night, Knowing the enemy |
| Target tracking | Maneuvering performance | Maneuvering restrictions limits. Obstacle, Misperception - dangerous approach |
| Attack | Maneuvering performance. Weapon depth. Performance of Radar, IFF, RWR, NVG systems | Maneuvering restrictions, Obstacle. Approaching the wingman, The distance to the explosion |
| Assessing attack | Maneuvering Performance. Sensors performance. | Maneuvering restrictions, Obstacle. Approaching the wingman, The distance to the explosion |

### 2.2. Identify mission-specific hazards / threats and risk assessment

Identifying hazards / threats is the fundamental step in aviation safety. It is recommended that a list of threats specific to each mission be developed against which effective action can be taken. Keeping an interception mission in mind, the main dangers can be:

- Fuel limit;
- Dangerous approach / ground impact / obstruction;
- Loss of aircraft control
- Shoot / launch incidents;
- Loss of orientation;

Latent conditions for threats are:

- Incorrect planning and longer flight time than planned;
- Deviation from the path;
- Incorrect study of the obstacle;
- Wrong altimetry;
- Failure of the navigation system;
- Defect of the barometric system;
- Exceeding the limits of the flight tire;
- Incorrect setting of warnings;
- Distance perception error;
- Execution of maneuvers in conditions of low visibility or inadequate visual contrast;
- Focusing attention / distracting from critical elements
- Incorrect communication procedures within the crew / formation / operational controller of the mission.

The risk analysis may include the following:

a. The probability of occurrence of events or activation of latent conditions is difficult to estimate but can be said to be proportional to the interruption of the flight in the respective conditions and inversely proportional to the experience of the pilots.

b. Exposure is a constant in combat situations, given that all crews are exposed to danger under the same conditions.

c. Severity may vary from pilot to pilot, and experience and quality of training may play an important role in limiting the development of special situations or limiting the effects of aviation events.

**2.3. Identifying and establishing safety measures**

Indeed, security measures focus proactively on elements of mission planning, preparation and execution (application of procedures) with emphasis on the following:

*a. Prevention of loss of aerodynamic control of the aircraft:*

- Study of the permitted flight tire, depending on the operating configuration;
- Setting the warning system compatible with the permitted flight tire;
- Study of the decision time available in special situations;
- Designing / establishing attack procedures and maneuvers according to the available diagram;
- Establishing clearance / avoidance maneuvers according to the available tire;
- Establishing the procedures for verifying the operation of the systems (NAV, COM, Pitot Tube);
- Study of weather conditions: turbulence, visibility, icing, other dangerous weather conditions

*b. Preventing impact with ground in controlled flight:*

- Altimetry procedure;
- Establishing the procedures for verifying the operation of the systems (NAV, Pitot Tube);
- Studying the map: marking obstacles and relief, setting the navigation and warning system;
- Study of take-off / landing procedures;
- Study of weather conditions: turbulence, visibility, icing, other dangerous weather conditions;
- Avoiding deviation from living;
- Identifying moments of concentration / distraction;
- Taking into account the position of the Sun, ceiling, clouds, natural horizon, and landmarks for establishing attack maneuvers.

*c. Fuel limit:*

- Calculation of fuel according to the ordered profile;
- Establishing an alternative profile, especially for base return;
- Setting the warning system;
- Establishing the minimum amount of fuel for mission interruption;
- Establishing the procedures for verifying the operation of the systems (NAV, Pitot Tube);

*d. Operation of the armament system:*

- Coupling / decoupling the weapon system at the entrance / exit of the attack, after violating the target;
- Entering the area of the own aerodrome with the disconnected weapon system;
- IFF identification rules to avoid fratricide;
- Procedures in case of blocking / failure of the armament system;
- Asymmetric flight.

### 2.4. Implementing safety measures and evaluating their effect

The application of aviation safety measures is the direct and unequivocal responsibility of pilots and crew members. Where appropriate, doctrinal procedures or changes shall be established / updated. We believe that they need to be monitored by air safety commanders and officers, as well as flight instructors, in order to enhance safety. It is important to carry out the objective control process of the mission so that the benefits of compliance with safety measures as well as the weaknesses and factors that can trigger potential hazards or latent conditions for the occurrence of aviation events can be highlighted.

### 2.5. Strategic security processes for maintaining operational capabilities

We consider institutionalized training one of the fundamental elements for increasing the level of aviation safety for the benefit of operational capabilities. The selection provides people with the most developed potential for training and development in the military pilot profession. Continuous, coordinated, systematic training in the areas that are essential for the flight is the fundamental condition for:

- Prevention of latent conditions / preconditions for an aviation event;
- Creates the theoretical basis, decision-making skills, piloting technique and effective risk management for the precise execution of missions.

## CONCLUSIONS

Aviation safety cannot be separated from the quality of mission execution. Even if it is apparently put into practice by the staff belonging to the specialized structure and commanders, aviation safety is a problem for all those who carry out aviation activities.

Operational capabilities are based on the number of staff trained under certain conditions and the resources available. It is obvious that by carrying out risk reduction actions and achieving aviation safety objectives, the preservation of operational capabilities is supported.

The effort of the prevention processes is focused on:

-Systematic identification of hazards and safety measures for all missions, permanently;

-Simplification of procedures / missions;

-Concentrating the effort of aeronautical activities in periods close to important exercises or missions;

-Continuous communication and search for those mechanisms specific to the human being to activate the conservation instinct and the desire for knowledge as well as to increase professional motivation as essential engines to ensure an acceptable level of aviation safety.

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