



Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Federal Office of Civil Aviation FOCA
RPAS Working Group

RPAS Integration in Switzerland A holistic Approach

ICAO RPAS Symposium, 24. March 2015
Workshop 1, Airworthiness

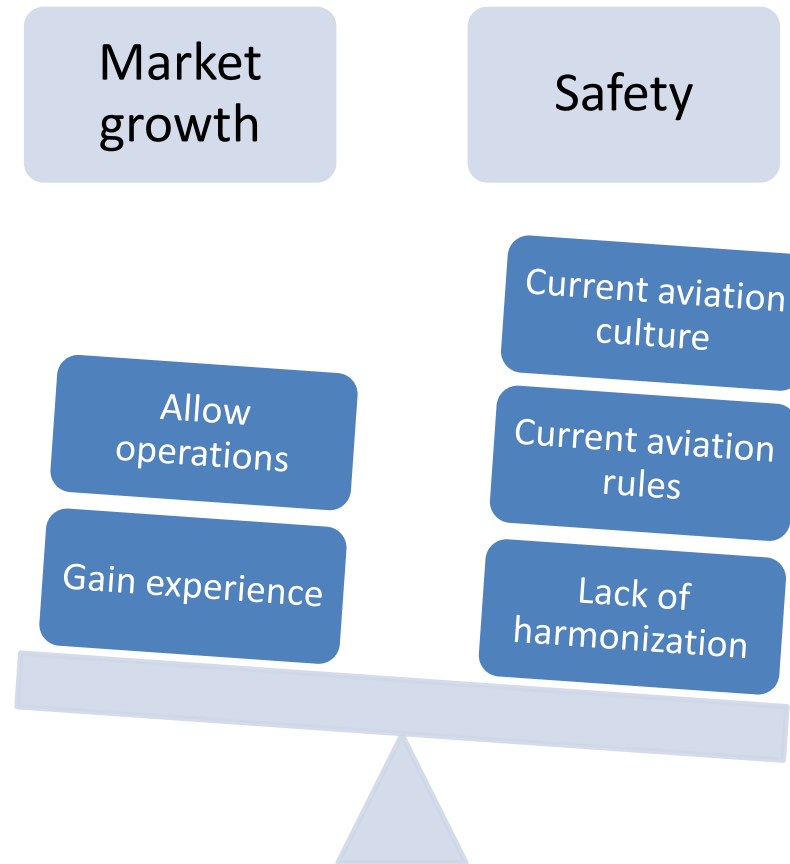


Our starting point

- **We need to ensure a safe aviation system.**
- **RPAS are “tools” to perform certain tasks.**
- **Commercial or not is not of importance.**
- **Operators need to fly to get experience with the RPAS and if there is a business case for them.**
- **We need to treat them proportional to the risk they pose to 3d parties.**
- **We need to ensure equal treatment.**
- **We all have limited resources.**

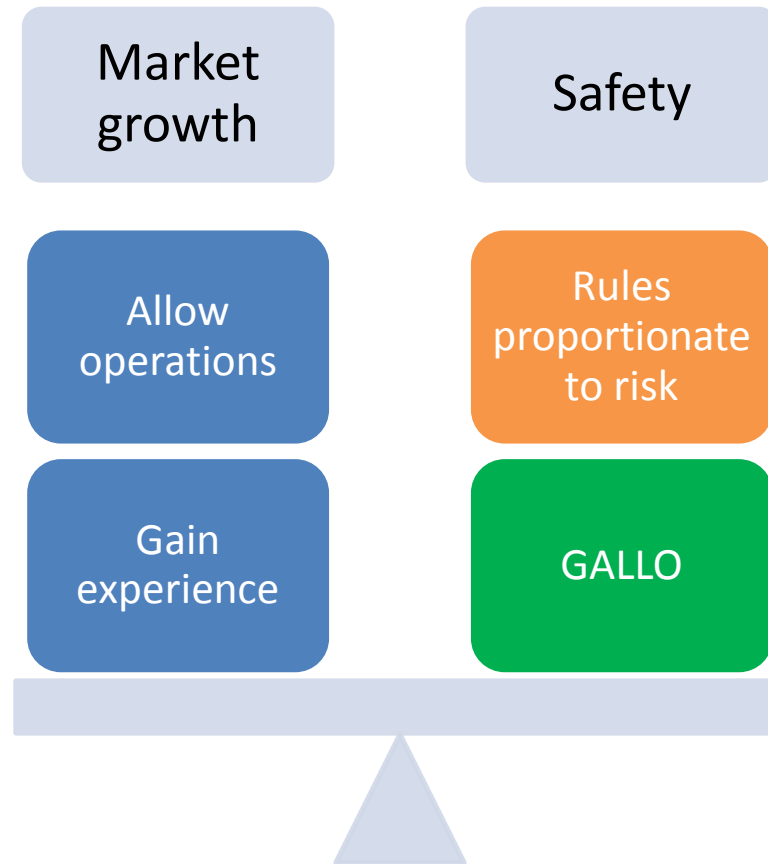


A balancing act...





A balancing act...





Resulting Concept in Switzerland

No additional
~~No risk~~
Authorisation
mitigation

- (Below 30kg)
- Within direct visual contact (VLOS)
- Not within a distance of less than 100 meters around crowds (outdoors)
- > 5km Distance to civil & military airports/aerodromes
- < 150m AGL within a CTR
- Commercial ops allowed

Additional
risk
mitigation



No additional
~~Certification~~
mitigation

- Operation inside the approved RPAS design envelope.
- Operation is part of the approved Operation Certificate scope.
- Operation is part of the approved crew qualification
- NOT POSSIBLE IN SWITZERLAND TILL 2016



Specifics of the «?» ops category

- Wide variety of operations, very difficult to categorize
- Wide range of expertise among applicants
 - Small start-ups (no money, no time, great people, great ideas)
 - Photographers with NO aviation experience
 - Meteorologists with NO aviation experience
 - Military
- Wide range of RPAS
 - COTS (e.g. Phantom S-800)
 - Amateur built
 - Custom built for specific operation
- Huge economic potential if allowed to grow
- But «normal» Airworthiness Certification will not help!



A change in strategy – out of comfort zone!





A change in culture, from atomistic...



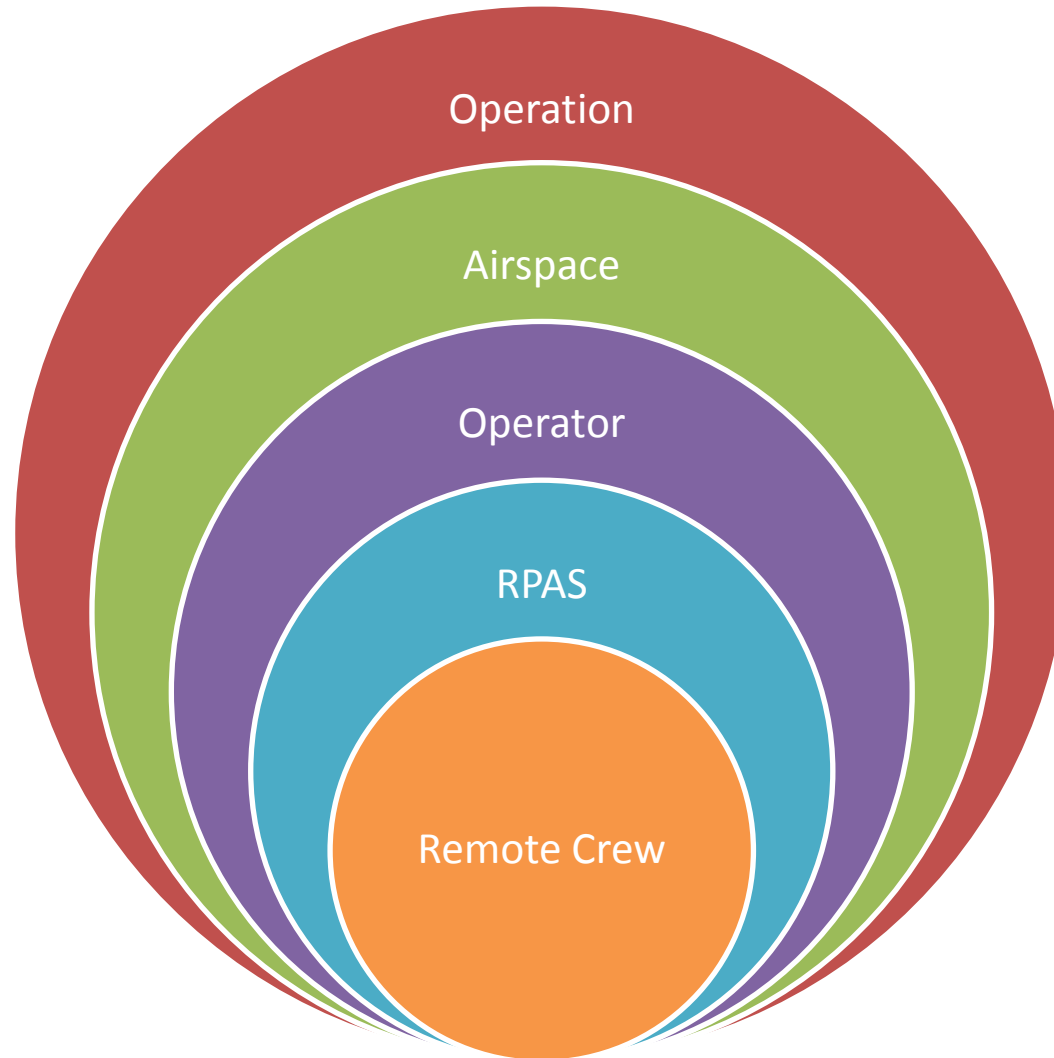


.. to holistic!





Back to basics - Safety of RPAS





Total Hazard and Risk Assessment

- A tool to determine, if the risks are acceptable and what safety barriers/mitigations need to be established.
- These safety barriers can affect the RPAS and the operational environment.
- **Therefore, detailed information are required about:**
 - Operator
 - Operation
 - RPAS incl. Datalink & QMS (configuration control, change management, CAW, etc.)
 - Proposed Limitations
- The advantage of a Total Hazard and Risk Assessment as above is, that it can be used as well, to determine the applicable certification basis for a product (CS-LURS/LUAS.1).



We call it «GALLO»

Guidance for an Authorisation for Low Level Operation of RPAS

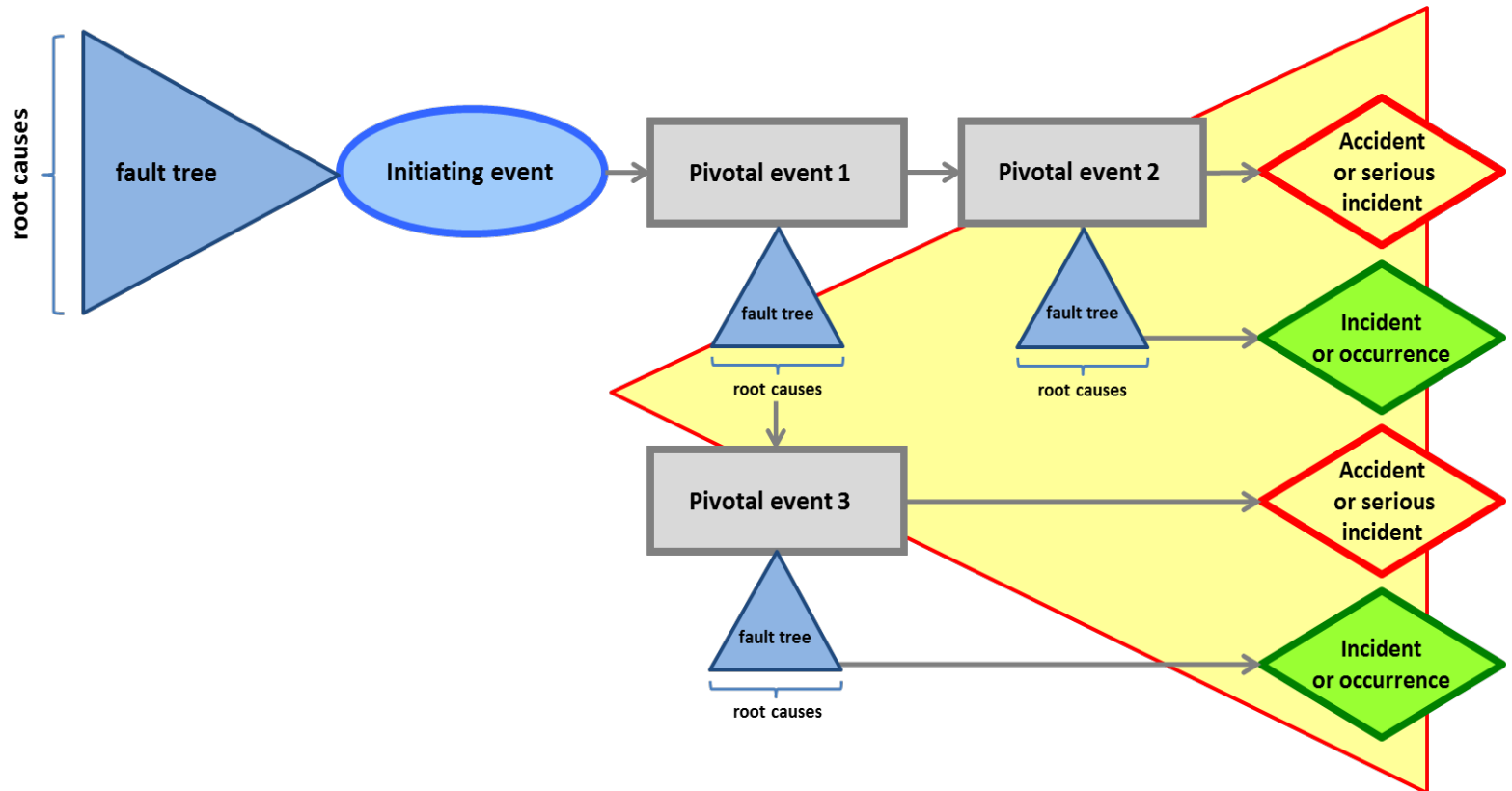
- A Total Hazard and Risk Assessment as required e.g. in CS-LURS
- Technical shortcomings can be mitigated by operational limitations[...]
- Allows operations where normal airworthiness certification is impractical

1. What happens if [...]?

2. Why this can happen?

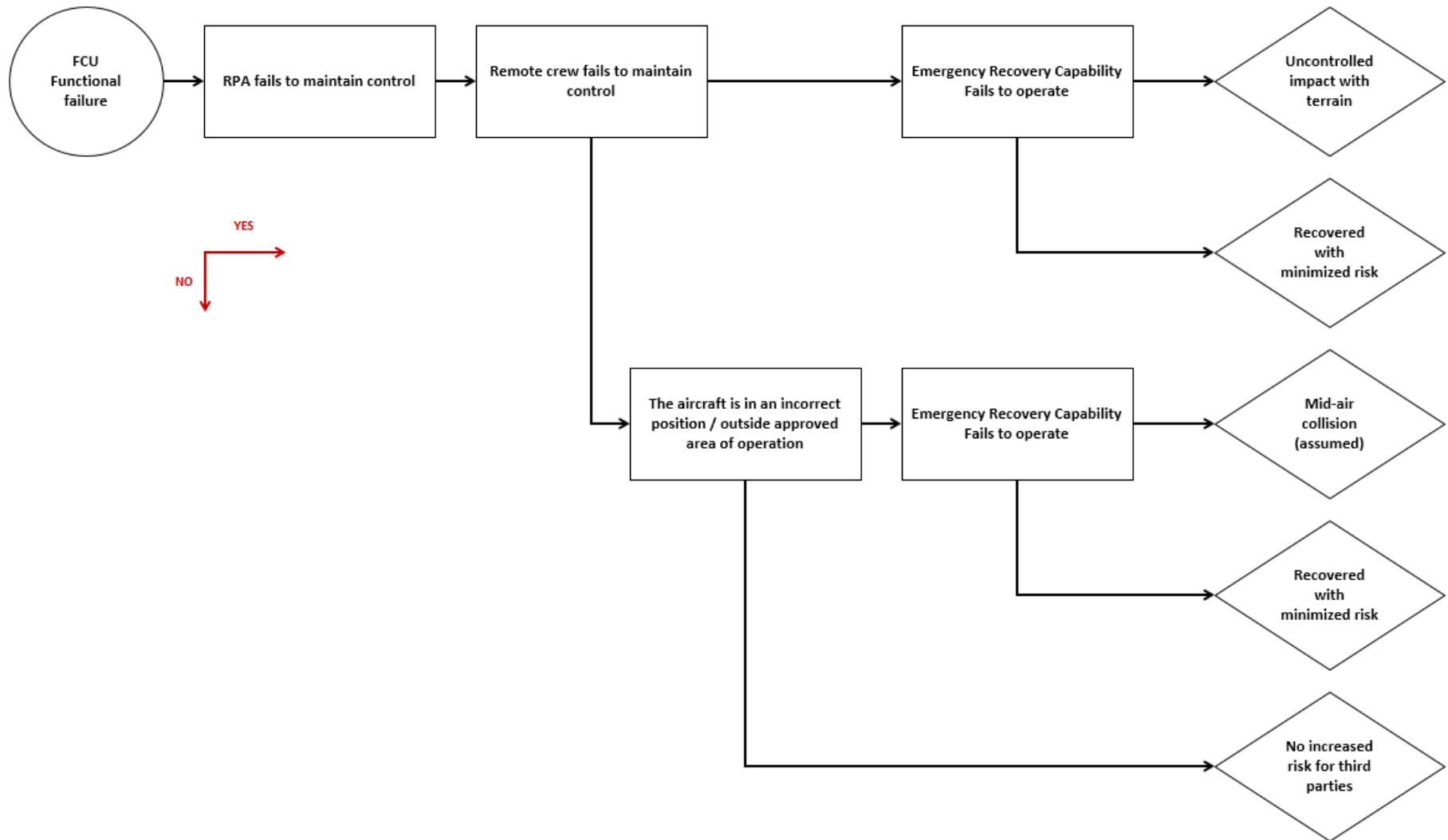


Event Sequence Diagram



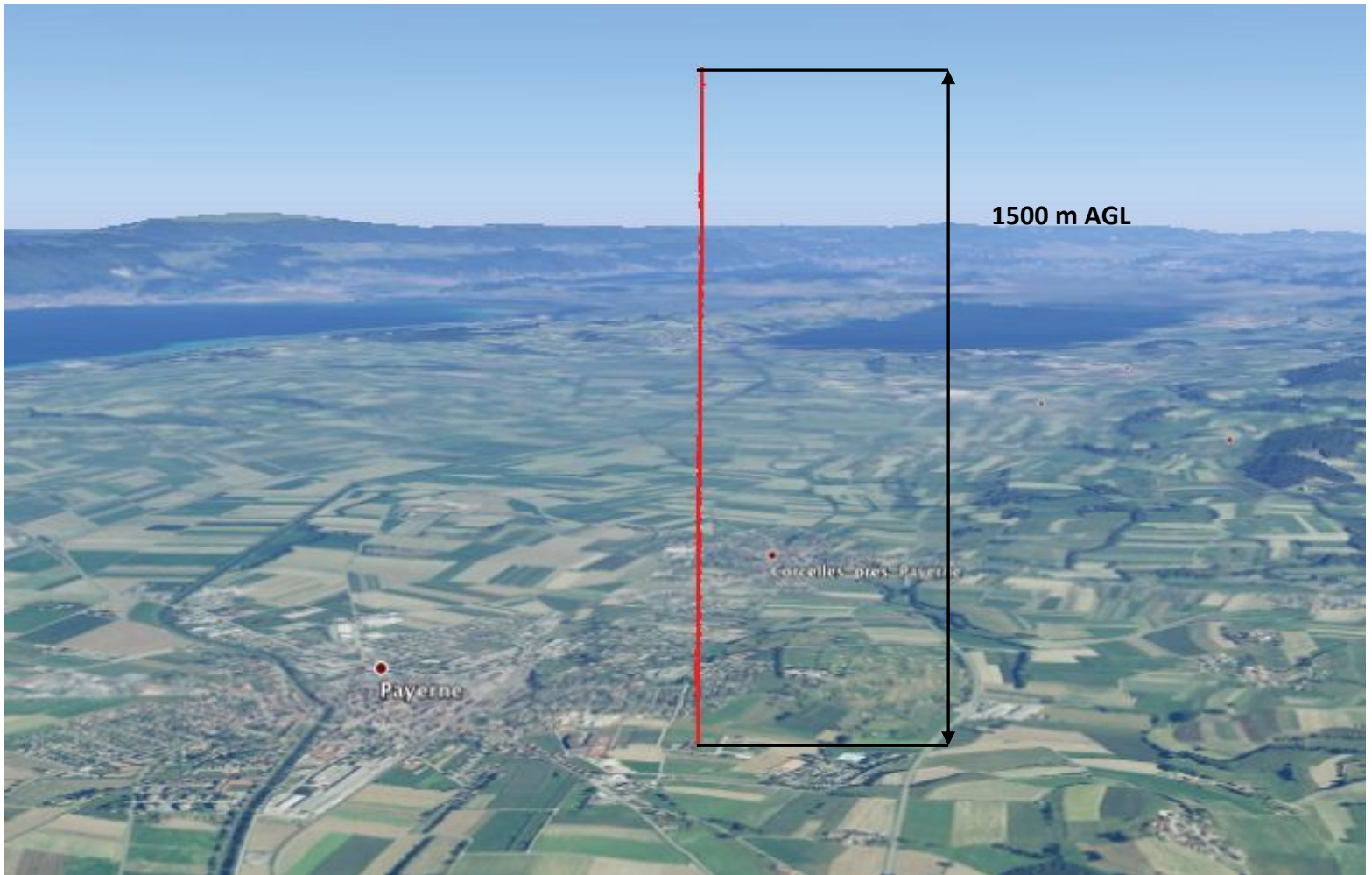


ESD – System failure



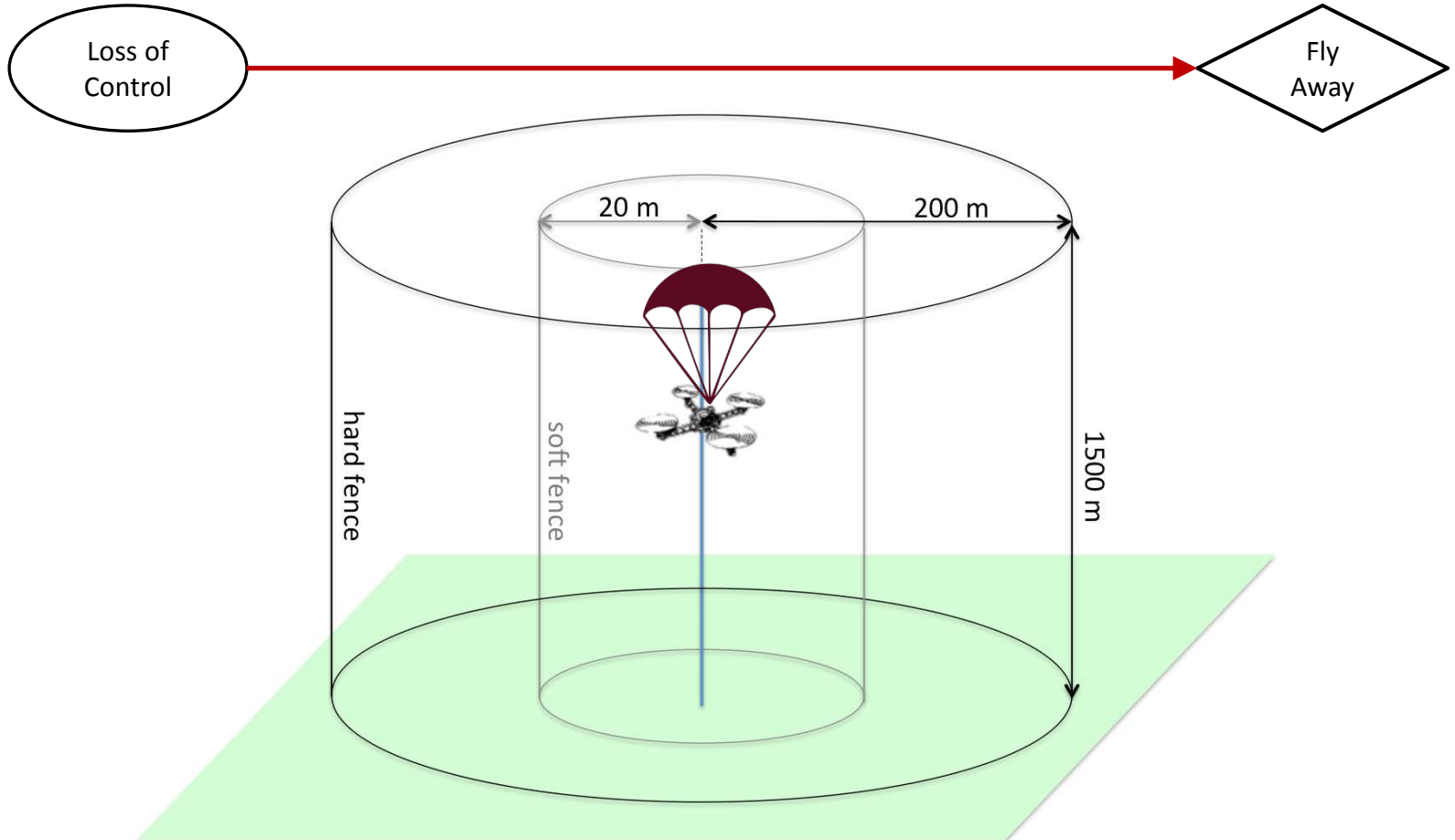


A practical example



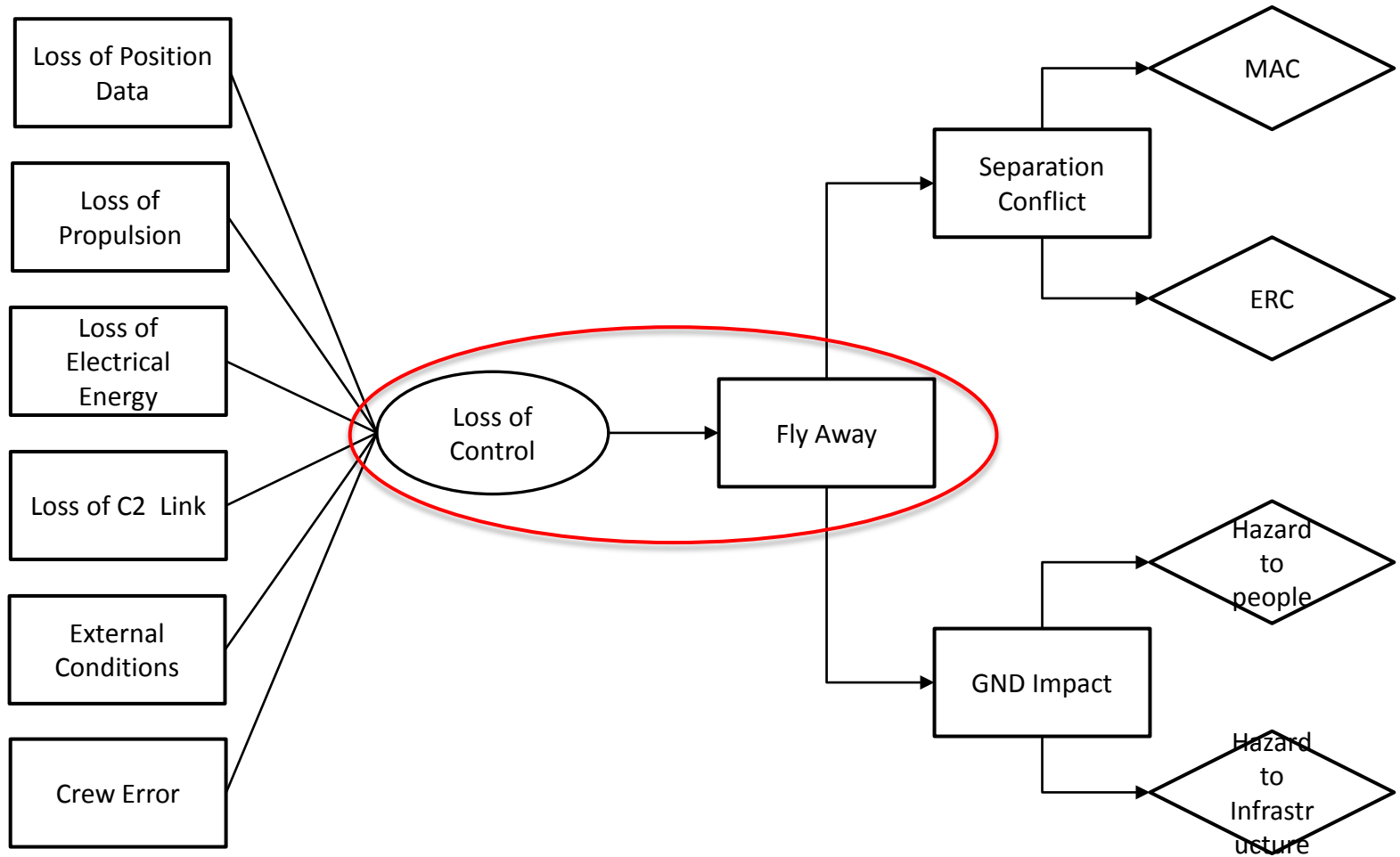


What happens if [...]?



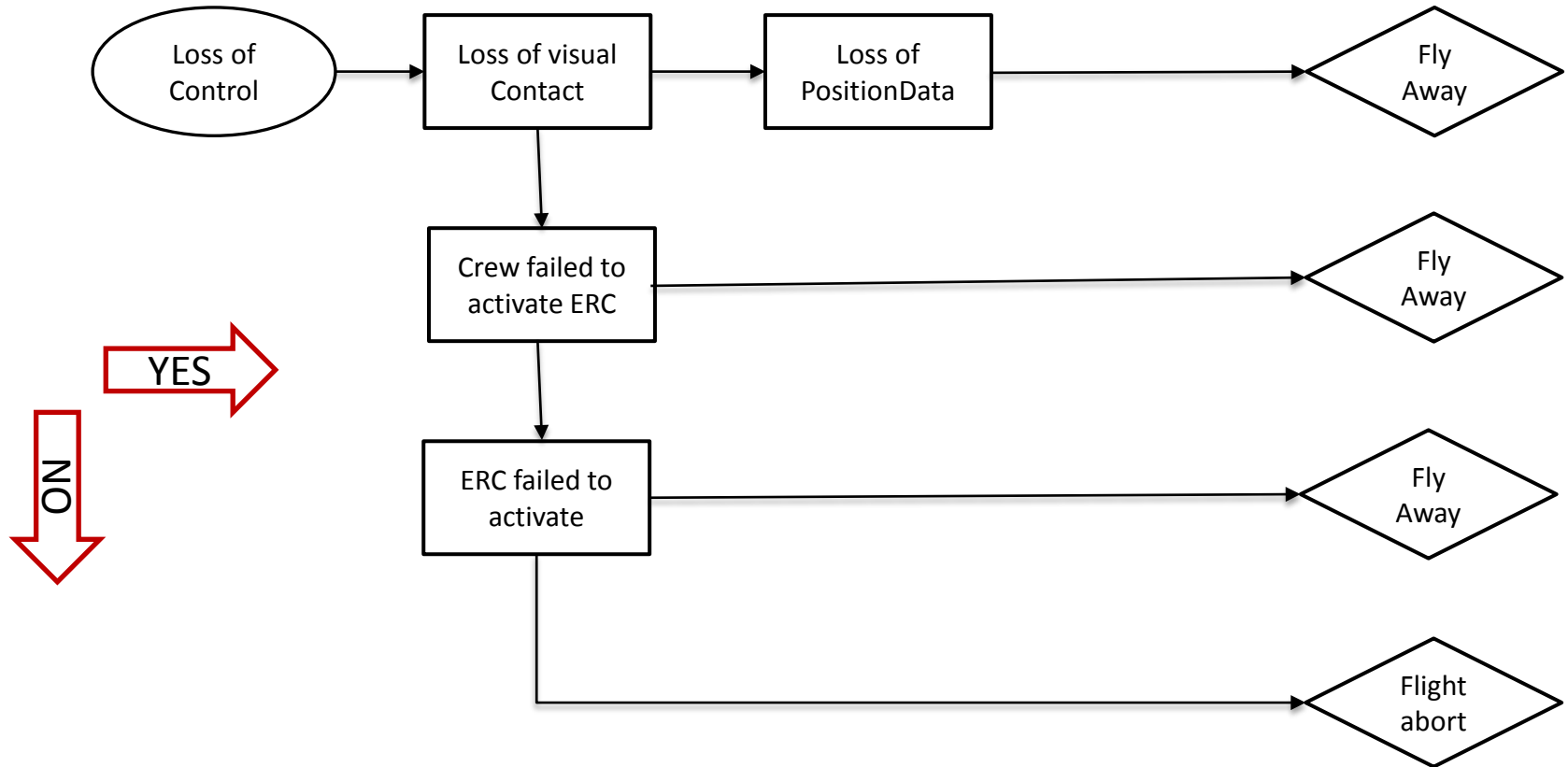


What happens if [...]?





What happens if [...]?



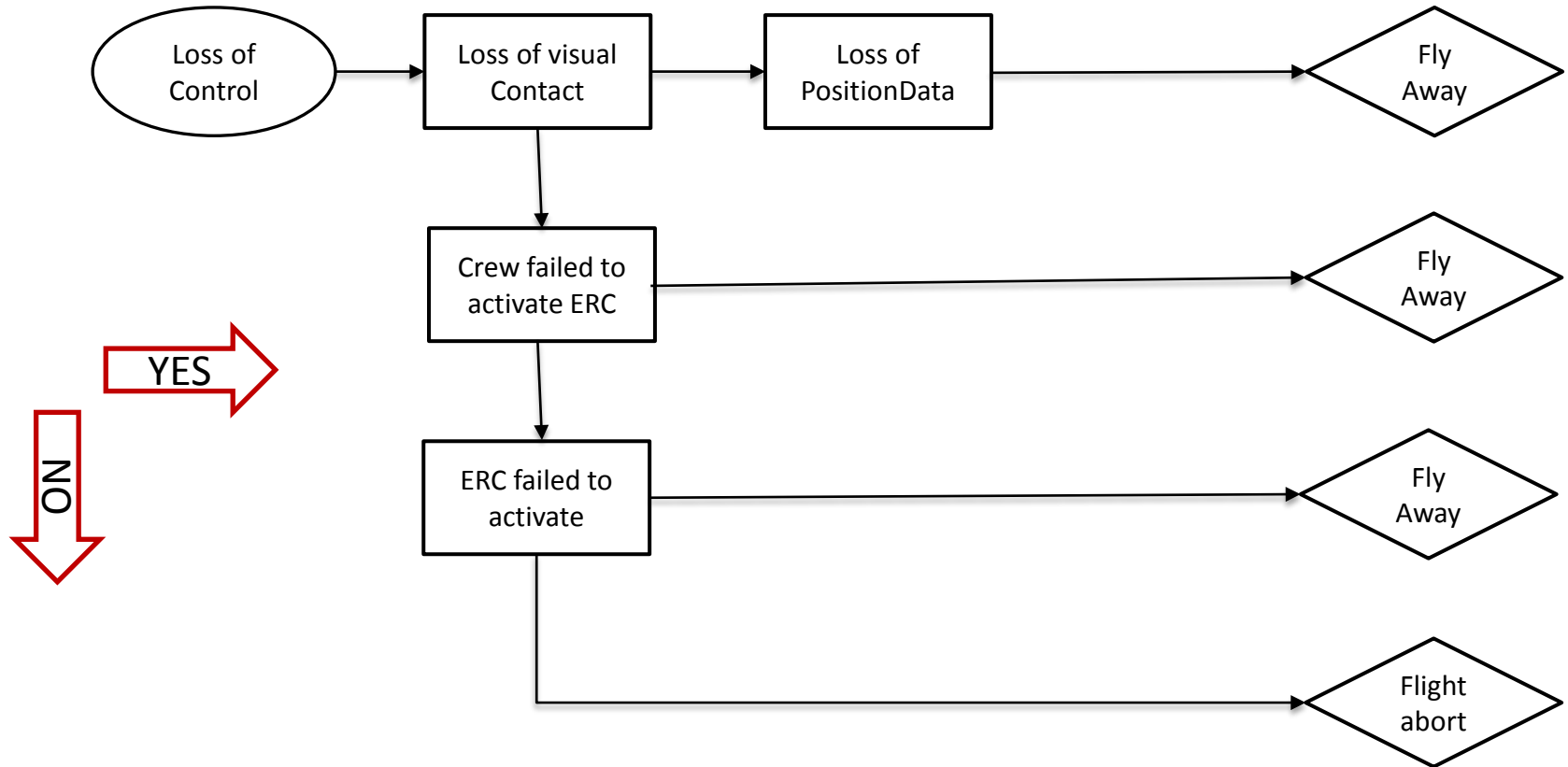


Safety barriers “log”

| Safety barrier | Related limitation/condition |
|---|--|
| Maintain visual contact with RPA at all times | <ol style="list-style-type: none">1. Ops to be conducted at night (due to other safety barrier)2. A light must be installed on the RPA and visible to ground crew at all times3. No flight into clouds or when visibility does not allow visual contact with the RPA4. «Return-to-home» to be initiated in case of failure of the light |
| Maintain Position Data | <ol style="list-style-type: none">1. Second Position Data Source (GLONASS, INU, etc.)2. Independent power supply3. Etc... |
| ... | <ol style="list-style-type: none">1. ... |



What happens if [...]?



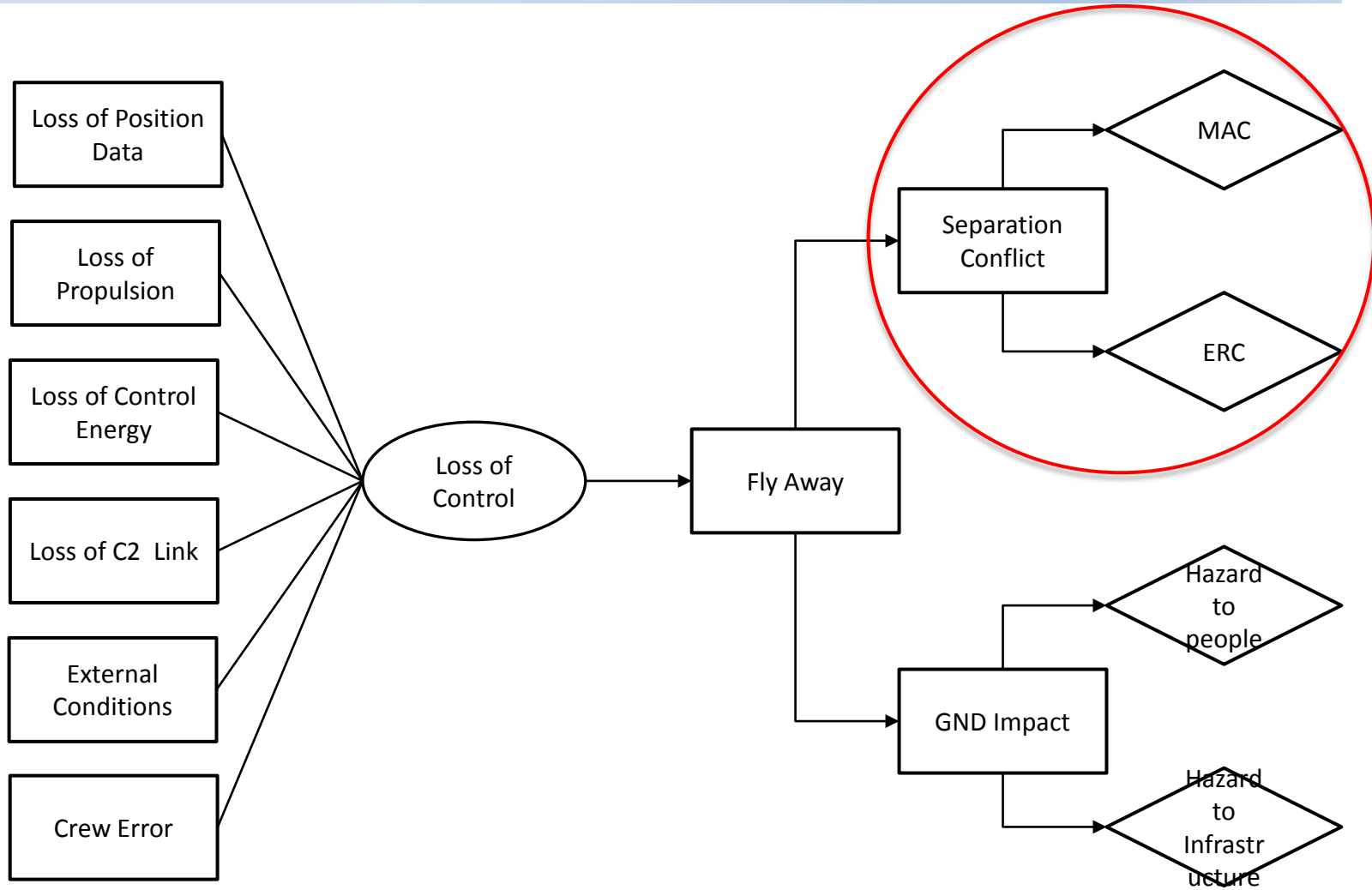


Safety barriers “log”

| Safety barrier | Related limitation/condition |
|---|--|
| Ensure flight crew awareness, to initiate the ERS when required | <ol style="list-style-type: none">1. Crew training2. Additional observer3. Etc... |
| Adequate ERS maintenance | <ol style="list-style-type: none">1. ERS maintenance in Authorisation2. ERS operation cycle log3. Etc... |
| ... | <ol style="list-style-type: none">1. ... |

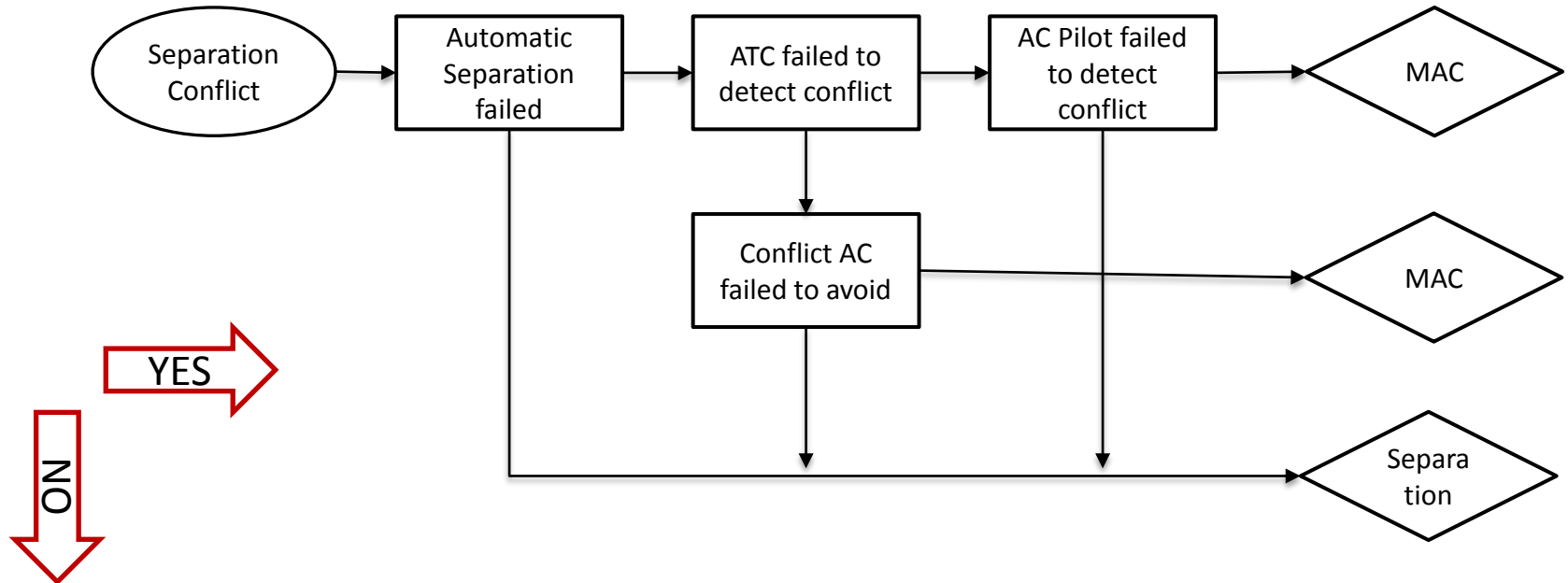


What happens if [...]?



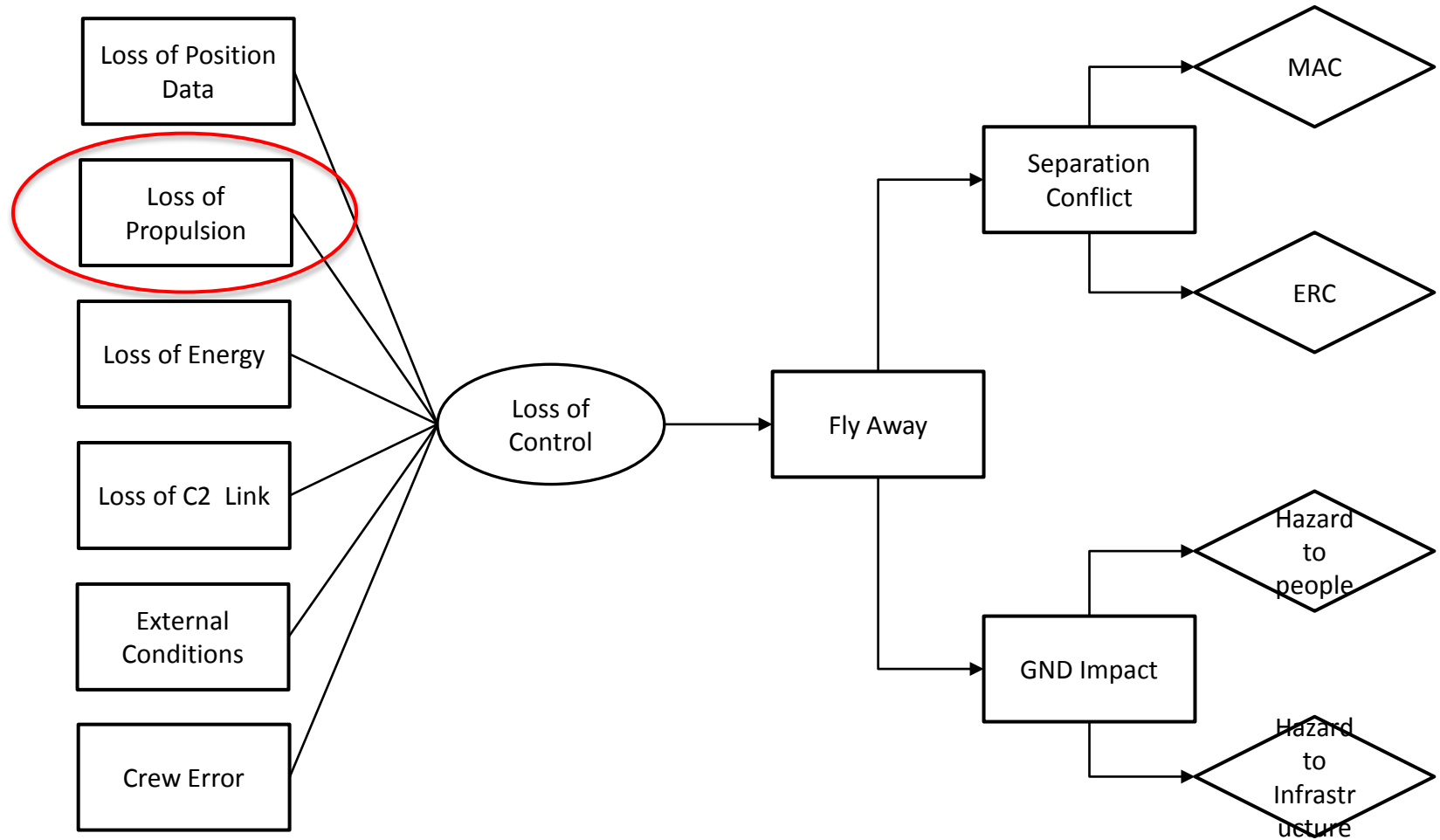


What happens if [...]?



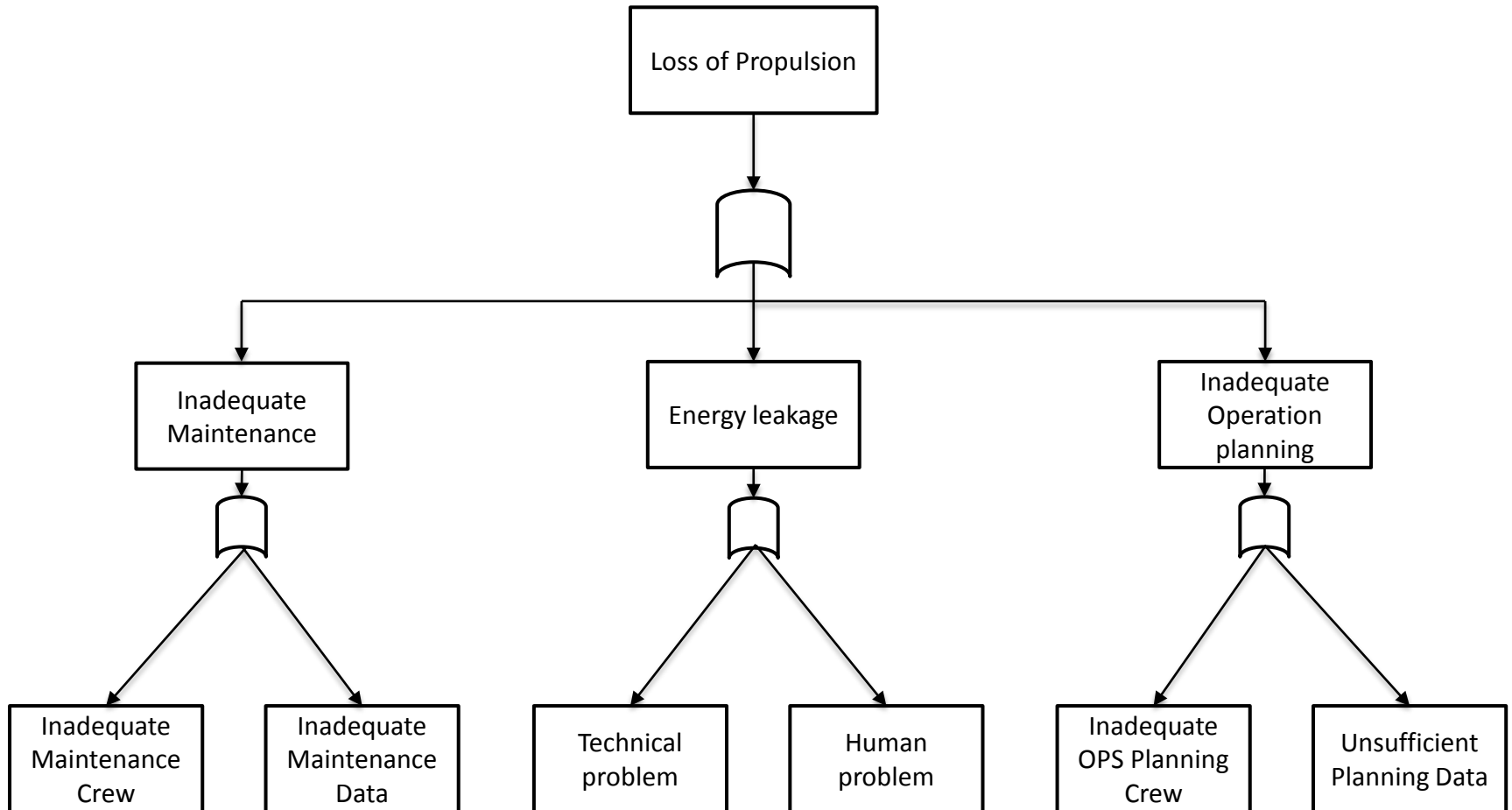


Why this can happen [...]?



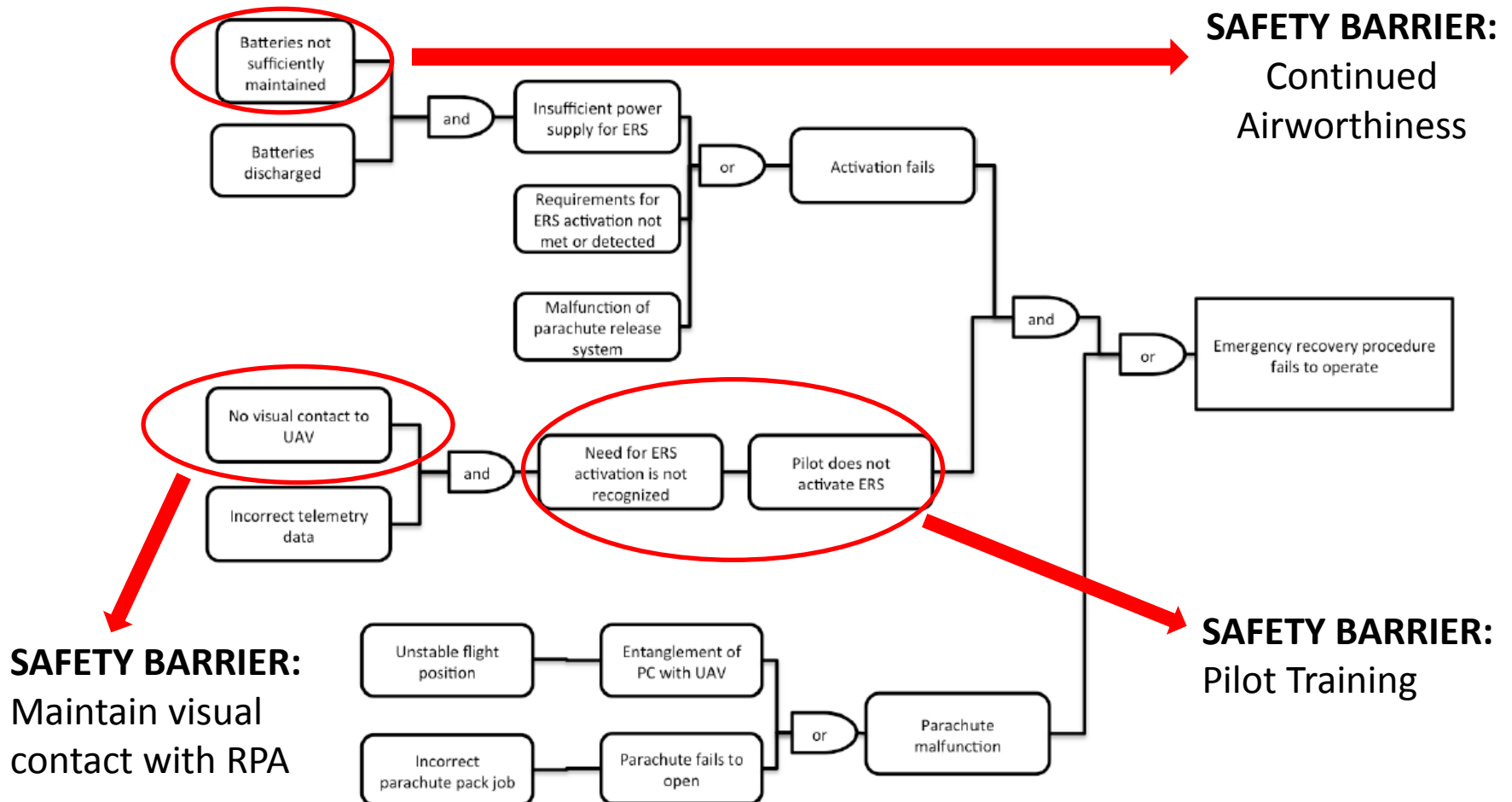


Why this can happen [...]?





Bow Tie – why this can happen [...]



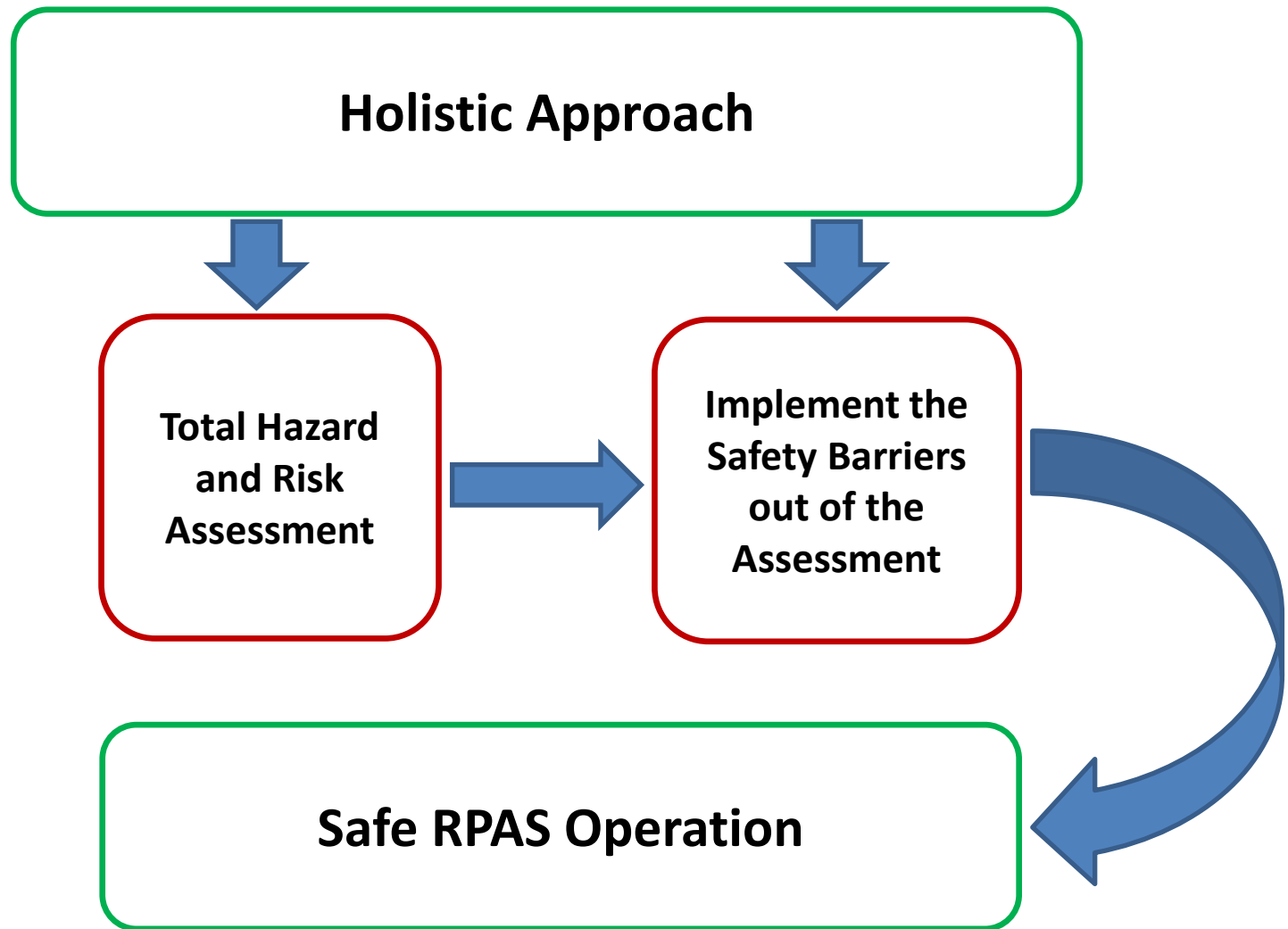


Safety barriers “log”

| Safety barrier | Related limitation/condition |
|---|---|
| Ensure all Data required to perform the intended operation is available | <ol style="list-style-type: none">1. Respective Processes in place to transform the intended operation in adequate mission planning2. Training of involved personell3. Etc... |
| Ensure, energy leakage will not result In a loss of controll | <ol style="list-style-type: none">1. No single energy source2. Ground Crew training3. Pilots training4. Etc... |
| ... | <ol style="list-style-type: none">1. ... |



Resulting 3 Safety Modules





Safety barriers “log” extend it further

| Safety barrier | Related limitation/condition |
|--|---|
| Ensure safe separation to other aircrafts in uncontrolled airspace | <ol style="list-style-type: none">1. Fly where no VFR traffic is flying (close to obstacles, direct in clouds...)2. Stay away from any IFR routes (coordinate with ANSP)3. Etc... |
| Ensure operational safety in icing conditions | <ol style="list-style-type: none">1. Procedures to abort the flight in case icing accumulation affects the performace (power)2. No people NOT under operator controll in the operation area3. Anti Icing on ERS4. Etc... |
| ... | <ol style="list-style-type: none">1. ... |



Risk model and accident scenarios

- GALLO model based on results of ASCOS WP3.2 results
- 6 accident scenarios represented as ESD types (Event Sequence Diagram)
- Events are further detailed in Fault Trees

ESD type 1 – System failure

ESD type 2 – Datalink deterioration

ESD type 3 – Operations outside approved envelope/limitations

ESD type 4 – Fire

ESD type 5 – Loss of safe separation

ESD type 6 – Remote crew error





Conclusions

Guidance for an Authorization for Low Level Operation of RPAS

Provides a framework for the applicant to:

1. Collect information about his intended operation
2. Perform a structured technical review of the RPAS with focus on safety features related to the operation
3. Analyse the accident scenarios and identify the relevant safety barriers
4. Provide all this information to the authority in a standardized format



Conclusions

Guidance for an Authorization for Low Level Operation of RPAS

Provides a framework for the certifying authority to:

1. Build a comprehensive picture of the operation under approval
2. Understand the risks involved in the operation
3. Understand what safety barriers are in place to ensure safety of the operation
4. **Invest the limited available resources on the verification of those barriers**



Questions...





...and Answers...

