

# **EHEST SAFETY MANAGEMENT TOOLKIT**

## ***MARIA***

*(My Assessment of Risks for Incidents and Accidents)*  
Guidance Manual  
2nd Edition, 01 August 2016



Courtesy: Elicampiglio  
Photo: Michele Calovi

## European Helicopter Safety Team

# MARIA

(My Assessment of Risks for Incidents and Accidents)

## Guidance Manual

**Edition 2**  
01 August 2016

## ABOUT THE MANUAL

This manual will walk you through the installation of the OpenOffice suite and the usage of the EHEST "MARIA" tool.

The tool has been developed by Capt. Stefano BURIGANA, Elilombarda Safety Manager and revised by the EHEST Specialist Team Ops. & SMS. The tool has been released by EHEST to assist operators to develop their own Company risk assessments better.

The tool is open source, e.g. it can be used, copied, distributed and changed. The only requirements are that:

- **The tool cannot be sold or used for remuneration.**
- **If the tool is changed, the changes must be made available to the community.**

**The information (risk evaluations) contained inside the tool must be considered as examples. Every operator MUST make its own analysis and risk evaluation, since those can significantly differ between different operators or operations.**

**NOTE: Downloading the MARIA file, the computer could save the file as "read only", preventing the insertion of data and the use of the database.**

**If necessary, right-click on the file (before opening it), select "Properties" and uncheck the "Read only" box.**

Please report your comments and suggestions to:

[ehest@easa.europa.eu](mailto:ehest@easa.europa.eu)

In case of "technical" questions about the MARIA tool, please report also to:

[sburigana@elilombarda.com](mailto:sburigana@elilombarda.com)

[stefano.burigana@gmail.com](mailto:stefano.burigana@gmail.com)

## **Table of Contents**

<b>ABOUT THE MANUAL.....</b>	<b>3</b>
<b>1) HOW TO INSTALL THE EHEST "MARIA".....</b>	<b>5</b>
<b>2) ABOUT TERMINOLOGY.....</b>	<b>10</b>
<b>3) "MARIA" RISK ASSESSMENT METHODOLOGY.....</b>	<b>11</b>
<b>4) WHY AN EHEST RISK ASSESSMENT TOOL?.....</b>	<b>17</b>
<b>5) HOW TO USE THE EHEST "MARIA" TOOL.....</b>	<b>18</b>
<b>OPERATION.....</b>	<b>22</b>
<b>HAZARDOUS EVENT.....</b>	<b>23</b>
<b>CAUSE.....</b>	<b>27</b>
<b>CONSEQUENCES – PROACTIVE/RECOVERY BARRIER – TASK.....</b>	<b>28</b>
<b>REPORTS.....</b>	<b>29</b>
<b>EHEST RADEC FORM.....</b>	<b>32</b>
<b>SPECIFIC REPORTS.....</b>	<b>32</b>
<b>LISTS.....</b>	<b>33</b>
<b>6) SUPPORT EHEST.....</b>	<b>34</b>

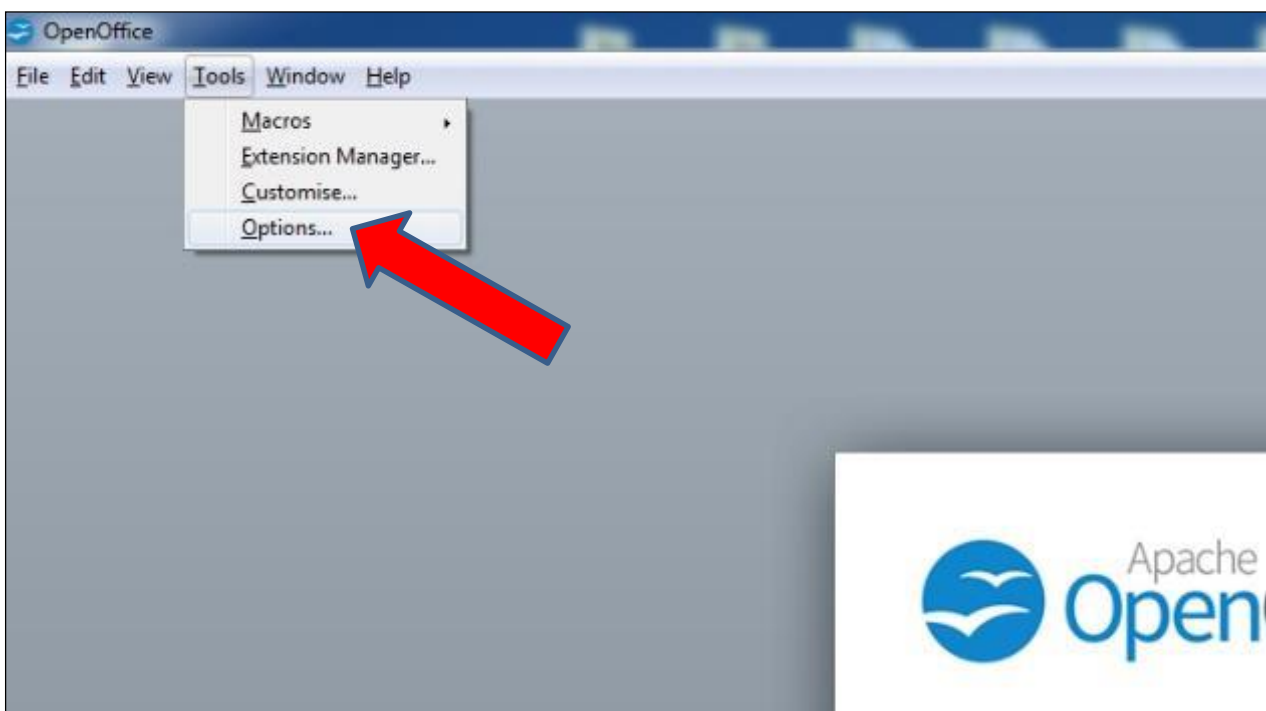
## 1) HOW TO INSTALL THE EHEST "MARIA"

MARIA is based on OpenOffice, an open source cost-free office suite that can be downloaded and installed by everybody. The idea was to create a tool that could be used with everyday computer programs but, since not every Microsoft Office suite has the Access database in it, EHEST opted for a world-recognized free program such as OpenOffice for the development of MARIA.

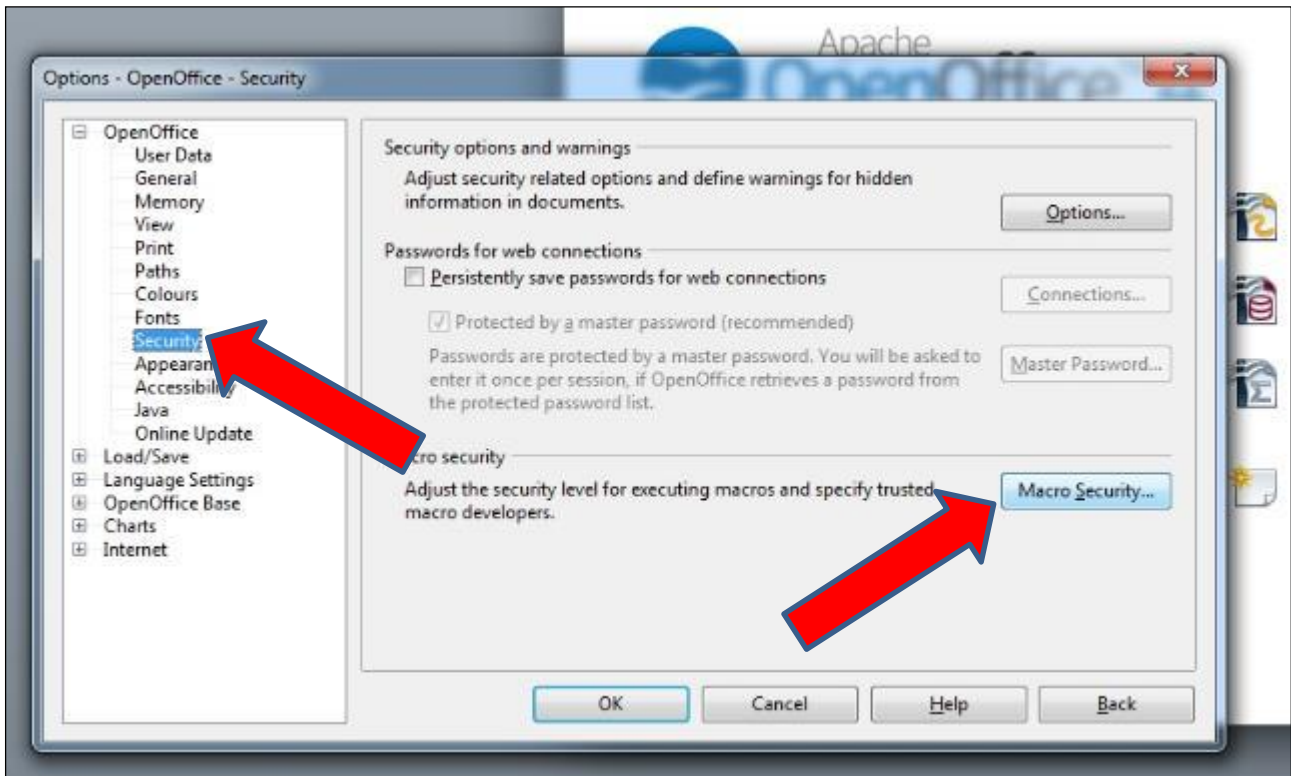
**NOTE: There are different free Office suites available, e.g. NeoOffice, LibreOffice, OpenOffice. Be sure to use the Apache OpenOffice.**

These are the steps for installing and setting up the OpenOffice suite to be used with MARIA.

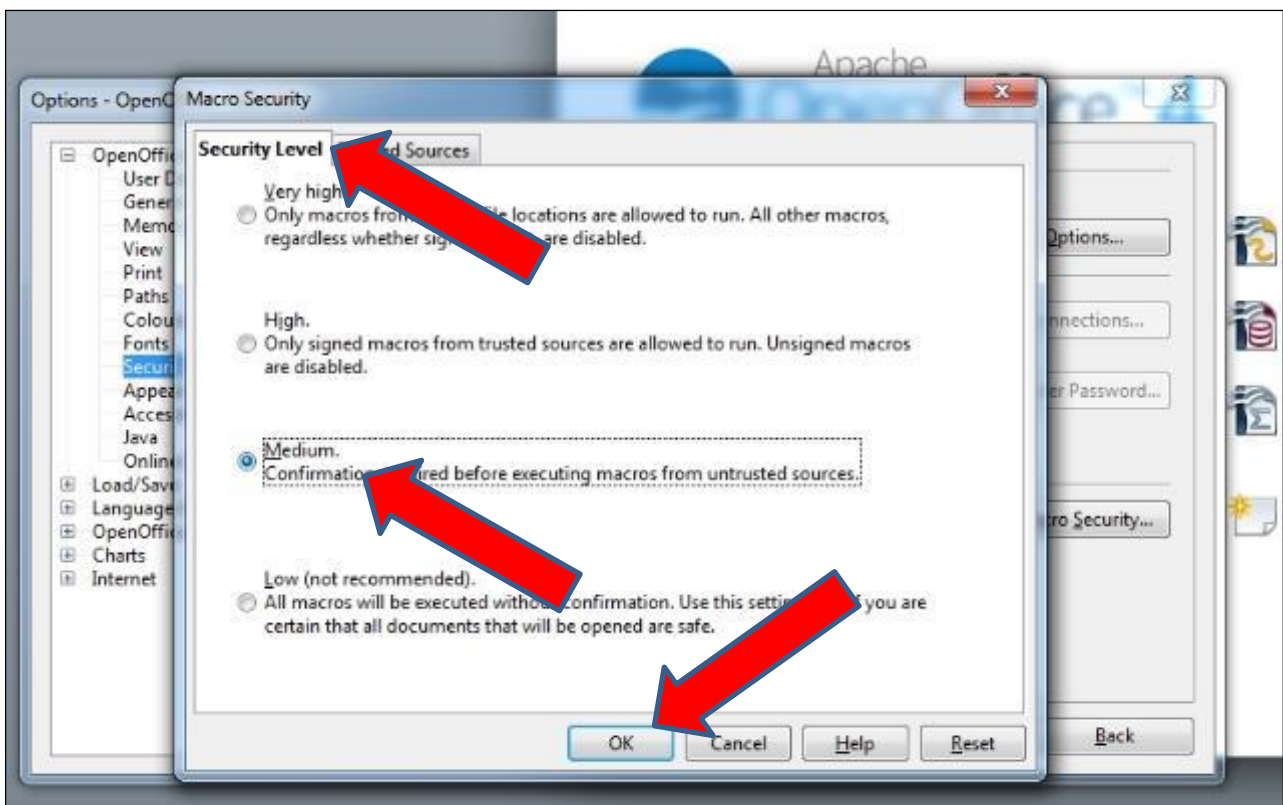
- 1) Download OpenOffice from <http://www.openoffice.org/download/index.html>
- 2) Install the OpenOffice suite
- 3) Enable macros:
  - Select **Tools, Options**



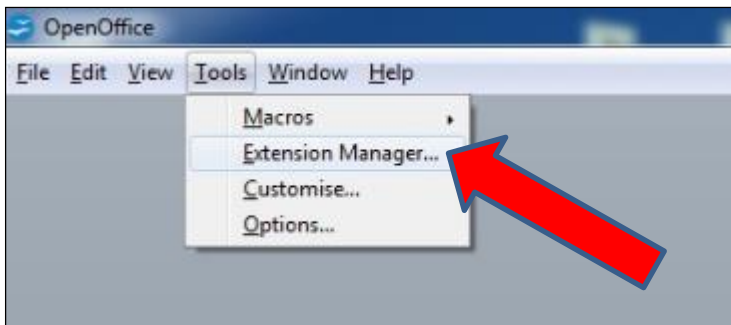
- Select **Security, Macro Security...**



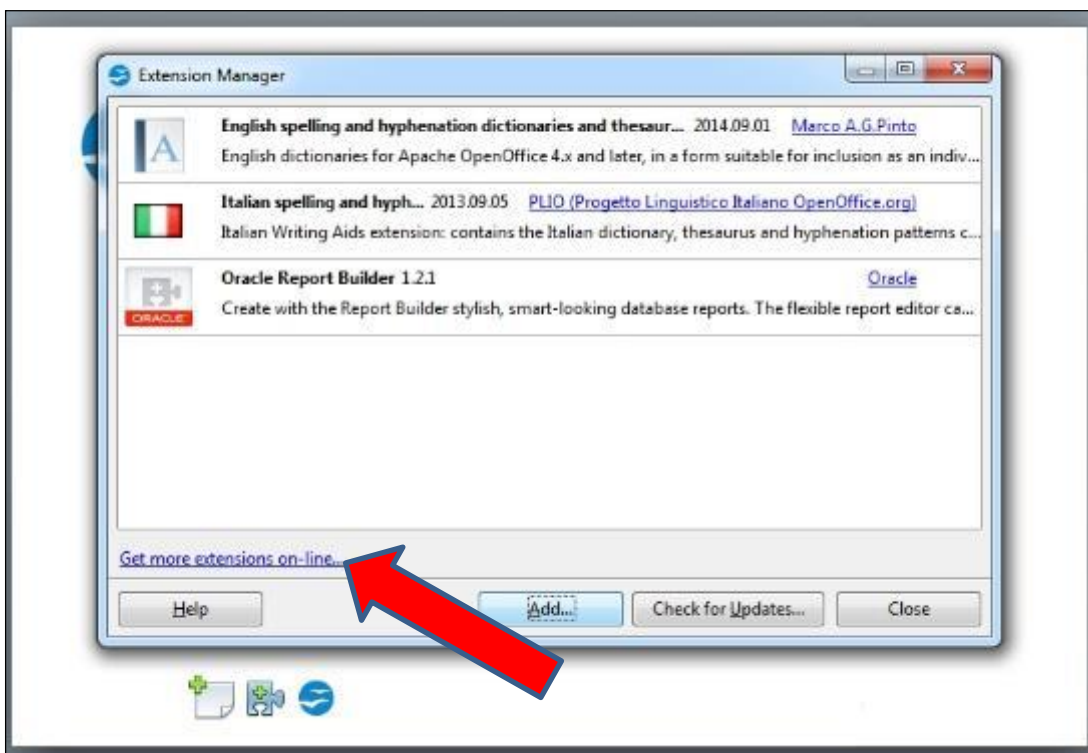
- Select **Security Level** tab, **Medium** (suggested), **OK**.



- 4) Install the Oracle Report Builder. This extension is used to produce the reports:
- Select **Tools, Extension Manager**



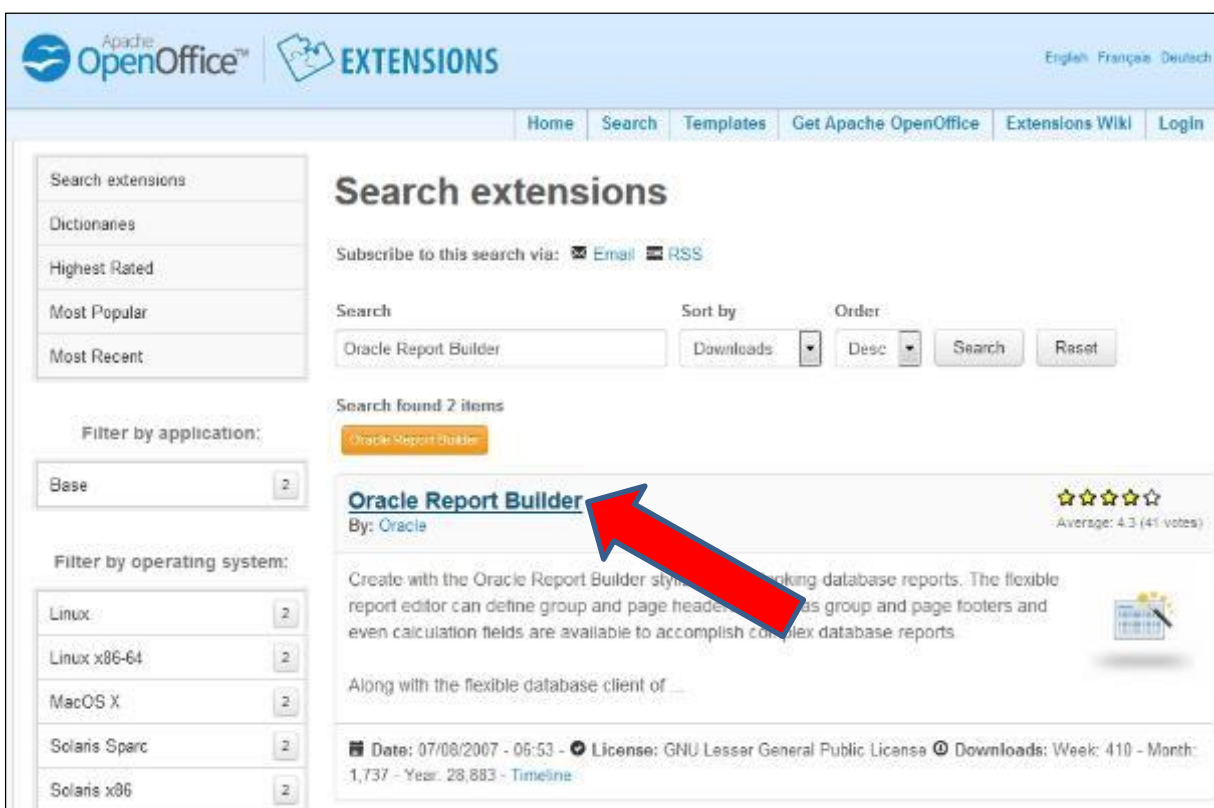
- Select **Get more extensions on-line** (you must have an internet connection)



- Write **"Oracle Report Builder"** in the search window and press **Search**



- Select the extension **Oracle Report Builder**






- Select **Download Extension**

## Oracle Report Builder

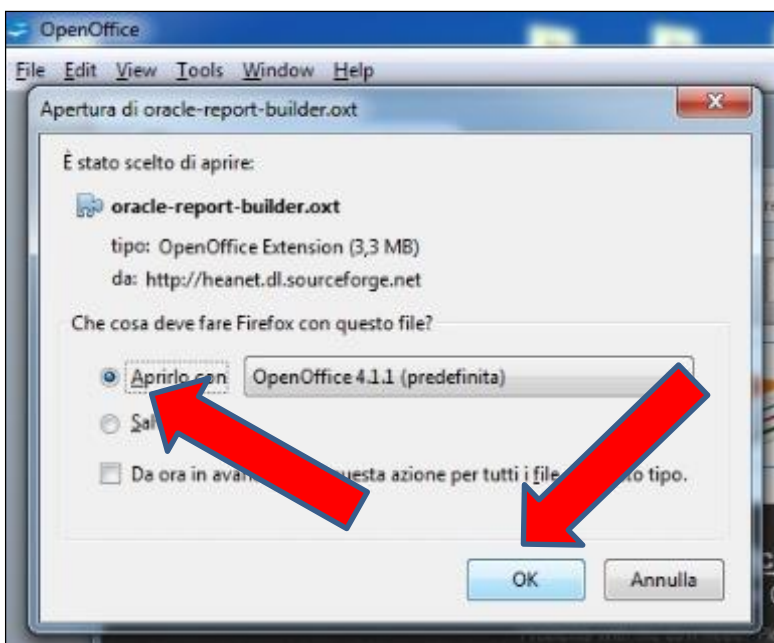
View Releases

Provider:	ORACLE Oracle
Maintainer:	mh
Rating:	★★★★☆ Average: 4.3 (41 votes)
Application:	Base
Tags:	Sun, , reports, , base, , oracle,
Source code:	<a href="http://hg.services.openoffice.org/DEV300/file/2ebd15d9e8a6/reportbuilder">http://hg.services.openoffice.org/DEV300/file/2ebd15d9e8a6/reportbuilder</a>
Post date:	Tuesday, 7 August, 2007 - 06:53
Statistics	Week: 410 - Month: 1,737 - Year: 26,883 - <a href="#">Timeline</a>



System Independent releases  
 Compatible with OpenOffice 3.0  
 User feedback:  
 Compatible with OpenOffice 4.x?  
 0%   100%

- Select the extension **Open with** and **OK**



## 2) ABOUT TERMINOLOGY

MARIA uses a variation of the Bowtie methodology to manage the risk analysis, but efforts have been made in order to maintain consistency with the European Regulation terminology and concepts. This means that some terms were adapted to best represent the concepts or to reduce confusion with other available methodologies.

MARIA is not a BowTie method, but it takes some of the BowTie concepts.

Please refer to the UK CAA website for an explanation of BowTie



(<http://www.caa.co.uk/default.aspx?catid=2786&pagetype=90>).

With reference to the BowTie diagram above, these are the main differences:

Hazard is perhaps the most used word in aeronautical safety, but several different concepts are used with this word:

**BOWTIE METHODOLOGY** – Hazard is a situation, operation, event that is part of the normal life, but that has the potential of harming the safety. For example, weather is something we are used to living with: clouds, wind, rain, temperature are normal elements we cope with every day. These are all HAZARDS, but they can be harmful in case of low clouds, strong or gusty winds, heavy rain or icing conditions. In the latter case the hazards became THREATS and could be contributing factors for an unwanted situation (top event)

**EUROPEAN REGULATION** – The Regulation does not make such differentiation, but consider the HAZARD as a general event or situation that already is outside normal situation or that is already a contributing factor to a possible incident or accident. Cf. "ORO.GEN.200 - Management system – (a) (3)":

the identification of aviation safety hazards entailed by the activities of the operator, their evaluation and the management of associated risks, including taking actions to mitigate the risk and verify their effectiveness;

In MARIA tool, both HAZARDS and THREATS (as for Bowtie meaning) are called CAUSES, and for simplicity they can be listed together.

The more general meaning of HAZARD used by the EU Regulation, in the Bowtie methodology is the central part of the graphic and is called TOP EVENT. As said before, these are situations or events that can be seen as an unwanted state, i.e. something happened that is already outside

the normal situation and, if not treated accordingly, can develop into an incident or accident. An example can be the inadvertent entry into IMC, altitude infringement or wrong radio frequency selection.

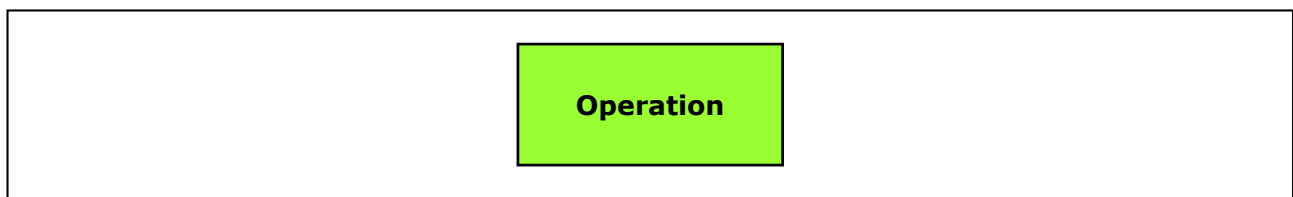
In MARIA tool, these are called HAZARDOUS EVENTS as they are close to the concept used by Bowtie methodology, but they can be easily understood as HAZARDS as for EU Regulation.

Consequences, Proactive and Recovery Barriers maintain the same meaning as for Bowtie terminology.

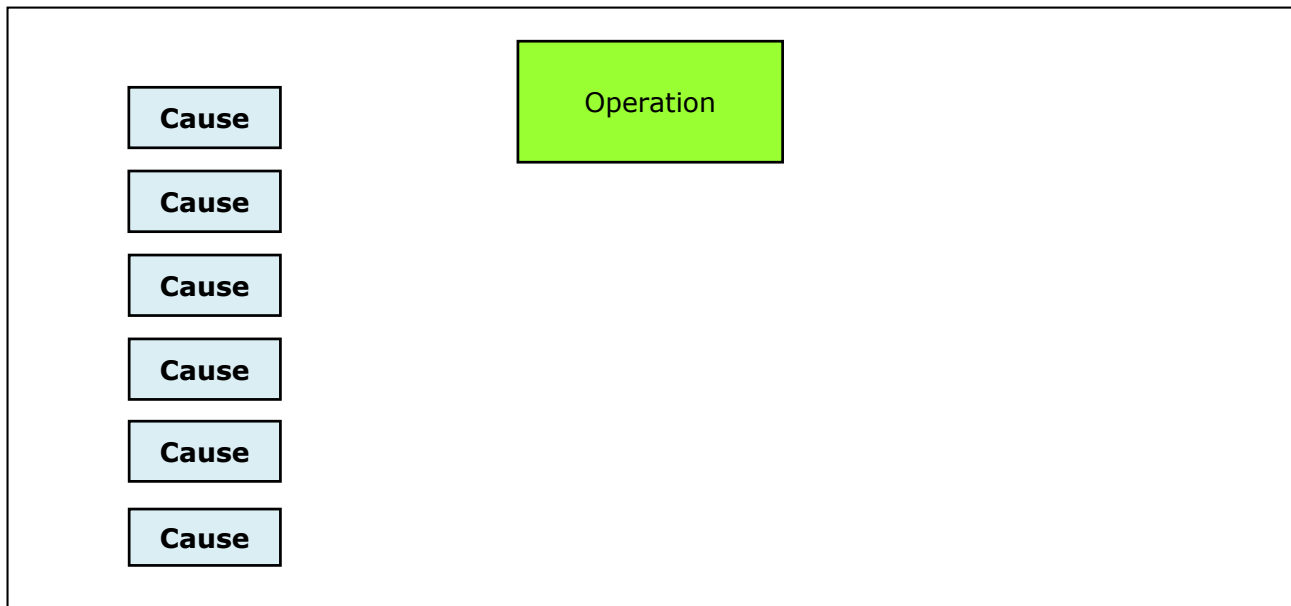
### **3) "MARIA" RISK ASSESSMENT METHODOLOGY**

Following is a description of the MARIA risk assessment methodology.

First an **Operation** is created. An Operation is the risk assessment, the safety occurrence, the management of change, and so on, that we want to analyse in order to split it in more simple/basic contributing factors/causes.



The situation, or operation, we are studying is "inserted" or it "lives" inside a specific environment made of "Causes" which can either be Hazards or Threats.



**Hazards** are not necessarily “bad things”: they are situations, environments, operations that we normally do or live with, but that can lead to an unwanted situation. As an example meteorological situations, or even a thunderstorm, is a Hazard: it exists and we live with it. It does not necessarily give any danger, yet... unless I fly under or within the thunderstorm, that is something I do not want to do (= Hazardous Event). If I end up under or within a thunderstorm, I can have damage to the aircraft, lightning strikes, even loss of control and crash on ground. These are all “Consequences” (see ahead) that are potentially catastrophic results from a non-regular situation (Hazardous Event).

**Threats** describe events that may cause an unsafe state if not managed with preventive controls. They are generally called “Contributing Factors”, and are not unwanted situations (Hazardous Events) yet, but they can turn (alone or in combination) into a Hazardous Event if a barrier will not stop the sequence of events.

Consider the Hazardous Event and ask the question ‘why’ or ‘how’ could this occur?

In the thunderstorm example we can have:

HAZARDS (they are all normal elements we work with):

- Thunderstorm
- Night operations
- Marginal VFR

THREATS (contributing factors)

- The pilot heads toward the thunderstorm
- The aircraft was released with the weather radar not operative and under MEL
- Thunderstorms were not forecast

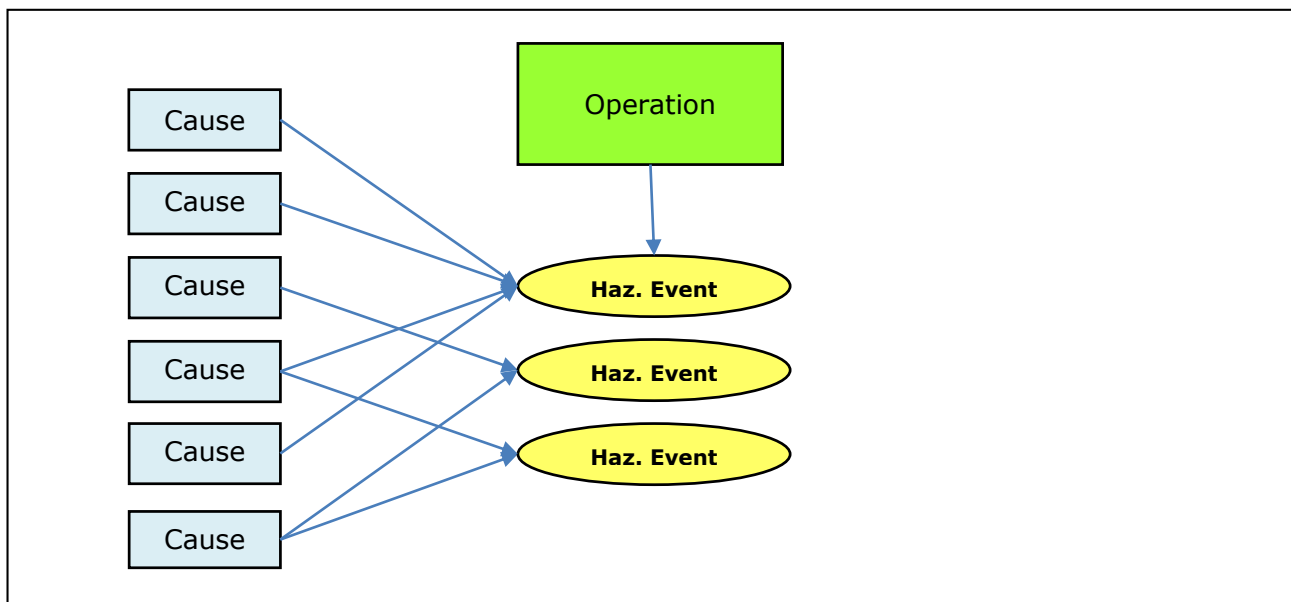
All the above are considered as “CAUSES”.

“Causes” could end up in some unwanted events called **Hazardous Events**. These are events/occurrences/situation that are outside the normal management of a flight or maintenance: something happened which is not wanted, it puts the personnel or the aircraft in an unwanted situation, and it can be a precursor to a much worse incident or accident.

A single Cause can end up in more than a Hazardous Event. For example, flying close to a CB I can possibly end up with:

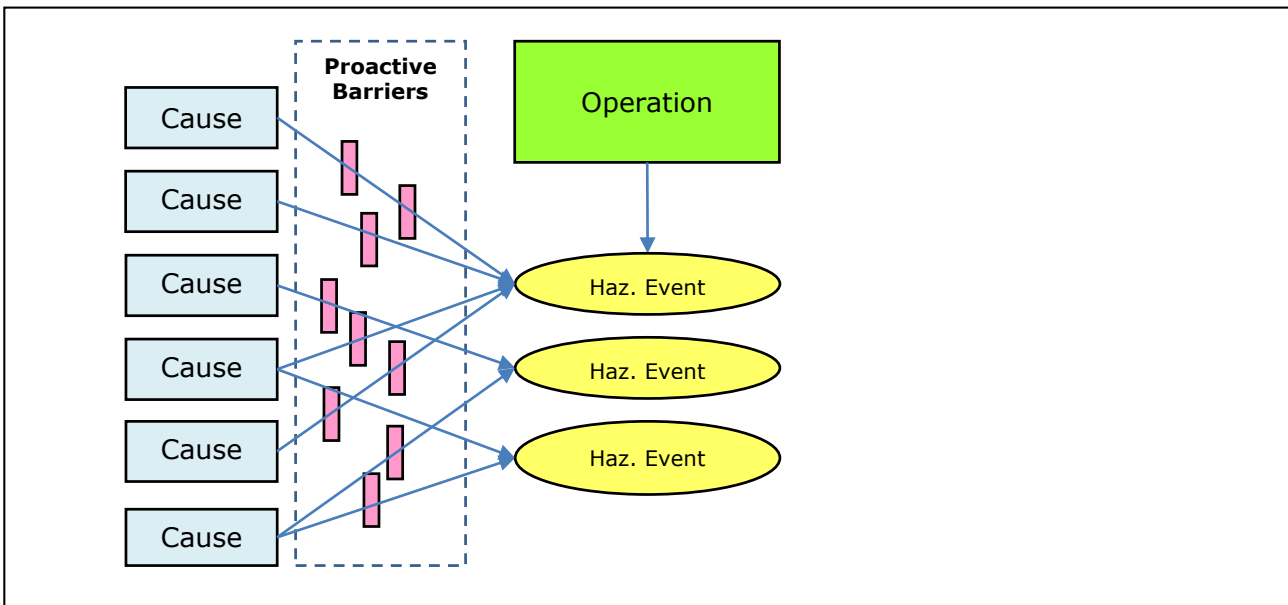
- flying in severe turbulence; or
- inadvertent IMC; or
- icing conditions; and so on.

These situations are outside the normal flight conditions I want to maintain, but they are not detrimental, yet. I am in an unwanted state or situation, but I can still recover from the situation provided I apply some recovery actions or “Barriers”.

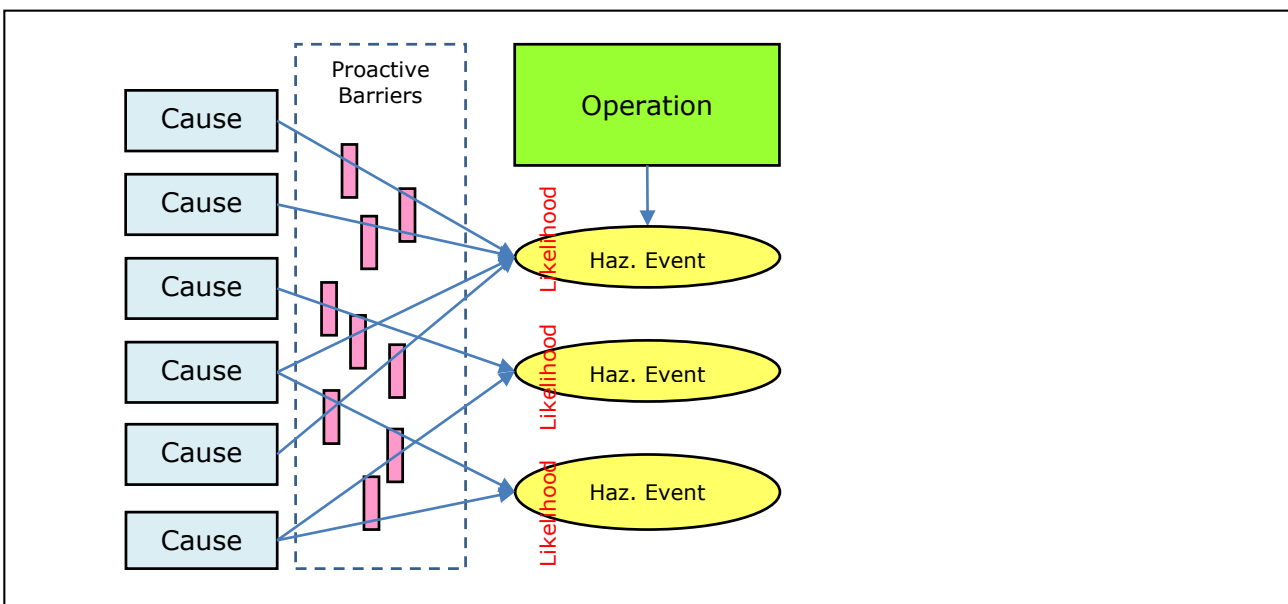


We generally have, or will strive to have, several methods for avoiding, intercepting, blocking events before they change from a normal and wanted situation to a dangerous, abnormal or unwanted situation (Hazardous Event). To do that, we use procedures, back-up systems, double controls, technology, and so on. All these are called **Proactive Barriers**.

Every Cause has its own list of related safety controls, called “Proactive Controls”, that are put there to try to avoid, or put a “barrier”, to a normal situation that can turn into an undesirable situation (Hazardous Event).



We can list all the things that will help us to maintain the control of the situation (Barriers). After that, we can evaluate the **Likelihood** (probability) that a particular Hazardous Event would happen and an unwanted state or situation would arise.



Together with the development and improvement of safety Barriers, the evaluation of the Likelihood of a Hazardous Event and the evaluation of the Risk level of a Consequence are the most important part of a safety analysis.

The Risk is assessed by the use of a **Risk Matrix**.

A Risk Matrix is an evaluation table, or graphic, where we choose in one side the possibility (Likelihood) that the “bad thing” (Hazardous Event or Consequence) would happen and in the other side the gravity (Severity) of the Consequences of the “bad thing” if it finally happens.

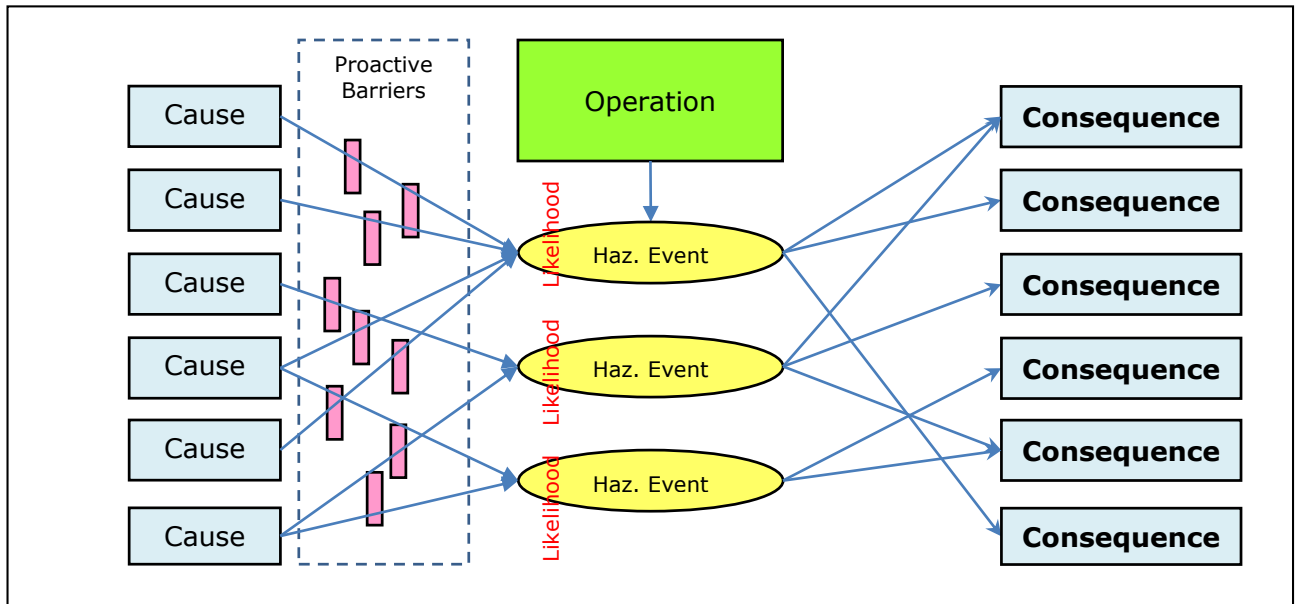
RISK MATRIX							
		Risk Likelihood	Risk Severity				
			Negligible (A)	Minor (B)	Major (C)	Hazardous (D)	Catastrophic (E)
Likely to occur many times. Has already occurred in the Company (> 3 times/year - indicative). Has occurred frequently in the history of the aviation industry.		Frequent (5)	5 A	5 B	5 C	5 D	5 E
Likely to occur sometimes. Has already occurred in the Company (< 3 times/year - indicative). Has occurred infrequently in the history of the aviation industry.		Occasional (4)	4 A	4 B	4 C	4 D	4 E
Unlikely to occur, but possible. Has already occurred in the Company at least once. Has seldom occurred in the history of the aviation industry.		Remote (3)	3 A	3 B	3 C	3 D	3 E
Very unlikely to occur. Not known to have occurred in the Company but already occurred at least once in the history of the aviation industry.		Improbable (2)	2 A	2 B	2 C	2 D	2 E
Almost inconceivable that the event will occur. It has never occurred in the history of the aviation industry.		Extremely Improbable (1)	1 A	1 B	1 C	1 D	1 E
		Personnel	Superficial or no injuries	Light injuries	Serious injuries	Fatality	Multiple fatalities
Unacceptable Risk Level	Unacceptable under the existing circumstances	Environment	Negligible or no effects	Little impact	Noteworthy local effects	Effects difficult to repair	Massive effects (pollution, destruction, etc.)
Tolerable Risk Level	Acceptable based on risk mitigation. It may require management decision	Material values & assets	Negligible impact	Financial loss with little impact. Damage < 50K€	Substantial financial loss. Damage < 250K€	Severe financial loss, long term eff. Damage < 1 M€	Catastrophic financial loss. Damage > 1 M€
Acceptable Risk Level	Acceptable	Reputation	Light or no impact	Limited impact	Considerable impact	National impact	International impact

Risk Matrix should be of “quantitative” type, that means a matrix where the likelihood is a real statistic of similar events happened per amount of time/flight hours/cycles. In real life, this is not realistic for small or even medium size operators who would never fly the minimum statistic basic flight hours (10.000 or even 100.000) during the whole Company lifetime.

For this reason, we work with “qualitative” reference when it comes to evaluate the likelihood part of the risk matrix. Just sit down and think if a similar event has ever happened in the Company, in similar Companies, or in the aeronautical world (as far as you know). In the worst situation (no information at all) just think how often could that event happen in your company and make an evaluation based on your judgment. This could not be a scientific approach, but it is surely better than having no likelihood ideas at all. After all: who better than you knows your job? You will probably make a good estimation of likelihood based on your knowledge and experience of similar situations.

Hazardous Events are assessed only for the Likelihood that this event could happen, while Consequences are assessed also by the possible severity of the consequences. This is because in the Hazardous Event nothing detrimental happened yet, but we only have an unwanted situation that we want to recover from.

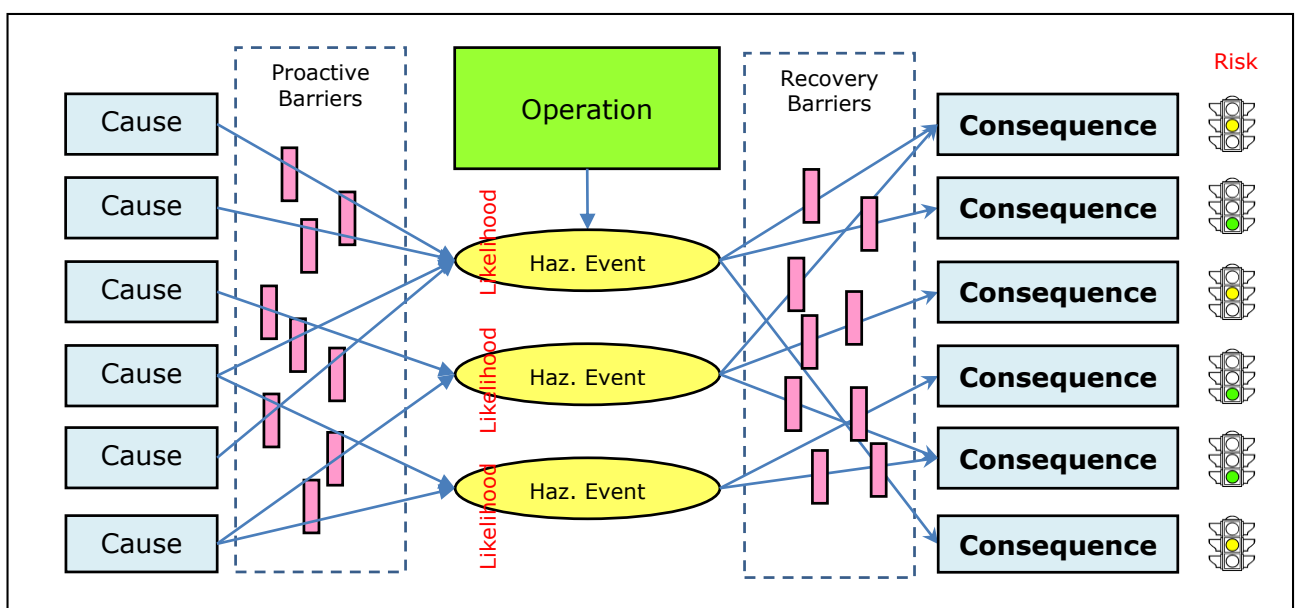
As said before, the Hazardous Event is only an occurrence or situation that could lead to an accident. Therefore, the next step is to identify and link all the **Consequences** that could be triggered by the Hazardous Events. This is the right side of the tool.



Consequences describe the possible incidents or accidents that may potentially result from the Hazardous Event if the event is not managed with recovery controls.

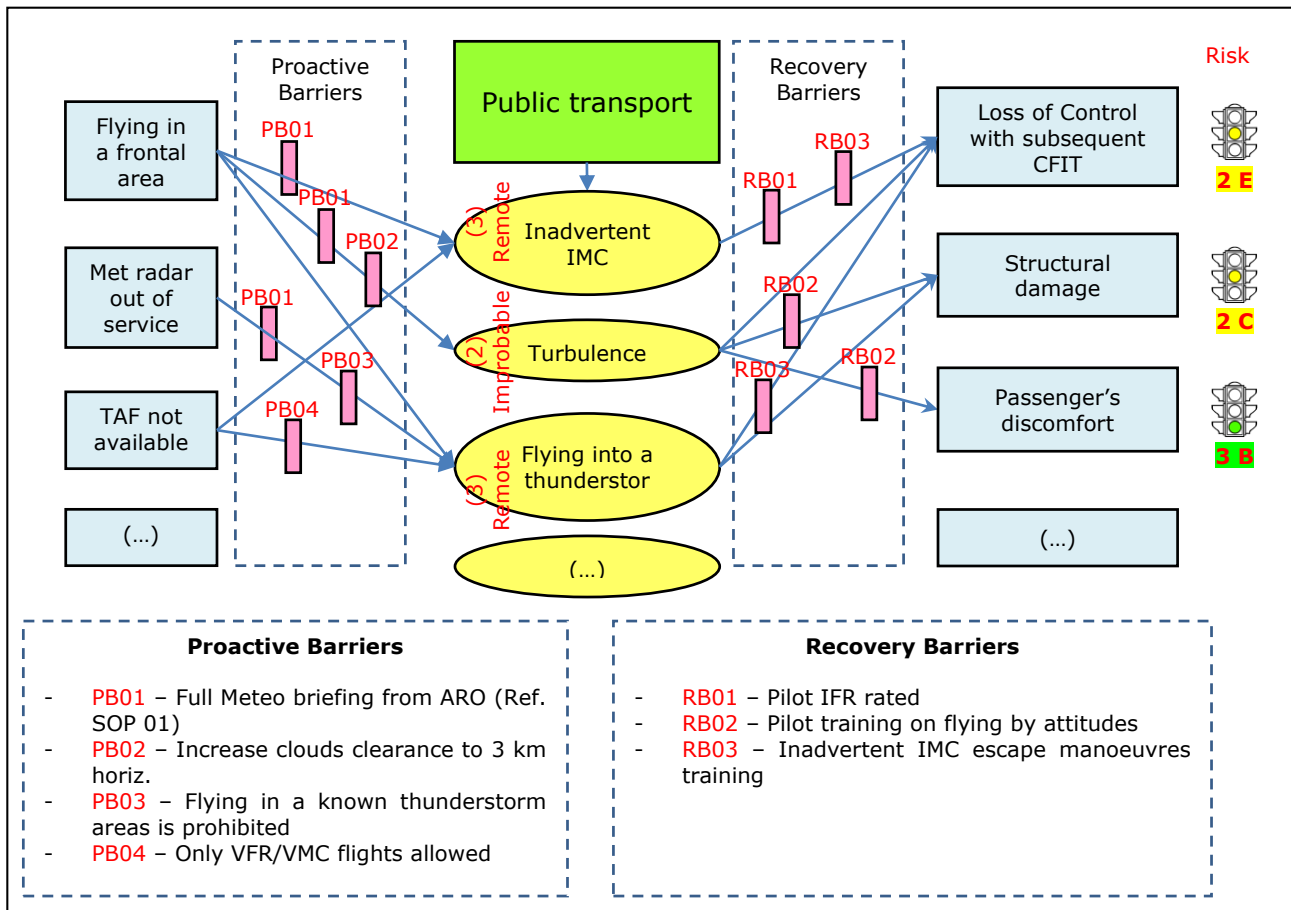
In our flying close to a CB example, the inadvertent IMC Hazardous Event could lead to a loss of control with possible CFIT if the pilot do not do something to recover from the inadvertent IMC (Recovery Barriers).

As well as the Proactive Barriers, we can have several measures in place to reduce the possibility that a Hazardous Event turns into a Consequence. These are called **Recovery Barriers**.



In the practical world, mitigations could be either the measures that block the chain of events from an abnormal situation (Hazardous Event) to the possible Consequence (reducing the Risk Likelihood), or the measures in place to reduce the deleterious outcome of an accident (reducing the Risk Severity).

The following example is how the thunderstorm could be analysed and rated.



#### 4) WHY AN EHEST RISK ASSESSMENT TOOL?

Handling a complete methodology to make an in depth risk assessment and analysis could become very complicated, because there are many connections between the elements (in a technical database terminology: several “many-to-many relations”) that makes the use of a classical “tabular list” very unhandy. Just to clarify:

- An operator will have several Operations (i.e. risk assessments on its operations, changes, occurrences, etc.).
- Each Operation has several Hazardous Events. Each Hazardous Event can be linked to more than one Operation. **(many-to-many relations)**
- Each Hazardous Event could be triggered by several Causes. Each Cause can be the starting point of several Hazardous Events. **(many-to-many relations)**

- Each Hazardous Event can be prevented by several Proactive Barriers. Those Barriers are used to limit the Likelihood that a Hazardous Events happens. **(many-to-many relations)**
- Hazardous Events can lead to some Consequences. More than one Consequence could be the result of several Hazardous Events. **(many-to-many relations)**
- I could stop the event chain from a Hazardous Event to Consequences or reduce the magnitude of the Consequence through the implementation of some Recovery Barriers. Those Recovery Barriers can be used to reduce the potential negative effects of many Hazardous Events. **(many-to-many relations)**

Now, try to keep in mind all these connections when developing your own 'Bowtie' on plain paper!... Impossible even for easy studies.

To help the safety analysts (e.g. Post Holders, Managers, Safety Managers) to take into consideration all the dangerous situations and the controlling elements related to their operations, EHEST developed the MARIA tool.

## **5) HOW TO USE THE EHEST "MARIA" TOOL**

### **NOTE:**

**The OpenOffice Base program, as many other programs, could crash erasing important data or a whole day's work.**

**I strongly suggest to periodically save your work, i.e. every ten minutes of work or after an important entry.**

**Moreover, because it happened that after a crash the file could not be opened anymore or behaved strangely, I strongly suggest to back up your working file periodically or after important entries.**

Open the database double-clicking on the MARIA file.

Wait until the main page opens. It could take a while (up to 1 minute).

**MARIA (My Assessment of Risks for Incidents and Accidents)**

**EHEST RISK ASSESSMENT TOOL**

A - SELECT THE CASE STUDY  
B - SELECT THE TOP EVENTS  
C - SELECT THE HAZARD OR THE CONSEQUENCE  
D - SELECT THE BARRIER  
E - SELECT THE TASK

Copyright & Country  
Captain  
Siddharth BURGARA  
ELLORHANA

Operation  
OP 01 Sling load operations

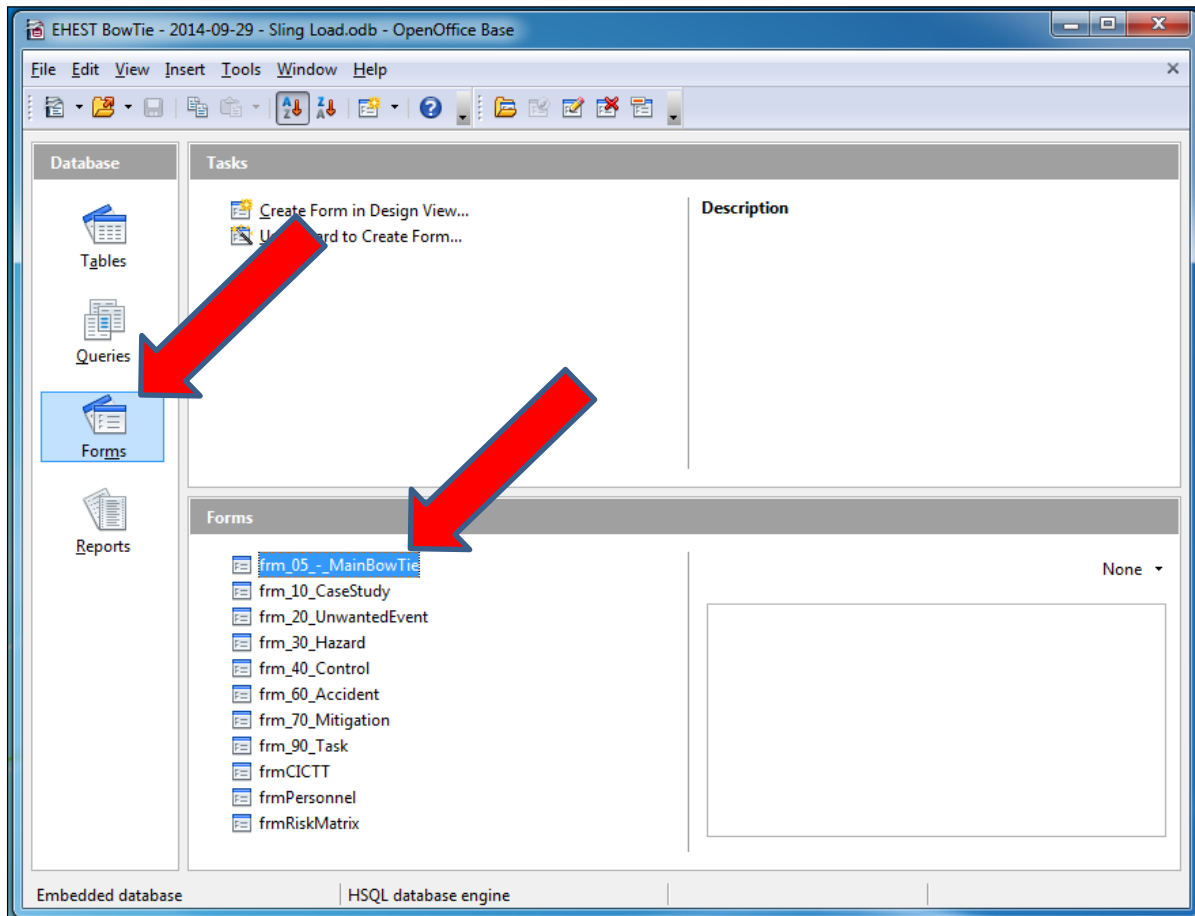
**REPORTS**  
Report  
Op. Proc. Bar.  
Report  
Op. Res. Bar.

**RADEC**  
Cause  
Proactive Barrier  
Hazardous Event  
Recovery Item  
Consequence

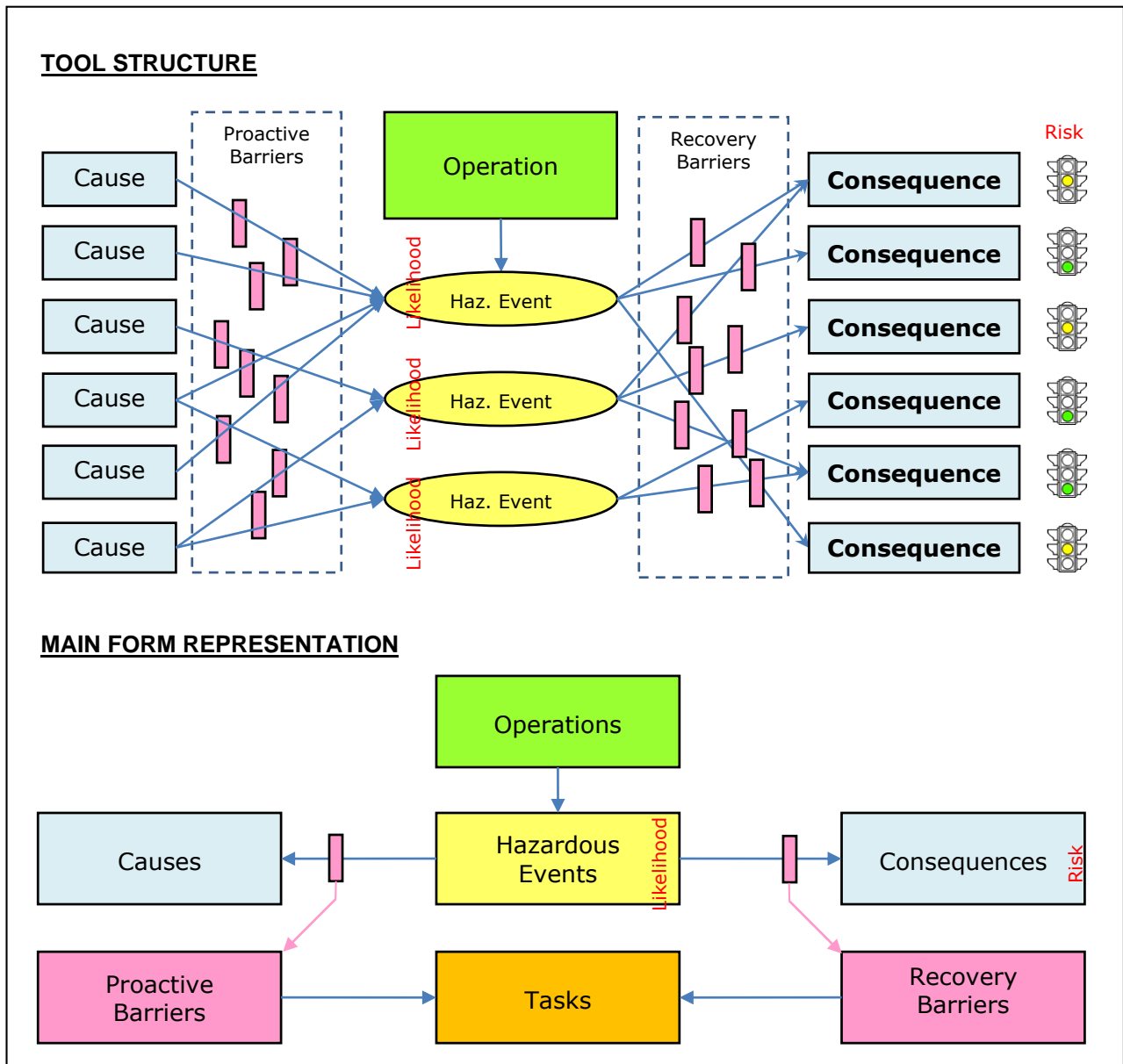
No.	Cause	No.	Hazardous Event	Like	No.	Consequence	Risk
HE 000	CA 000, Trees, bushes, vegetation	OP 01	HE 000 - Reduced separation with obstacle	2	HE 000	CO 001 - Aircraft crash	2 E
HE 001	CA 002, Wires, power lines	OP 01	HE 002 - Reduced separation of the load from	3	HE 001	CO 002 - Property damage on ground	3 C
HE 002	CA 003, Low Clouds	OP 01	HE 003 - Degraded aircraft performance	1	HE 002	CO 004 - Injury to flight crew or crew member	3 C
HE 003	CA 004, Low visibility, fog	OP 01	HE 004 - Degraded aircraft performance during	1	HE 003	CO 005 - Injury to passengers	2 C
HE 004	CA 005, Confined area operations, landings, take offs	OP 01	HE 005 - Aircraft unintentionally deviates from	2	HE 004	CO 006 - Aircraft not available	3 B
HE 005	CA 006, Use of sling load	OP 01	HE 006 - Safety measures not respected by per	1	HE 005	CO 007 - Pilot/personnel not available	1 B
HE 006	CA 007, Operation planning	OP 01	HE 007 - Load is not properly respected [sling]	1	HE 006	CO 008 - Rules infringement	4 B
HE 007	CA 008, Mountainous area	OP 01	HE 008 - Unexpected technical problem relate	3	HE 007	CO 011 - Main rotor blades strike a ground ob	3 C
		OP 01	HE 009 - Unexpected technical problem on air	3	HE 008	CO 012 - Tail rotor blades strike a ground ob	3 C
		OP 01	HE 010 - Loose objects moved by the rotor disc	3	HE 009	CO 013 - Impact with wires or cables	2 E
		OP 01	HE 011 - Not accurate or missing mission plan	2			

No.	Proactive Item	No.	Task	Task Name	Due D.	No.	Recovery Item
CA 001	PB 003, Pilot experience	PB 001	T 001	Develop SOP Sling Load Operation	31/03/25	CO 001	RB 001, Emergency Response Plan (ERP)
CA 002	PB 004, Pilot recovery	PB 002	T 002	Develop SOP Sling Load Operation	31/03/25	CO 002	RB 002, Pilot and personnel data
CA 003	PB 005, Radio contact with personnel on ground					CO 003	RB 003, Spare helicopter availability
CA 004	PB 006, Initial Recce of the operating area					CO 004	RB 004, Personnel proper clothing
CA 005	PB 007, Previous ground reconnaissance					CO 005	RB 005, Survival kit
CA 006	PB 008, Pilot minimum mountain experience					CO 006	RB 006, Portable aeronautical radio on board
CA 007	PB 009, Personnel on ground experience					CO 007	RB 007, Emergency Locator Beacon (ELB)
CA 008	PB 010, Personnel on ground recovery					CO 008	RB 008, Insurance
CA 009	PB 011, Mission planning					CO 009	RB 009, First Aid Kit
CA 010	PB 012, Pre-flight Risk Assessment					CO 010	RB 010, Winch strike protection system
CA 011	PB 013, In-flight decision making training						

If the main page does not open automatically, select "Forms" from the left-side column and then double-click on "frm\_05 - \_MainBowTie" on the bottom right window.

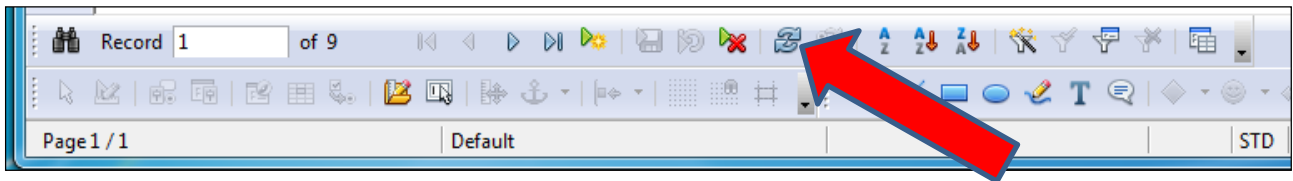


Here you can find the tool structure, as explained before, and how it is showed on the main form:



You can enter information (Operation, Hazardous Event, Cause, Proactive Barrier, Consequence, Recovery Barrier, Task) in the order you want. The important thing is then to link every piece of information together.

**NOTE:** in order to be able to see the variations to the database after an entry, use the "Refresh" button on the lower part of the database window, or close and re-open the form.



## OPERATION

You start a safety study, or Operation (risk assessment, management of change, occurrence analysis, etc.), by defining the Operation number and its definition.

Press "New/Edit" to enter the Operation window.

No.	Operation
OP 01	Sling load operations
New/Edit	
List	

## OPERATION

No.	Operation
OP 01	Sling load operations

↑↓

No.	Operation	Note	Initial Date	Revision Date
OP 01	Sling load operations			

**INSERT, DELETE OR UPDATE  
OPERATIONS**

The table at the top briefly lists all the Operations already inserted. You can enter or edit the Operations in the table below.

To close the window just click on the "X" on the upper-right of the window.

## HAZARDOUS EVENT

In this window you find all the Hazardous Events linked to the selected Operation. If you select a different Operation you will see its related Hazardous Event list.

To write a new Hazardous Event or to edit the existing ones, press "New/Edit" button and the following window will show up

No.	Hazardous Event	Likel.
OP 01	HE 001 - Reduced separation with obstacles	2
OP 01	HE 002 - Reduced separation of the load from	3
OP 01	HE 003 - Degraded aircraft performance	1
OP 01	HE 004 - Degraded aircraft performance during	1
OP 01	HE 005 - Aircraft unintentionally deviates from	2
OP 01	HE 006 - Safety measures not respected by per	3
OP 01	HE 007 - Load is not properly prepared (sling l	3
OP 01	HE 008 - Unexpected technical problem relate	3
OP 01	HE 009 - Unexpected technical problem on air	3
OP 01	HE 010 - Loose objects moved by the rotor dow	3
OP 01	HE 011 - Not accurate or missing mission plan	2

New/Edit HE - CAs HE - COs List

### HAZARDOUS EVENT

Has. Event n.: HE 001

Description: Reduced separation with obstacles

Note: The aircraft does not maintain the required safety separation from ground obstacles

Date Inserted: 13/03/15 Revision:

Likelihood: 2 - Improbable - Very unlikely to occur

Risk Matrix:

References:

#### Operation

No.	Operation
OP 01	Sling load operations

#### Hazardous Events related to the Operation

Operation	Related Hazardous Events
OP 01	HE 001, Reduced separation with obstacles
OP 01	HE 002, Reduced separation of the load from obstacles (sling load)
OP 01	HE 003, Degraded aircraft performance
OP 01	HE 004, Degraded aircraft performance during sling load operations
OP 01	HE 005, Aircraft unintentionally deviates from normal in-flight parameters
OP 01	HE 006, Safety measures not respected by personnel on ground during sling load operations
OP 01	HE 007, Load is not properly prepared (sling load operations)
OP 01	HE 008, Unexpected technical problem related to sling load operations
OP 01	HE 009, Unexpected technical problem on aircraft

Record 1 of 15

#### Hazardous Event List

ID Haz. Event	Description	Likelihood
HE 001	Reduced separation with obstacles	2
HE 002	Reduced separation of the load from obstacles (sling load)	3
HE 003	Degraded aircraft performance	1
HE 004	Degraded aircraft performance during sling load operations	1
HE 005	Aircraft unintentionally deviates from normal in-flight parameters	2
HE 006	Safety measures not respected by personnel on ground during sling load operations	3
HE 007	Load is not properly prepared (sling load operations)	3
HE 008	Unexpected technical problem related to sling load operations	3
HE 009	Unexpected technical problem on aircraft	3
HE 010	Loose objects moved by the rotor downwash	3

Record 1 of 15

**B - LINK EACH OPERATION WITH RELATED HAZ. EVENTS**

1 - Select the Operation element

2 - Add, delete or edit related Hazardous Events

**A - ADD, DELETE OR EDIT HAZARDOUS EVENT LIST**

This window is split in two sections:

a complete list of all the inserted Hazardous Events...

... and a place where to link the Operation with the related Hazardous Events.



**HAZARDOUS EVENT**

Haz. Event n.: HE 001

Description: Reduced separation with obstacles

Note: The aircraft does not maintain the required safety separation from ground obstacles.

Date Inserted: 13/03/15 Revision:

Likelihood: 2 - Improbable - Very unlikely to occur

Risk Matrix:

References:

**Operation**

No.	Operation
OP 01	Sling load operations

**B - LINK EACH OPERATION WITH RELATED HAZ. EVENTS**

1 - Select the Operation element  
2 - Add, delete or edit related Hazardous Events

**Hazardous Events related to the Operation**

Operation	Related Hazardous Events
OP 01	HE 001, Reduced separation with obstacles
OP 01	HE 002, Reduced separation of the load from obstacles (sling load)
OP 01	HE 003, Degraded aircraft performance
OP 01	HE 004, Degraded aircraft performance during sling load operations
OP 01	HE 005, Aircraft unintentionally deviates from normal in-flight parameters
OP 01	HE 006, Safety measures not respected by personnel on ground during sling load operations
OP 01	HE 007, Load is not properly prepared (sling load operations)
OP 01	HE 008, Unexpected technical problem related to sling load operations
OP 01	HE 009, Unexpected technical problem on aircraft

Record 1 of 15

**A - ADD, DELETE OR EDIT HAZARDOUS EVENT LIST**

**Hazardous Event List**

ID Haz. Event	Description	Likelihood
HE 001	Reduced separation with obstacles	2
HE 002	Reduced separation of the load from obstacles (sling load)	3
HE 003	Degraded aircraft performance	1
HE 004	Degraded aircraft performance during sling load operations	1
HE 005	Aircraft unintentionally deviates from normal in-flight parameters	2
HE 006	Safety measures not respected by personnel on ground during sling load operations	3
HE 007	Load is not properly prepared (sling load operations)	3
HE 008	Unexpected technical problem related to sling load operations	3
HE 009	Unexpected technical problem on aircraft	3
HE 010	Lose objects moved by the rotor downwash	3

Record 1 of 15

You can insert a new Hazardous Event clicking on the "new record" symbol just under the Hazardous Event list.

**A - ADD, DELETE OR EDIT HAZARDOUS EVENT LIST**

**Hazardous Event List**

ID Haz. Event	Description	Likelihood
HE 001	Reduced separation with obstacles	2
HE 002	Reduced separation of the load from obstacles (sling load)	3
HE 003	Degraded aircraft performance	1
HE 004	Degraded aircraft performance during sling load operations	1
HE 005	Aircraft unintentionally deviates from normal in-flight parameters	2
HE 006	Safety measures not respected by personnel on ground during sling load operations	3
HE 007	Load is not properly prepared (sling load operations)	3
HE 008	Unexpected technical problem related to sling load operations	3
HE 009	Unexpected technical problem on aircraft	3
HE 010	Lose objects moved by the rotor downwash	3

Record 1 of 15

Then just fill up the left-hand, yellow-coloured section.

HAZARDOUS EVENT	
Haz. Event n.	HE 001
Description	Reduced separation with obstacles
Note	The aircraft does not maintain the required safety separation from ground obstacles
Date Inserted	13/03/15
Revision	
Likelihood	2 - Improbable - Very unlikely to occur
Risk Matrix	
References	

Hazardous Event reference Number (must be unique)

Give a name to the Hazardous Event

Explain the Hazardous Event.

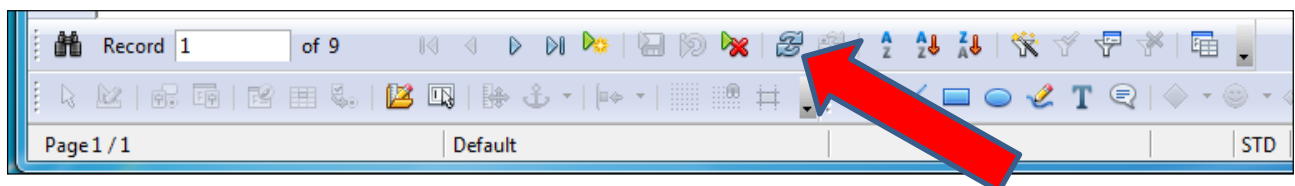
Insertion and revision dates

Rate the Likelihood

Show up the Risk Matrix for reference

List the references

**NOTE:** in order to be able to see the variations to the database use the “Refresh” button on the lower part of the database window, or close and re-open the form.



To link the Hazardous Events to the related Operation:

**Operation**

No.	Operation
OP 01	

**B - LINK EACH OPERATION WITH RELATED HAZ. EVENTS**

1 - Select the Operation element  
2 - Add, delete or edit related Hazardous Events

**Hazardous Events related to the Operation**

Operation	Related Hazardous Events
OP 01	HE 001, Reduced separation with obstacles
OP 01	HE 002, Reduced separation of the load from obstacles (sling load)
OP 01	HE 003, Degraded aircraft performance
OP 01	HE 004, Degraded aircraft performance during sling load operations
OP 01	HE 005, Aircraft unintentionally deviates from normal in-flight parameters
OP 01	HE 006, Safety measures not respected by personnel on ground during sling load operations
OP 01	HE 007, Load is not properly prepared (sling load operations)
OP 01	HE 008, Unexpected technical problem related to sling load operations
OP 01	HE 009, Unexpected technical problem on aircraft

Record 9 of 15

**A - ADD**

**Hazardous**

ID Haz. Event	Description	Count
HE 001	HE 001, Reduced separation with obstacles	3
HE 002	HE 002, Reduced separation of the load from obstacles (sling load)	3
HE 003	HE 003, Degraded aircraft performance	3
HE 004	HE 004, Degraded aircraft performance during sling load operations	3
HE 005	HE 005, Aircraft unintentionally deviates from normal in-flight parameters	3
HE 006	HE 006, Safety measures not respected by personnel on ground during sling load operations	3
HE 007	HE 007, Load is not properly prepared (sling load operations)	3
HE 008	HE 008, Unexpected technical problem related to sling load operations	3
HE 009	HE 009, Unexpected technical problem on aircraft	3
HE 010	HE 010, Lose objects moved by the rotor downwash	3

Record 1 of 15

Select the Operation you are working on

Scroll to the end of the available Hazardous Event list and select the empty record

Click on the drop down menu

Select the new Hazardous Event to link it to the active Operation.

**NOTE: you cannot choose the same Hazardous Event twice**

**NOTE: Each Hazardous Event must have at least one linked Cause and one linked Consequence entry in order to have a correct list output. Likewise, each Cause and each Consequence entry must have at least one linked barrier.**

**It is suggested to create a Cause, Consequence and Barriers entry, like "00 – No Entry" to be used in case of no operative entry.**

## CAUSE

In this window you find all the Causes linked to the selected Hazardous Event. If you select a different Hazardous Event you will see its related Cause list.

To write a new Cause or to edit the existing ones, press "New/Edit" button and it will show the following window.

No.	Cause
HE 001	CA 001, Trees, bushes, vegetation
HE 001	CA 002, Wires, power lines
HE 001	CA 003, Low Clouds
HE 001	CA 004, Low visibility, fog
HE 001	CA 009, Confined area operations, landings, take offs
HE 001	CA 010, Use of sling load
HE 001	CA 017, Operation planning
HE 001	CA 019, Mountainous area

New/Edit CA - PBs CA - HEs List

**CAUSE**

**B - LINK EACH HAZ. EVENT WITH RELATED CAUSES**  
1 - Select the Haz. Event element  
2 - Add, delete or edit related Cause

**Causes related to Hazardous Event**

Haz. Event	Related Causes
HE 001	CA 001, Trees, bushes, vegetation
HE 001	CA 002, Wires, power lines
HE 001	CA 003, Low Clouds
HE 001	CA 004, Low visibility, fog
HE 001	CA 009, Confined area operations, landings, take offs
HE 001	CA 010, Use of sling load
HE 001	CA 017, Operation planning
HE 001	CA 019, Mountainous area

Record 1 of 8

**Hazardous Event**

HE ID	Hazardous Event
HE 001	Reduced separation with obstacles
HE 002	Reduced separation of the load from obstacles
HE 003	Degraded aircraft performance
HE 004	Degraded aircraft performance during sling load
HE 005	Aircraft unintentionally deviates from normal flight
HE 006	Safety measures not respected by personnel on ground
HE 007	Load is not properly prepared (sling load operation)
HE 008	Unexpected technical problem related to sling load
HE 009	Unexpected technical problem on aircraft
HE 010	Loss objects moved by the rotor downwash
HE 011	Not accurate or missing mission planning and
HE 012	Flight close to, or into, adverse meteorological
HE 013	Unwanted movement of cargo in flight (sling load)
HE 014	Repetitive flight pattern/manoeuvres

Record 1 of 14

**Cause n.** CA 001

**Cause Name** Trees, bushes, vegetation

**Description** Trees, bushes and vegetation could be dangerous while operating the helicopter near the ground

**Date Inserted** 18/03/15 **Revision** 1

**References**

**Cause List**

Cause	Cause Name
CA 001	Trees, bushes, vegetation
CA 002	Wires, power lines
CA 003	Low Clouds
CA 004	Low visibility, fog
CA 005	Vertical development clouds
CA 006	Wind
CA 007	Personnel on ground
CA 008	Properties on ground
CA 009	Confined area operations, landings, take offs
CA 010	Use of sling load
CA 011	Loss objects on the ground
CA 012	Sand, dust, light soil
CA 013	External load size and weight

Record 1 of 20

**A - ADD, DELETE OR EDIT CAUSE LIST**

Once again, this window is split into two sections: the list of Causes linked to the selected Hazardous Event, and the list of all the inserted Causes. In this section you can edit the Causes or create new one.

**CAUSE**

**B - LINK EACH HAZ. EVENT WITH RELATED CAUSES**  
1 - Select the Haz. Event element  
2 - Add, delete or edit related Cause

**Causes related to Hazardous Event**

Haz. Event	Related Causes
HE 001	CA 001, Trees, bushes, vegetation
HE 002	CA 002, Wind, power lines
HE 003	CA 003, Low Clouds
HE 004	CA 004, Low visibility, fog
HE 005	CA 005, Confined area operations, landings, take offs
HE 006	CA 006, Use of sling load
HE 007	CA 007, Operation planning
HE 008	CA 008, Miscommunication

Record 1 of 8

**Hazardous Event**

HE ID	Hazardous Event
HE 001	Reduced separation with obstacles
HE 002	Reduced separation of the load from obstacles
HE 003	Impaired aircraft performance
HE 004	Impaired aircraft performance during landing
HE 005	Aircraft unintentionally deviates from normal
HE 006	Safety measures not respected by personnel on
HE 007	Load is not properly prepared (sling, load secure)
HE 008	Unexpected technical problem related to sling
HE 009	Unexpected technical problem related to aircraft
HE 010	Load objects moved by the rotor downwash
HE 011	Not accurate or missing mission planning and
HE 012	Flight close to, or into, adverse meteorological
HE 013	Unwanted movement of cargo in flight during
HE 014	Repetitive flight pattern/misuse

### Linked Causes to Hazardous Events

### List of Causes

**Cause List**

Cause ID: CA 001  
Cause Name: Trees, bushes, vegetation  
Description: Trees, bushes and vegetation could be dangerous while operating the helicopter near the ground.  
Date inserted: 28/03/23  
Revision: 1

Cause	Cause Name
CA 001	Trees, bushes, vegetation
CA 002	Wind, power lines
CA 003	Low Clouds
CA 004	Low visibility, fog
CA 005	Confined area operations
CA 006	Wind
CA 007	Personnel on ground
CA 008	Procedures on ground
CA 009	Confined area operations, landings, take offs
CA 010	Use of sling load
CA 011	Load objects on the ground
CA 012	Load, sling, higher soil
CA 013	Unwanted movement of cargo

Record 1 of 25

**A - ADD, DELETE OR EDIT CAUSE LIST**

The procedure is similar to that explained in the HAZARDOUS EVENT paragraph just above.

## CONSEQUENCES – PROACTIVE/RECOVERY BARRIER – TASK

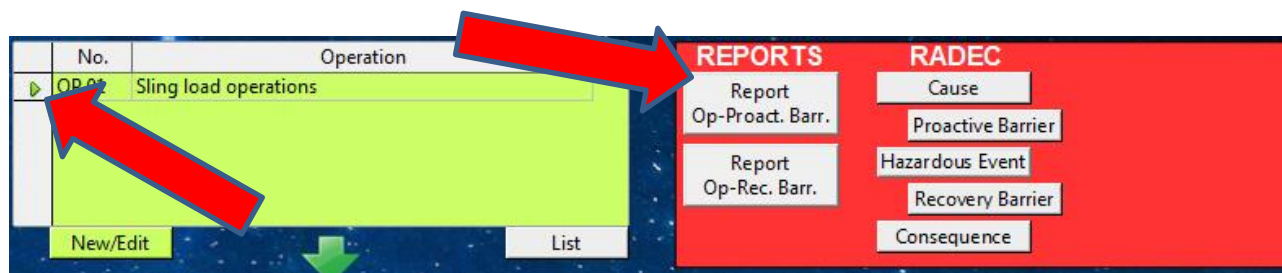
The other parts of the tool work in a similar way to the Hazardous Event and Cause sections explained before.

Tasks are not automatically linked to the Proactive or Recovery Barriers, but you must manually insert the reference number in the Task. Ref. cell.

Nr.	Task Name	Task Ref.	Description
T 001	Develop SOP Sling Load	PB 001	
T 002	Develop EGPWS	PB 025	

## REPORTS

You can create general reports based on the selected Operation. The reports will give you all the Hazardous Events, and the linked Causes, Proactive Barriers, Consequences and Recovery Barriers in a tabular form.



Just click the related button to open a new spreadsheet window with all the elements in a cascade.

**"Report CS-Proact. Barr."** button creates a list of all related elements of the selected Operation:

Operation  
     Hazardous Event  
         Cause  
             Proactive Barrier

**"Report CS-Rec. Barr."** button creates a list of all related elements of the selected Operation:

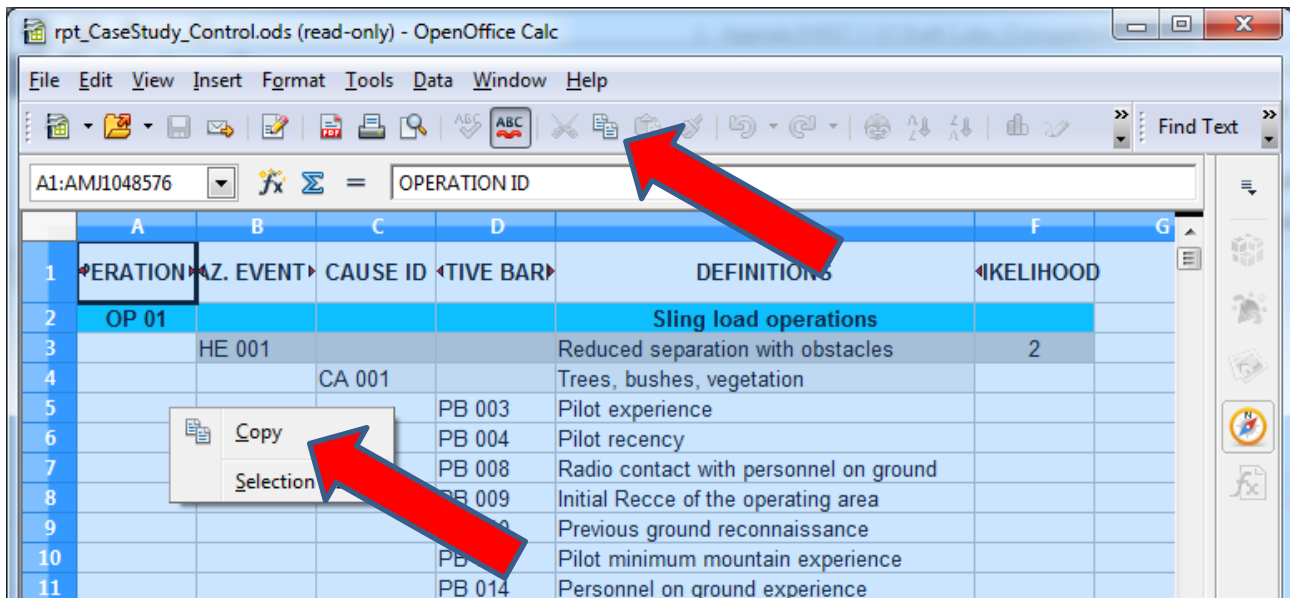
Operation  
     Hazardous Event  
         Consequence  
             Recovery Barrier

The left spreadsheet, 'rpt\_CaseStudy\_Mitigation.ods', displays a table with columns: OPERATION ID, EVENT, SEQUENCE, and VERY BAR. It lists various risk events (OP 01, HE 001) and their associated mitigation measures (RH 001-010, RD 001-010, RB 001-010).

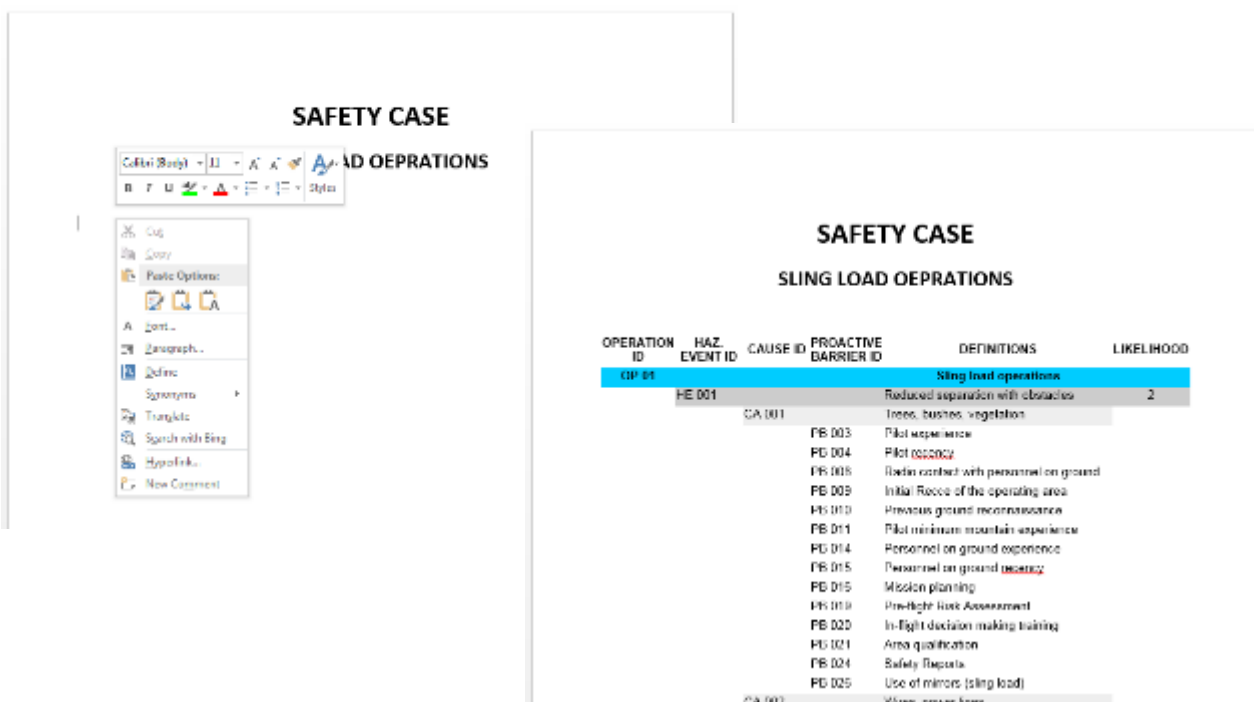
The right spreadsheet, 'rpt\_CaseStudy\_Controls.ods', displays a table with columns: OPERATION ID, EVENT, CAUSE ID, DEFINITIONS, and LIKELIHOOD. It lists the same events and their associated control measures (CA 001, CA 002, CA 003) and their definitions (PB 001-020).

**NOTE: Due to the various “many-to-many” links inside the database, the reports could take quite a long time to show up (1 minute or even more).**

The lists are an OpenOffice spreadsheet document that can be copied-pasted to any OpenOffice document or other commercial word processors and spreadsheets (e.g. Microsoft Word or Excel). Select all the required cells and then select “Copy” (icon, or right click on the selection, or Ctrl-C key combination).

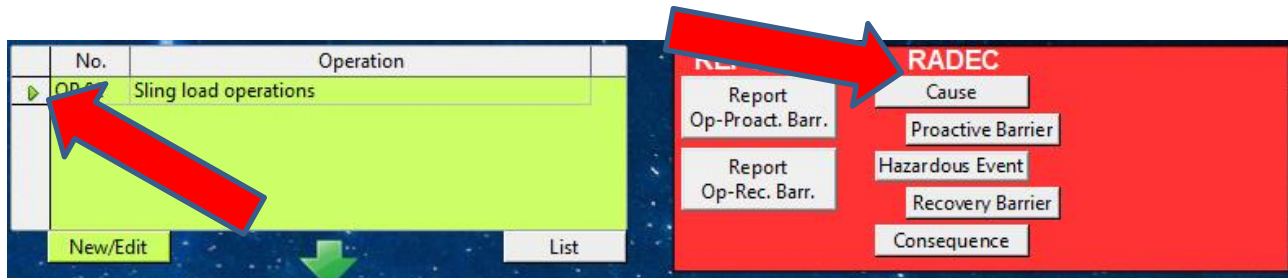


Open your new word processor or spreadsheet document, point the position you want to insert the table and select "Paste" (icon, or right click on the selection, or Ctrl-V key combination).



## EHEST RADEC FORM

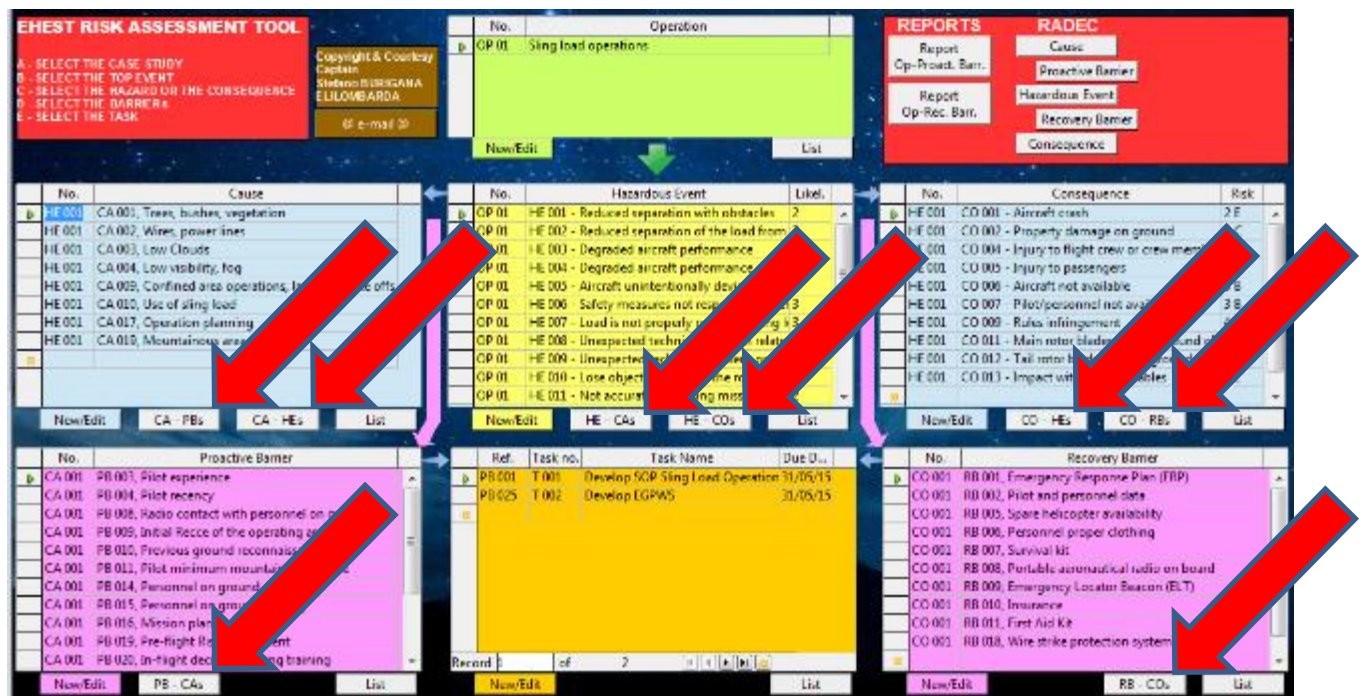
It is possible to select all the elements related to the selected Operation by clicking on the RADEC buttons.



These buttons provide a list of the Cause, Hazardous Events, Proactive Barriers, Consequences and Recovery Barriers you can use on your own documents or in the EHEST RADEC form (ref. EHEST SMS Manual non-complex operators). Just select the items and copy-paste on your documents.

## SPECIFIC REPORTS

There are several reports available related to specific relations between the risk assessment elements.



- HE – CAs** Reports all the **Causes** related to the selected **Hazardous Event**  
**HE – COs** Reports all the **Consequences** related to the selected **Hazardous Event**
- CA – HEs** Reports all the **Hazardous Events** related to the selected **Cause**  
**CA – PBs** Reports all the **Proactive Barriers** related to the selected **Cause**
- PB – CAs** Reports all the **Causes** related to the selected **Proactive Barrier**
- CO – HEs** Reports all the **Hazardous Events** related to the selected **Consequence**  
**CO – RBs** Reports all the **Recovery Barriers** related to the selected **Consequence**
- RB – COs** Reports all the **Consequences** related to the selected **Recovery Barrier**

## LISTS

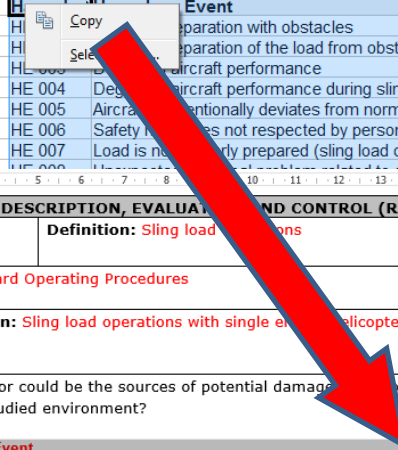
To have a list of all the inserted Operations, Hazardous Events, Causes, etc., select the "List" button underneath every table.

The screenshot displays the EHEST Risk Assessment Tool interface. It features several data tables and navigation elements:

- Top Left:** A red box with instructions: "A - SELECT THE CASE STUDY", "B - SELECT THE TOP EVENT", "C - SELECT THE HAZARD OR THE CONSEQUENCE", "D - SELECT THE BARRIER", "E - SELECT THE TASK". Below this is a "Copyright & Country" section for Captain Stefano BURGANA, ELILOMBARDIA, and an "E-mail" field.
- Top Center:** A table titled "Operation" with columns "No." and "Operation". It contains one entry: "OP 01 - Slings load operations". Below the table is a "List" button.
- Top Right:** A red box titled "REPORTS" and "RADEC" with buttons for "Report", "Op-Prod. Barr.", "Op-Rec. Barr.", "Cause", "Proactive Barrier", "Hazardous Event", "Recovery Barrier", and "Consequence".
- Middle Left:** A table titled "Cause" with columns "No.", "Cause", and "Likeli.". It lists various causes like "CA 001 - Trees, bushes, vegetation", "CA 002 - Wires, power lines", etc. Below the table is a "List" button.
- Middle Center:** A table titled "Hazardous Event" with columns "No.", "Hazardous Event", and "Likeli.". It lists events like "HE 001 - Reduced separation with obstacles", "HE 002 - Reduced separation of the load from", etc. Below the table is a "List" button.
- Middle Right:** A table titled "Consequence" with columns "No.", "Consequence", and "Risk". It lists consequences like "HE 001 - Aircraft crash", "HE 002 - Property damage on ground", etc. Below the table is a "List" button.
- Bottom Left:** A table titled "Proactive Barrier" with columns "No.", "Proactive Barrier", and "Likeli.". It lists barriers like "CA 001 - Pilot experience", "CA 002 - Pilot recency", etc. Below the table is a "List" button.
- Bottom Center:** A table titled "Task" with columns "Ref.", "Task no.", "Task Name", and "Due D.". It lists tasks like "PB 001 - T 001 - Develop SOP Slings Load Operation", "PB 002 - T 002 - Develop EGPWS". Below the table is a "List" button.
- Bottom Right:** A table titled "Recovery Barrier" with columns "No.", "Recovery Barrier", and "Likeli.". It lists barriers like "CO 001 - RB 001 - Emergency Response Plan (ERP)", "CO 002 - RB 002 - Pilot and personnel data", etc. Below the table is a "List" button.

Red arrows indicate the flow from the "List" buttons of the "Operation", "Cause", "Hazardous Event", "Consequence", "Proactive Barrier", "Task", and "Recovery Barrier" tables to the "List" button of the "Hazardous Event" table.

Use the reports output to copy-paste to your safety documents.



1	A	B	C	D	E
2	Operation	OP 01	Sling load operations		
3		Event		Likelihood	
4	HE 001	Reduced separation with obstacles		2	
5	HE 002	Reduced separation of the load from obstacles (sling load)		3	
6	HE 003	Degraded aircraft performance		1	
7	HE 004	Degraded aircraft performance during sling load operations		1	
8	HE 005	Aircraft unintentionally deviates from normal in-flight parameters		2	
9	HE 006	Safety measures not respected by personnel on ground during sling load operations		3	
10	HE 007	Load is not properly prepared (sling load operations)		3	
11	HE 008	Unexpected technical problem related to sling load operations		3	
12	HE 009	Unexpected technical problem on aircraft		3	
13	HE 010	Lose objects moved by the rotor downwash		3	
14	HE 011	Not accurate or missing mission planning and preparation (sling load)		2	
15	HE 012	Flight close to, or into, adverse meteorological conditions		2	
16	HE 013	Unwanted movement of cargo in flight (sling load)		2	
17	HE 014	Repetitive flight patterns/manoeuvres		4	
18	HE 015	External pressure		3	

RISK ASSESSMENT, DESCRIPTION, EVALUATION AND CONTROL (RADEC) FORM		
RA No.: RA 001	Definition: Sling load operations	
Ref.: Sling load Standard Operating Procedures		
Operation Description: Sling load operations with single engine helicopter in mountainous areas		
Hazards - What were or could be the sources of potential damage or adverse health effects in the studied environment?		
Hazardous Event ID	Hazardous Event	Likelihood
HE 001	Reduced separation with obstacles	2
HE 002	Reduced separation of the load from obstacles (sling load)	3
HE 003	Degraded aircraft performance	1
HE 004	Degraded aircraft performance during sling load operations	1
HE 005	Aircraft unintentionally deviates from normal in-flight parameters	2
HE 006	Safety measures not respected by personnel on ground during sling load operations	3
HE 007	Load is not properly prepared (sling load operations)	3
HE 008	Unexpected technical problem related to sling load operations	3
HE 009	Unexpected technical problem on aircraft	3
HE 010	Lose objects moved by the rotor downwash	3
HE 011	Not accurate or missing mission planning and preparation (sling load)	2
HE 012	Flight close to, or into, adverse meteorological conditions	2
HE 013	Unwanted movement of cargo in flight (sling load)	2
HE 014	Repetitive flight patterns/manoeuvres	4
HE 015	External pressure	3

## 6) SUPPORT EHEST

The EHEST Specialist Team Ops & SMS is making a big effort in order to develop and promote useful safety tools to the aeronautical world. Based on the practical final user experience, these tools can be improved.

Please support EHEST job by reporting your feedbacks and your suggestions to:

[ehest@easa.europa.eu](mailto:ehest@easa.europa.eu)