SINGAPORE AVIATION ACADEMY

SRM Methodology

SASS 27 Mar 2018

Gim T Teo

Principal Training Specialist (Safety Management)

SAA

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Presentation Objectives

- Methodology for conducting a specific H>TE>UC Safety Risk Mitigation (SRM) project/ task
- Excel SRM tool to perform and document a specific SRM project/ task
- Consolidated Barrier Strength Value (CBSV) methodology for deriving the Risk Index of a given Event or Consequence

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SRM Methodology - Module Outline

1. Your SRM Toolbox
2. Operational context of a SRM Project
3. Ascertain Hazard's viability for SRM action
   Three approaches to identify H>UE>C threads
4. Project Unsafe-Event / Consequence

Risk Mitigation - Hazard > Unsafe-Event

5. Identify Existing PCs (E-PC) [H>UE]
6. Identify Escalation Factors (EF) [EF>PC]
7. Identify Escalation Controls (EC) [EC>EF>PC]
8. Assess Existing Risk Index of Unsafe-Event
9. Identify New Preventive Controls (N-PC) [H>UE]
10. Identify Escalation Factors (EF) [EF>N-PC]
11. Identify Escalation Controls (EC) [EC>EF>N-PC]
12. Assess Resultant Risk Index of Unsafe-Event

Risk Mitigation - Unsafe-Event > Consequence

CBSV Methodology to assess Likelihood Value

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Section B:
SRM methodology

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1. Your SRM Toolbox

Why you need an SRM Toolbox

- SRM is a systematic process to account for adequacy of defences for each specific H>UE>C scenario
- Step-by-step procedure required to ensure consistency and validity of your SRM process
- Customized and pre-established SRM tooling required to guide and document each SRM task
- Procedure required for approval of completed SRM report as well as SRM project initiation

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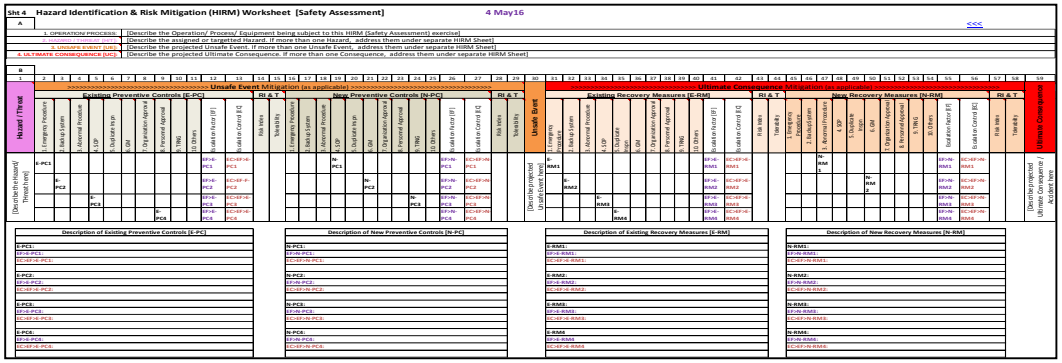
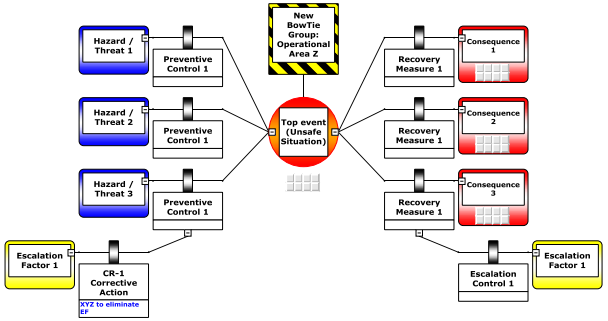
SRM Tooling options

- SRM Excel Worksheet (as addressed in this module)
- Bow-Tie SRM software





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SRM Worksheet (Excel)

Sht 4 **Hazard Identification & Risk Mitigation (HIRM) Worksheet [Safety Assessment]** 4 May16

<<<

1. OPERATION/ PROCESS:	[Describe the Operation/ Process/ Equipment being subject to this HIRM (Safety Assessment) exercise]
2. HAZARD / THREAT [H/T]:	[Describe the assigned or targetted Hazard. If more than one Hazard, address them under separate HIRM Sheet]
3. UNSAFE EVENT [UE]:	[Describe the projected Unsafe Event. If more than one Unsafe Event, address them under separate HIRM Sheet]
4. ULTIMATE CONSEQUENCE [UC]:	[Describe the projected Ultimate Consequence. If more than one Consequence, address them under separate HIRM Sheet]

Hazard / Threat	Unsafe Event Mitigation (as applicable) — Existing Preventive Controls [E-PC]												RI & T		Unsafe Event Mitigation (as applicable) — New Preventive Controls [N-PC]												RI & T		Unsafe Event	Ultimate Consequence Mitigation (as applicable) — Existing Recovery Measures [E-RM]												RI & T		Ultimate Consequence Mitigation (as applicable) — New Recovery Measures [N-RM]												RI & T		Ultimate Consequence
	1. Emergency Procedure	2. Backup System	3. Abnormal Procedure	4. SOP	5. Duplicate Insp'n	6. GM	7. Organization Approval	8. Personnel Approval	9. TRNG	10. Others	Escalation Factor [EF]	Escalation Control [EC]	Risk Index	Tolerability	1. Emergency Procedure	2. Backup System	3. Abnormal Procedure	4. SOP	5. Duplicate Insp'n	6. GM	7. Organization Approval	8. Personnel Approval	9. TRNG	10. Others	Escalation Factor [EF]	Escalation Control [EC]	Risk Index	Tolerability		1. Emergency Procedure	2. Backup System	3. Abnormal Procedure	4. SOP	5. Duplicate Insp'n	6. GM	7. Organization Approval	8. Personnel Approval	9. TRNG	10. Others	Escalation Factor [EF]	Escalation Control [EC]	Risk Index	Tolerability	1. Emergency Procedure	2. Backup System	3. Abnormal Procedure	4. SOP	5. Duplicate Insp'n	6. GM	7. Organization Approval	8. Personnel Approval	9. TRNG	10. Others	Escalation Factor [EF]	Escalation Control [EC]	Risk Index	Tolerability	
[Describe the Hazard/ Threat here]	E-PC1										EF>E-PC1	EC>EF>E-PC1						N-PC1							EF>N-PC1	EC>EF>N-PC1			[Describe projected Unsafe Event here]	E-RM1										EF>E-RM1	EC>EF>E-RM1					N-RM1								EF>N-RM1	EC>EF>N-RM1			[Describe projected Ultimate Consequence / Accident here
		E-PC2									EF>E-PC2	EC>EF-F-PC2								N-PC2					EF>N-PC2	EC>EF>N-PC2					E-RM2								EF>E-RM2	EC>EF>E-RM2								N-RM2					EF>N-RM2	EC>EF>N-RM2			
				E-PC3							EF>E-PC3	EC>EF>E-PC3										N-PC3			EF>N-PC3	EC>EF>N-PC3							E-RM3						EF>E-RM3	EC>EF>E-RM3													EF>N-RM3	EC>EF>N-RM3			
								E-PC4			EF>E-PC4	EC>EF>E-PC4													EF>N-PC4	EC>EF>N-PC4								E-RM4			EF>E-RM4	EC>EF>E-RM4													EF>N-RM4	EC>EF>N-RM4			

Description of Existing Preventive Controls [E-PC]	Description of New Preventive Controls [N-PC]	Description of Existing Recovery Measures [E-RM]	Description of New Recovery Measures [N-RM]
E-PC1:	N-PC1:	E-RM1:	N-RM1:
EF>E-PC1:	EF>N-PC1:	EF>E-RM1:	EF>N-RM1:
EC>EF>E-PC1:	EC>EF>N-PC1:	EC>EF>E-RM1:	EC>EF>N-RM1:
E-PC2:	N-PC2:	E-RM2:	N-RM2:
EF>E-PC2:	EF>N-PC2:	EF>E-RM2:	EF>N-RM2:
EC>EF>E-PC2:	EC>EF>N-PC2:	EC>EF>E-RM2:	EC>EF>N-RM2:
E-PC3:	N-PC3:	E-RM3:	N-RM3:
EF>E-PC3:	EF>N-PC3:	EF>E-RM3:	EF>N-RM3:
EC>EF>E-PC3:	EC>EF>N-PC3:	EC>EF>E-RM3:	EC>EF>N-RM3:
E-PC4:	N-PC4:	E-RM4	N-RM4:
EF>E-PC4:	EF>N-PC4:	EF>E-RM4	EF>N-RM4:
EC>EF>E-PC4:	EC>EF>N-PC4:	EC>EF>E-RM4	EC>EF>N-RM4:

<<< SRM CBSV Excel Template

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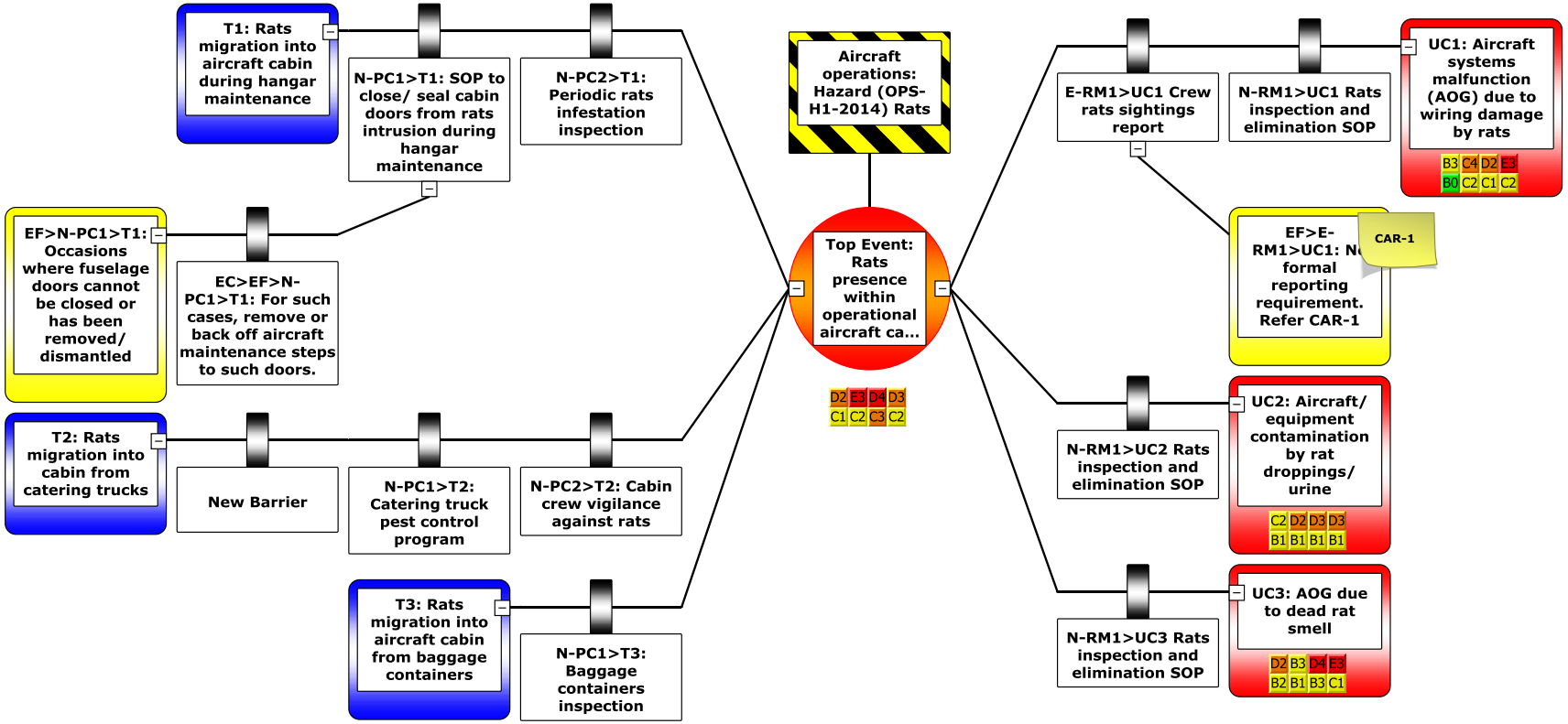
Bow-Tie SRM software



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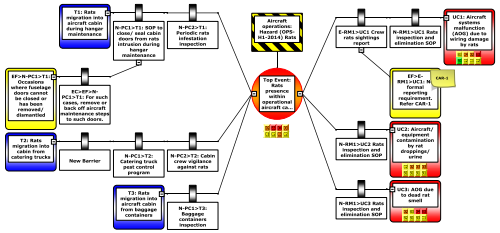
BTXP is a proprietary electronic SRM tool*

- Require BTXP training to fully utilise the tool
- Good points
  - results diagram; click & type; facilitate preliminary brain-storming; easy navigation, etc
- Limitations
  - single “Top Event” approach; no specific methodology to derive Likelihood value for the Risk Index

*CGE Risk Management Solutions



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SRM Worksheet (Excel)

- FOC
- Minimal training to use Excel spreadsheet
- Easy to customise
- Feature to derive Likelihood value from CBSV*
- Limitations – normal excel spreadsheet navigation; single H>UE>C SRM task per worksheet
- Possible future electronic version

*CBSV – Currently NA to CAAS SRM procedure

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Your specific SRM Toolbox

- Your SRM Toolbox for this Section is the “HIRM Wsht_Basic”
- Overview of the Excel HIRM Basic Worksheet

>>> 1_HIRM Wsht Basic

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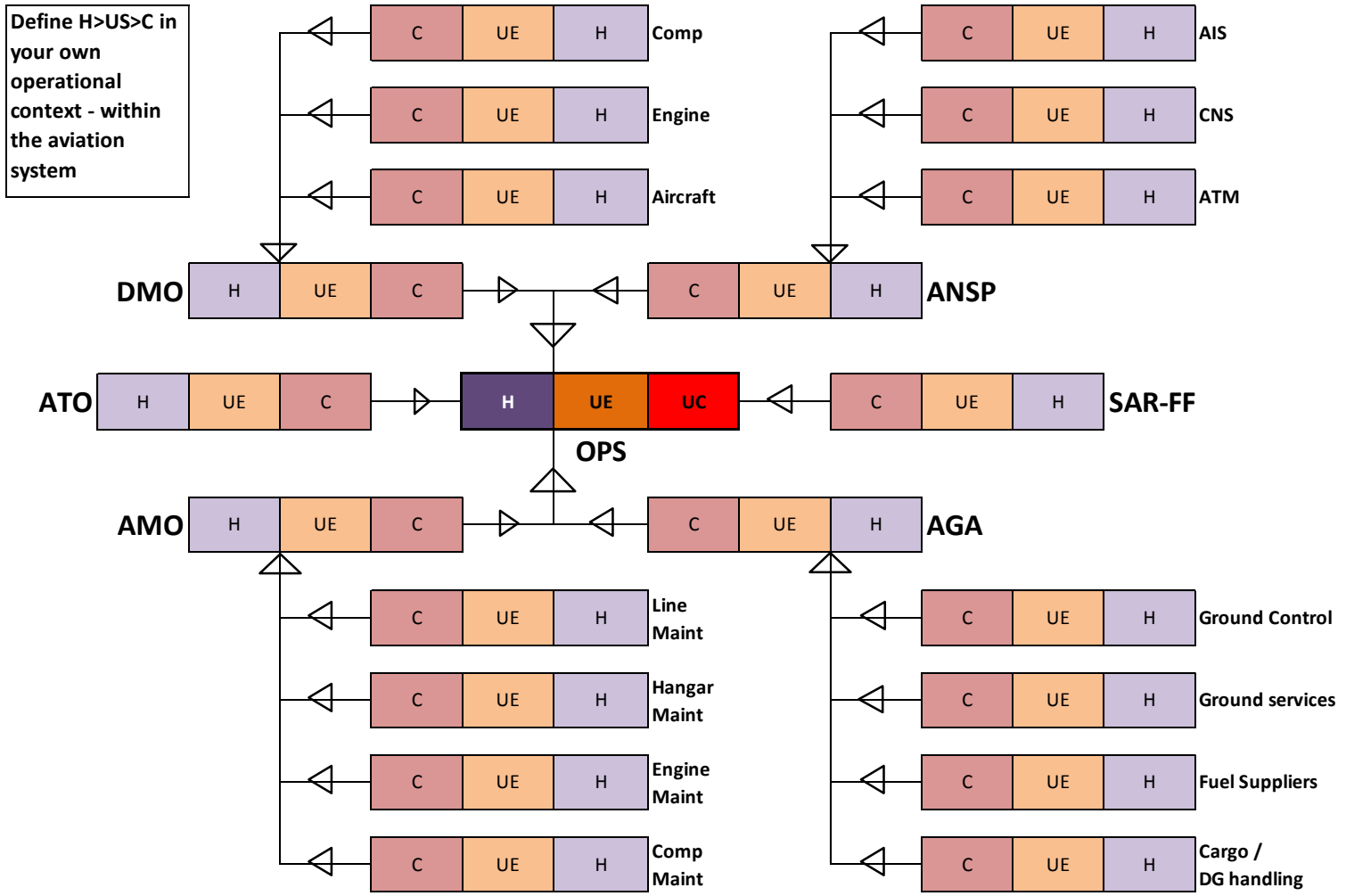
2. Operational context of a SRM Project



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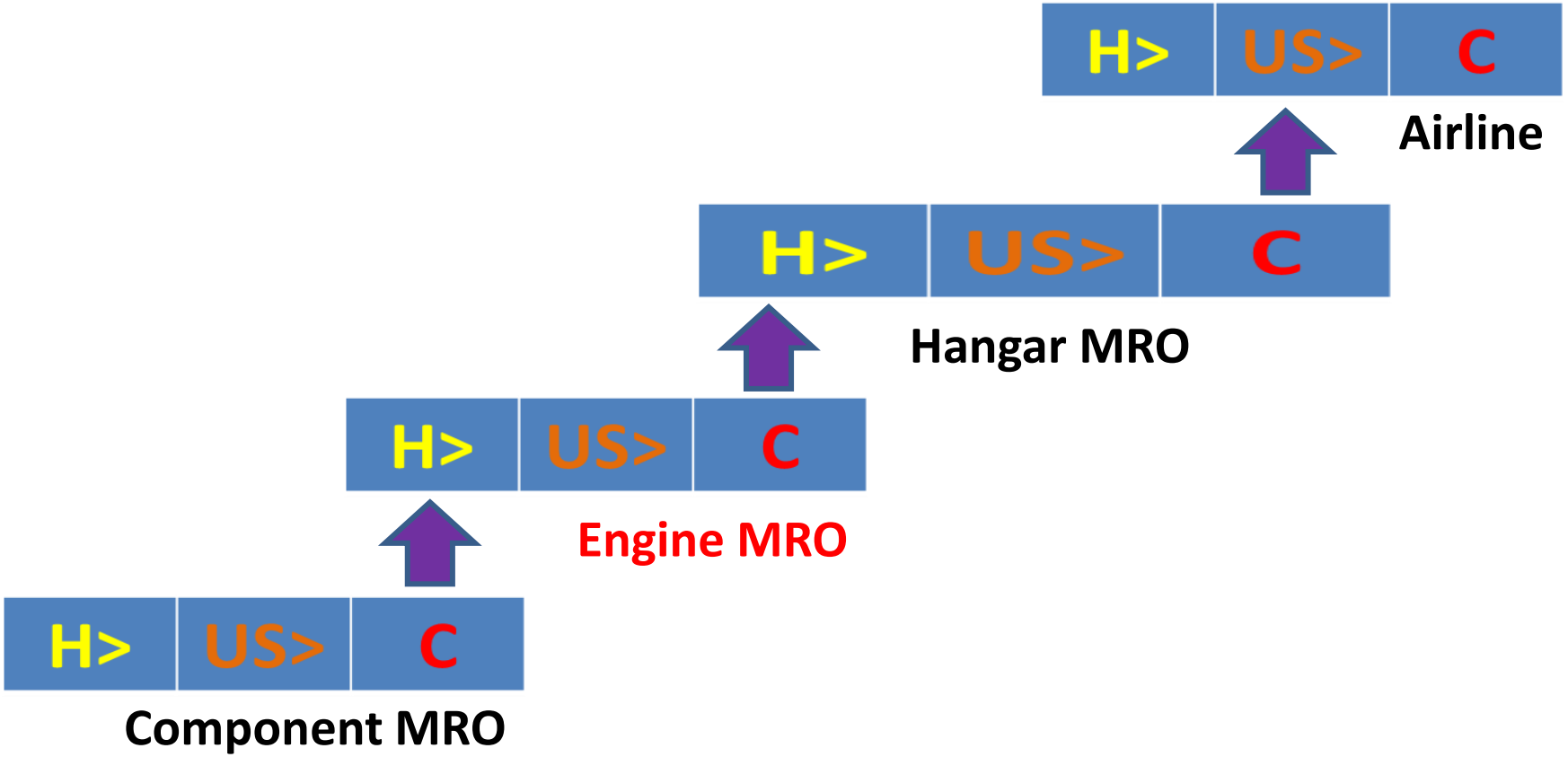
Define Hazard, Unsafe-Event & Consequence within your organization's operational context



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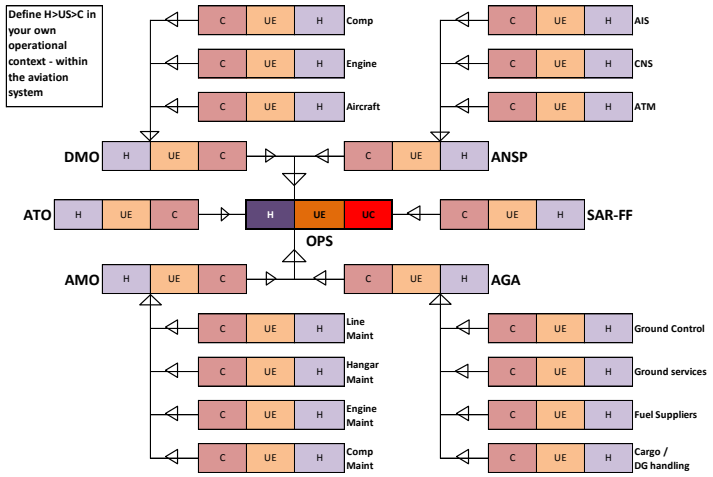
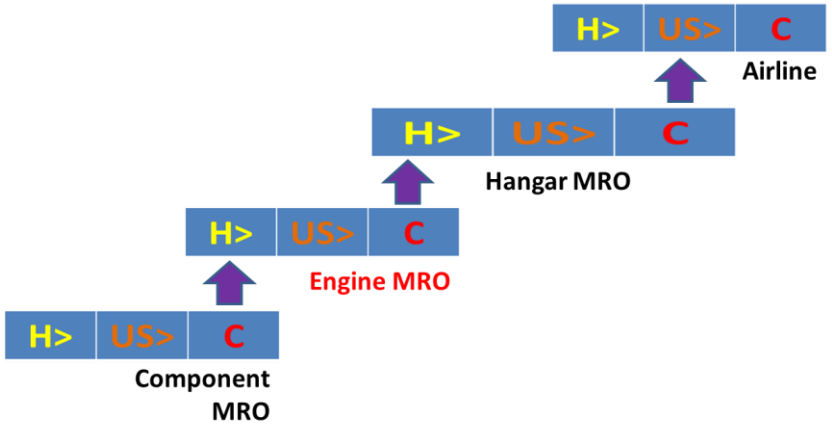
- Appropriate scoping of a H>UE>C thread is necessary to ensure that existing as well as intended new defenses will be within the purview and control of your organization.
- Exception for cross-organization or multi-sector SRM projects.

Example - Runway Safety Team SRM project involving AGA, AOC, ANS & AMO service providers





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Identifying potential SRM tasks

Three approaches to identify individual H>UE>C threads:

- From a given Hazard (Threat)
- From a given Unsafe-Event (Top Event)
- From a given Consequence (Ultimate Consequence

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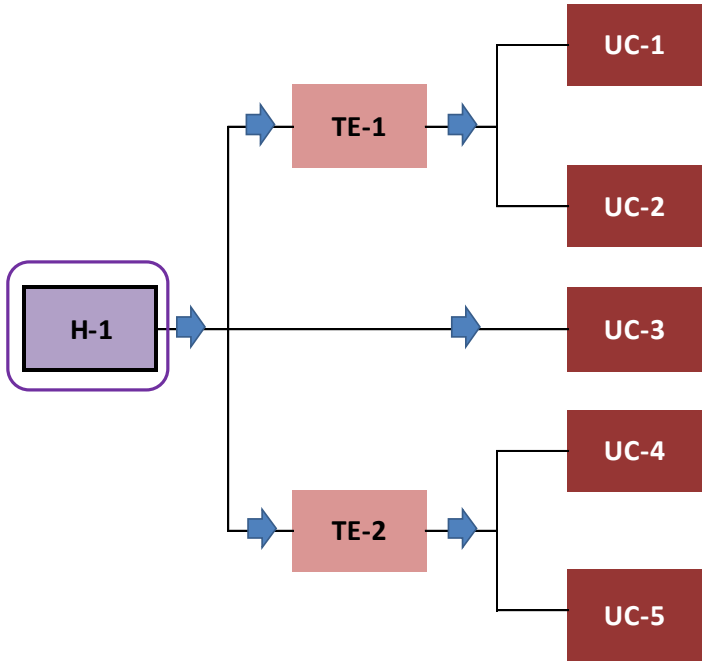
Brain-storming for specific H>UE>C threads

- From a given Hazard -



SRA Table - Hazard Approach

H	TE	UC
H-1	TE-1	UC-1
		UC-2
	Nil	UC-3
	TE-2	UC-4
		UC-5

Individual SRM Tasks

Task #	Thread
1	H-1 > TE-1 > UC-1
2	H-1 > TE-1 > UC-2
3	H-1 > UC-3
4	H-1 > TE-2 > UC-4
5	H-1 > TE-2 > UC-5

1. HAZARD (H) Approach

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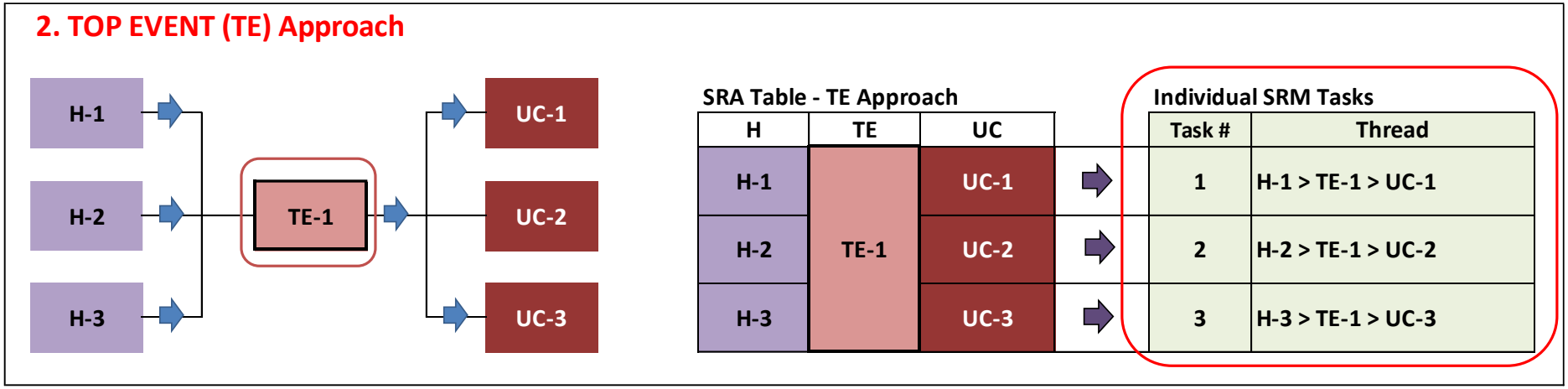
Brain-storming for specific H>UE>C threads

- From a given Unsafe-Event (Top Event) -



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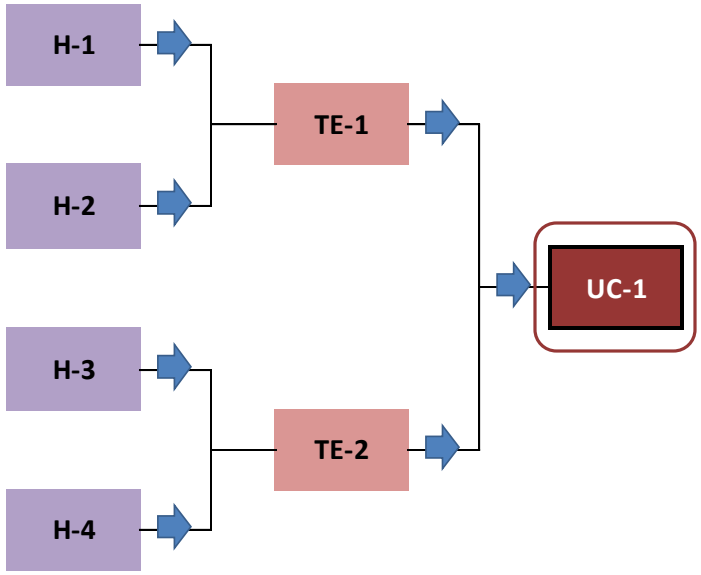
Brain-storming for specific H>UE>C threads

☐ From a given Consequence (Accident) -



SRA Table - UC Approach

UC	TE	H
UC-1	TE-1	H-1
		H-2
	TE-2	H-3
		H-4

Individual SRM Tasks

Task #	Thread
1	H-1 > TE-1 > UC-1
2	H-2 > TE-1 > UC-1
3	H-3 > TE-2 > UC-1
4	H-4 > TE-2 > UC-1

3. ACCIDENT (Ultimate Consequence) Approach

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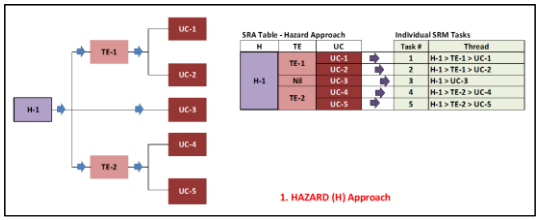
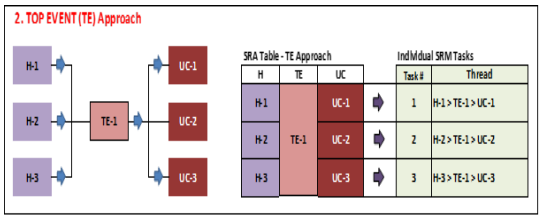
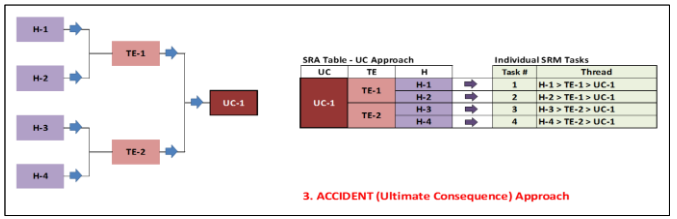
- Each H>UE>C thread so identified by these 3 approaches will constitute one potential specific SRM task

- Principal rationale for SMS-HIRM process - the proactive and systematic identification of all credible H>UE>C threads (pathways) to potential occurrences, and accounting for their defenses







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3. Ascertain Hazard's viability for SRM action

- Hazard is of permanent/ recurring nature
- Cannot be effectively disposed or eliminated through conventional corrective action
- Note severity (priority) level of the credible Unsafe-Event/ Consequence
- SRM action is within your SRM Team or organization's domain and expertise
- Costs, benefits and resources consideration.

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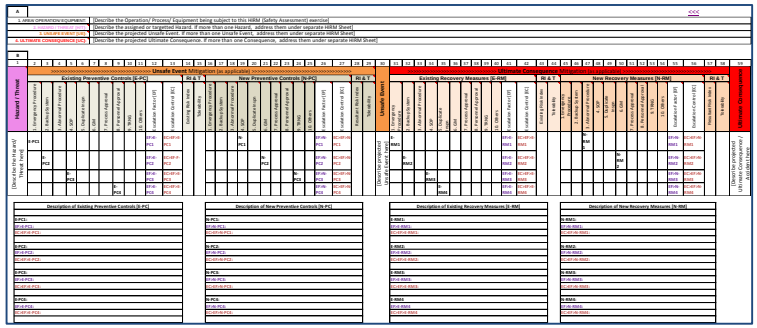
- Annotate your specific Hazard description in the SRM Worksheet, Table B, column 1
- Repeat the information in Table A, row 2

Hazard / Threat
[Describe the Hazard/ THreat here]



A
1. AREA/ OPERATION/ EQUIPMENT:
2. HAZARD / THREAT [H/T]:
3. UNSAFE EVENT [UE]:
4. ULTIMATE CONSEQUENCE [UC]:

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Hazard / Threat

[Describe the Hazard/ THreat here]

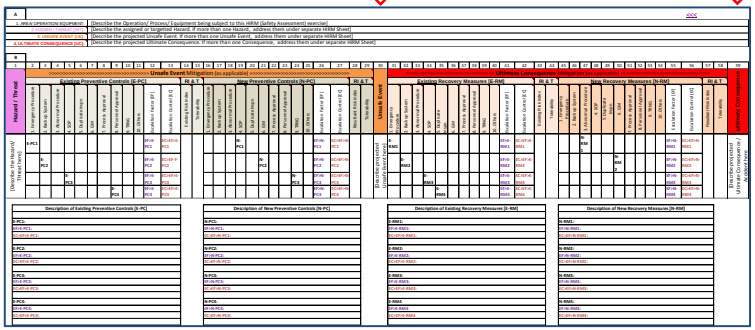
Unsafe Event

[Describe projected Unsafe Event here]

Ultimate Consequence

[Describe projected Ultimate Consequence / Accident here

- If Unsafe-Event/ Consequence information is part of hazard report, annotate in columns 30 & 59 as appropriate
- Repeat the information in Table A, row 3 & 4



A
1. AREA/ OPERATION/ EQUIPMENT:
2. HAZARD / THREAT [H/T]:
3. UNSAFE EVENT [UE]:
4. ULTIMATE CONSEQUENCE [UC]:

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4. Project Unsafe-Event / Consequence

- Where Unsafe-Event / Consequence information is not already available within a given hazard report, proceed to project (envisage) the Unsafe-Event / Consequence as appropriate
- Annotate this projected UE/ C information in their respective columns (30 & 59) as indicated in preceding slide
- Where multiple combinations of related H>UE>C threads are being identified, each specific thread should be captured as a potential parallel SRM task

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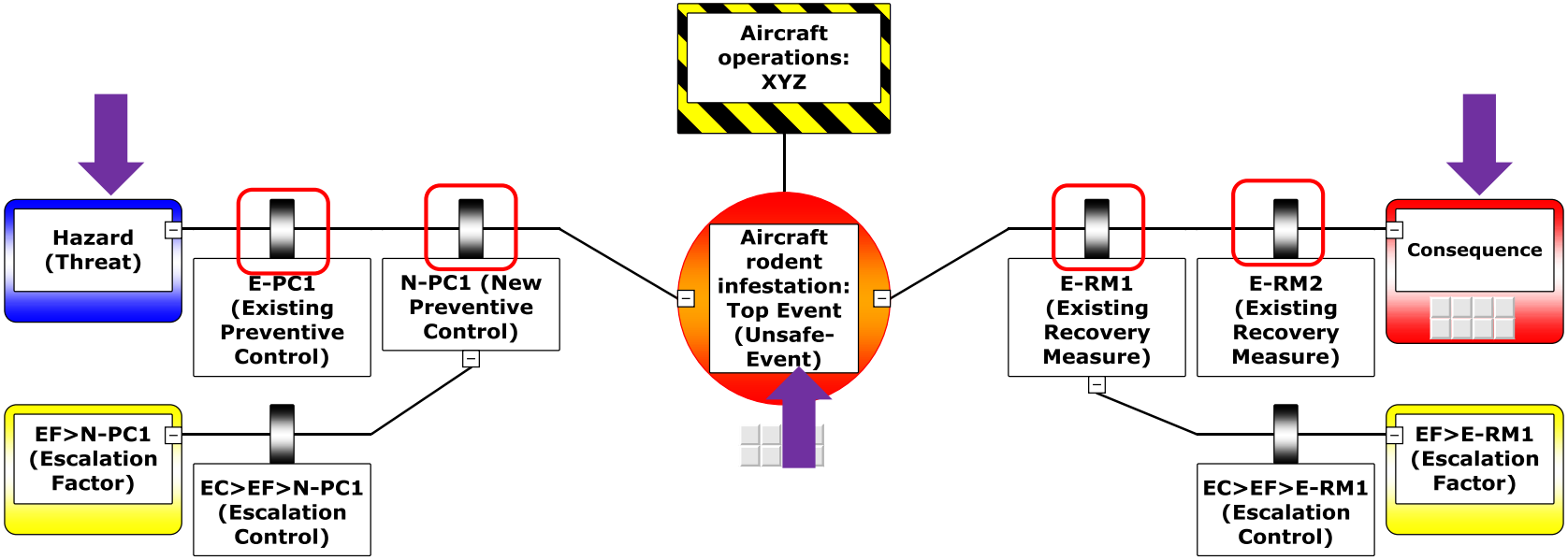
Verify H>UE>C correlation

- Ensure there is pertinent correlation between the Hazard and its projected Unsafe-Event/ Consequence
- Verify that defences are viable between the H>UE and UE>C escalation paths



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Risk Mitigation -

Hazard > Unsafe-Event

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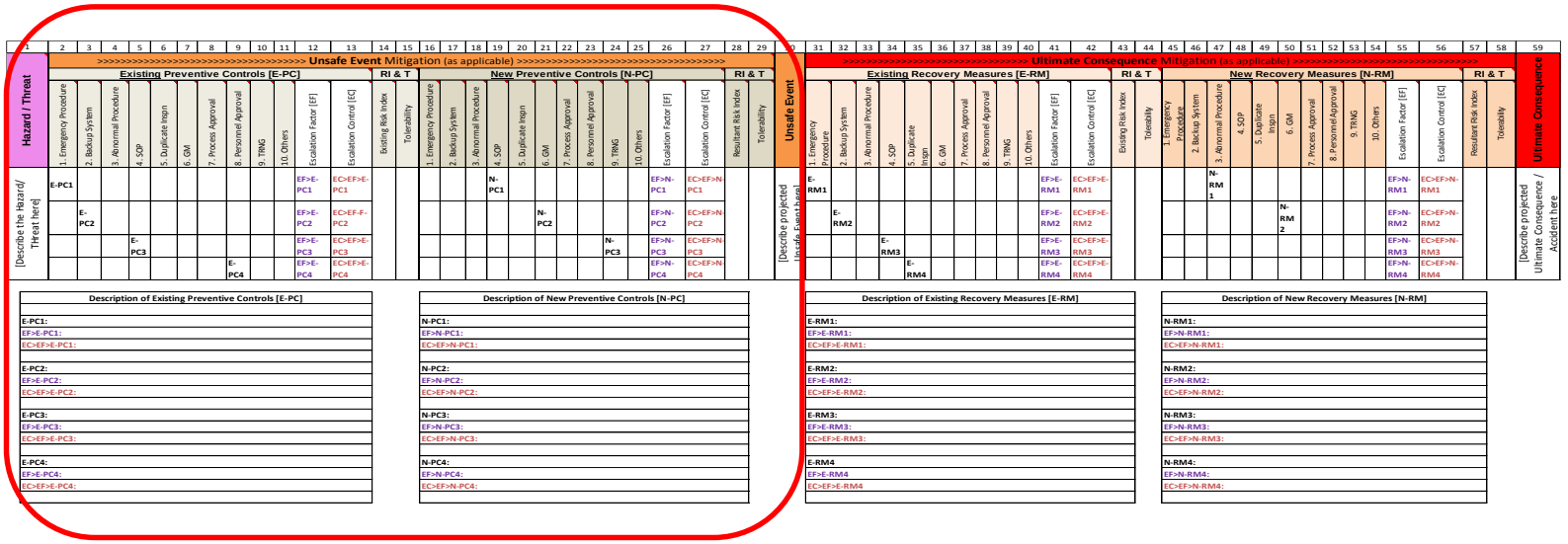
Risk Mitigation between Hazard to Unsafe-Event

Account for defences to mitigate between a Hazard and its projected Unsafe-Event



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Preventive Controls* (PC) [H>UE]

- A mitigating action or defense to block or prevent a Hazard/ Threat from escalating into an Unsafe Event
- Existing PCs refer to current/ known/ established PCs which are already in place before the current SRM exercise
- New PCs refer to new/ additional/ modified PCs being recommended, proposed or which will be put in place as a result of the current SRM exercise.

- *HIRM Wsht Basic, Sheet 2, item 7

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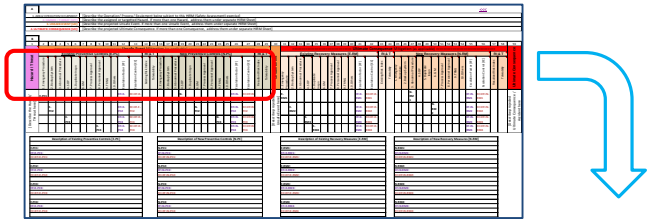
Categories of Preventive Controls (column 2-11; 16-25)



| Hazard / Threat | >>>>

Customize Preventive Control categories

10 Categories

1. Emergency Procedure
2. Backup System
3. Abnormal Procedure
4. SOP
5. Duplicate Inspn
6. GM
7. Process Approval
8. Personnel Approval
9. TRNG
10. Others

- ☐ Customize PC categories to suit the organization's aviation sector and operational context

Examples –

- ✓ NOTAM (aerodrome service provider)
- ✓ AFOP (airworthiness & flight operations procedures)
- ✓ SRG-PP (SRG – Policy & Procedures); etc

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Additional guidance on meaning of each PC category is within its “Comment” flag

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5. Identify Existing PCs (E-PC) [H>UE]

- Identify all Existing PCs that are pertinent to the specific Hazard > Unsafe-Event scenario (combination)
- Go through the PC categories systematically (from category 1 to 10) to guide the SRM team in their search for E-PCs
- Identified E-PCs that are outside of the indicated categories shall also be captured accordingly and annotated under “Others” (new PC category column can also be added if necessary)

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Existing Preventive Control identifier code

Assign an identifier code to each Existing PC

Example:

“E-PC1” = Existing Preventive Control No. 1

“E-PC2” = Existing Preventive Control No. 2.

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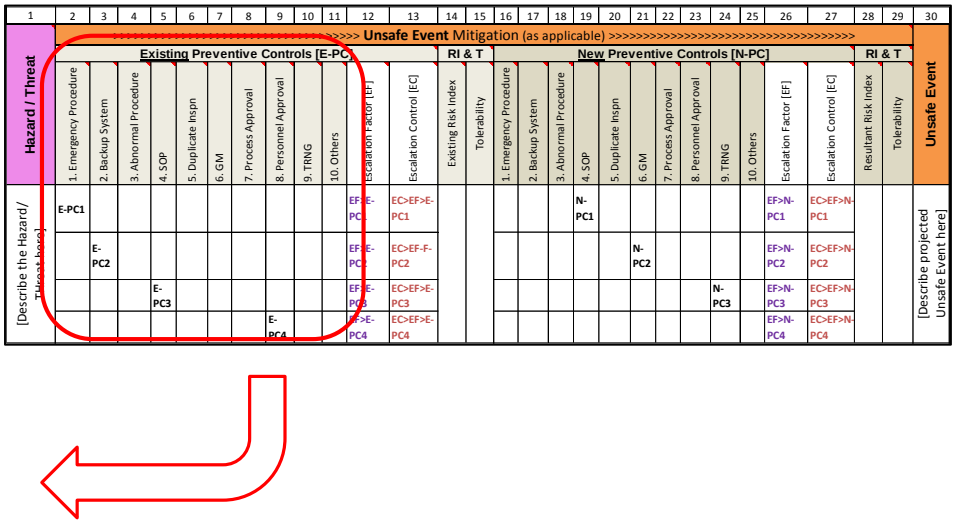
- Annotate the identifier code of each Existing-PC in the relevant E-PC category column, as illustrated here
  - Each additional E-PC shall be annotated on a new row

Existing Preventive Controls [E-PC]											
1. Emergency Procedure	2. Backup System	3. Abnormal Procedure	4. SOP	5. Duplicate Inspn	6. GM	7. Process Approval	8. Personnel Approval	9. TRNG	10. Others	Escalation Factor [EF]	Escalation Control [EC]
E-PC1										EF>E-PC1	EC>EF>E-PC1
	E-PC2									EF>E-PC2	EC>EF-F-PC2
			E-PC3							EF>E-PC3	EC>EF>E-PC3
							E-PC4			EF>E-PC4	EC>EF>E-PC4



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Existing Preventive Controls [E-PC]											
1. Emergency Procedure	2. Backup System	3. Abnormal Procedure	4. SOP	5. Duplicate Inspn	6. GM	7. Process Approval	8. Personnel Approval	9. TRNG	10. Others	Escalation Factor [EF]	Escalation Control [EC]
E-PC1										EF>E-PC1	EC>EF>E-PC1
	E-PC2									EF>E-PC2	EC>EF-F-PC2
			E-PC3							EF>E-PC3	EC>EF>E-PC3
							E-PC4			EF>E-PC4	EC>EF>E-PC4

Description of Existing Preventive Controls [E-PC]
E-PC1:
EF>E-PC1:
EC>EF>E-PC1:
E-PC2:
EF>E-PC2:
EC>EF>E-PC2:
E-PC3:
EF>E-PC3:
EC>EF>E-PC3:
E-PC4:
EF>E-PC4:
EC>EF>E-PC4:

- Annotate the description of each Existing-PC in the *"Description of E-PCs"* table (below the E-PC columns)
- Example of E-PC1 description below:

Description of Existing Preventive Controls [E-PC]
***E-PC1**: Flight, cabin and maintenance personnel are normally expected to report any rat sightings within an aircraft [Crew SOP 3.5]*

- Annotate documentary references alongside each existing preventive control's description

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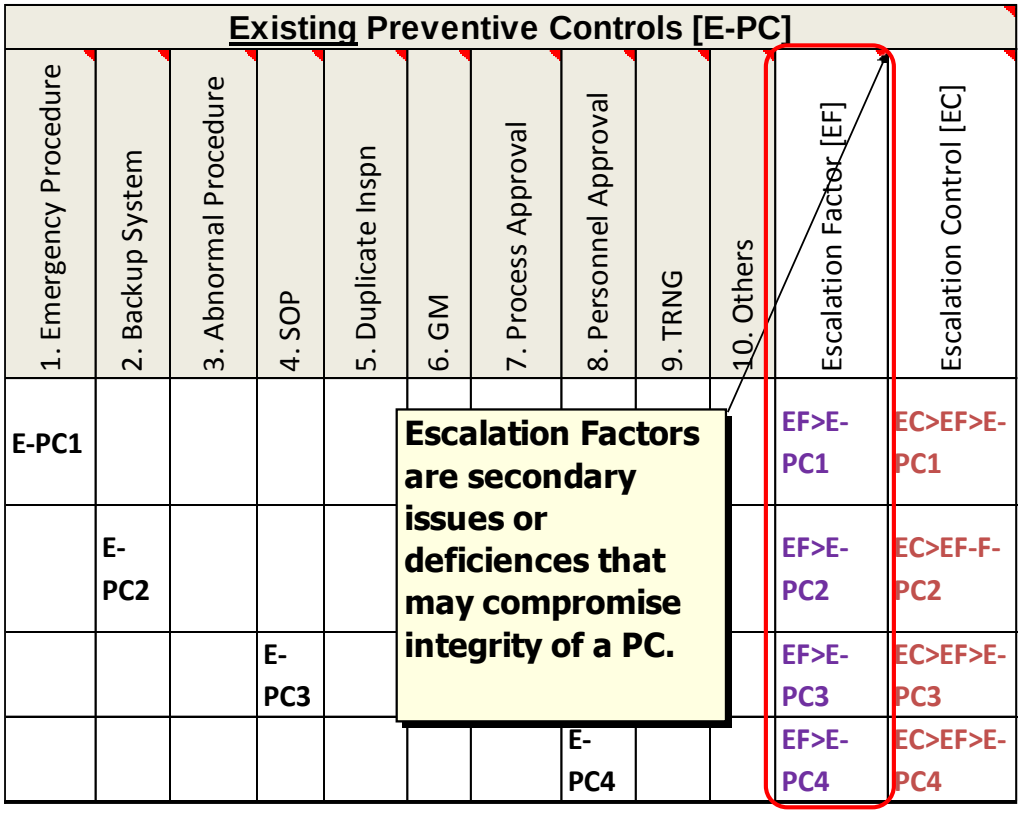
Escalation Factor* (EF) [EF>PC]

- Possible deficiency or latent factor/ condition which may weaken the effectiveness of a Preventive Control
- Use where applicable only

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Hazard / Threat	>>>>

- Escalation Factors are secondary issues or deficiencies that may compromise the integrity of a PC
- If not mitigated for, an Escalation Factor may impact the barrier strength of a Preventive Control



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6. Identify Escalation Factors (EF) [EF>PC]

- Examine each Existing PC for any credible or known Escalation Factor
- Assign an EF identifier code to each identified Escalation Factor. Example:

  “EF>PC1” – Escalation Factor affecting Preventive Control No. 1

  “EF>PC2” – Escalation Factor affecting Preventive Control No. 2

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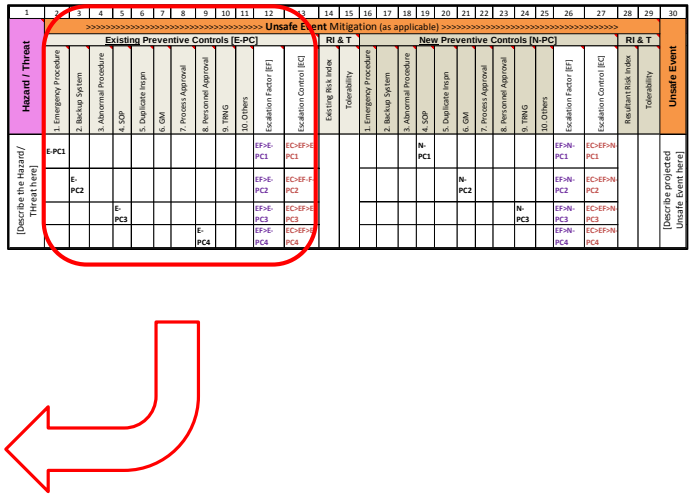
Annotate the EF identifier code in the Escalation Factor column of the affected PC's row

Existing Preventive Controls [E-PC]											
1. Emergency Procedure	2. Backup System	3. Abnormal Procedure	4. SOP	5. Duplicate Inspn	6. GM	7. Process Approval	8. Personnel Approval	9. TRNG	10. Others	Escalation Factor [EF]	Escalation Control [EC]
E-PC1										EF>E-PC1	EC>EF>E-PC1
	E-PC2									EF>E-PC2	EC>EF-F-PC2
			E-PC3							EF>E-PC3	EC>EF>E-PC3
							E-PC4			EF>E-PC4	EC>EF>E-PC4



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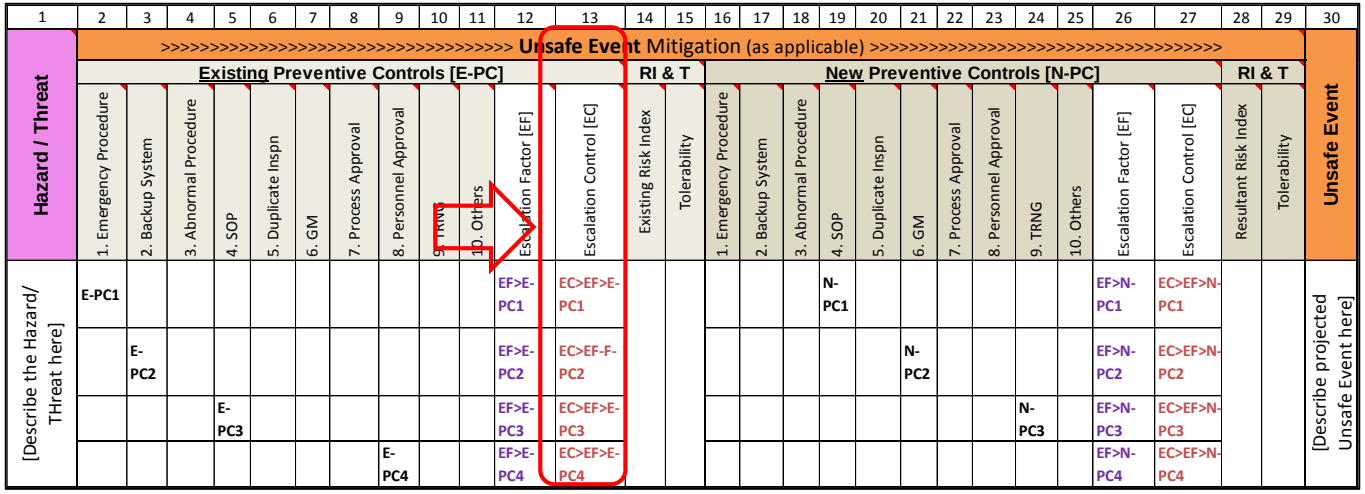
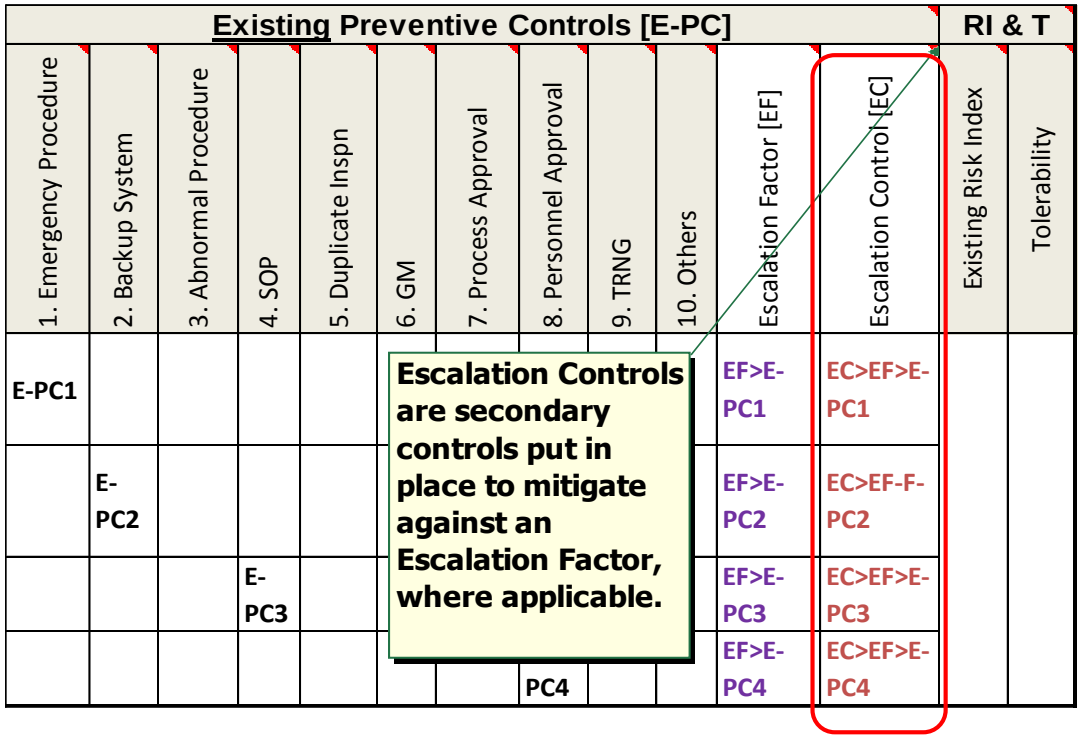
Escalation Control (EC) [EC>EF]

- A mitigating action or defense to block or prevent an Escalation Factor from compromising or weakening a Preventive Control
- Use where applicable only



1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Hazard / Threat	>>>>

- Escalation Controls are secondary controls put in place to mitigate against an Escalation Factor, where applicable



- Where an existing EC is not available for a given EF, an appropriate EC should be considered during subsequent evaluation of New Preventive Controls

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7. Identify Escalation Controls (EC) [EC>EF>PC]

- Examine each Escalation Factor for any credible or known Escalation Control
- Assign an EC identifier code to each identified Escalation Control. Example:
  - “EC>EF>PC1” = Escalation Control for EF affecting PC No. 1
  - “EC>EF1>PC2” = Escalation Control for EF No. 1 affecting PC No. 2

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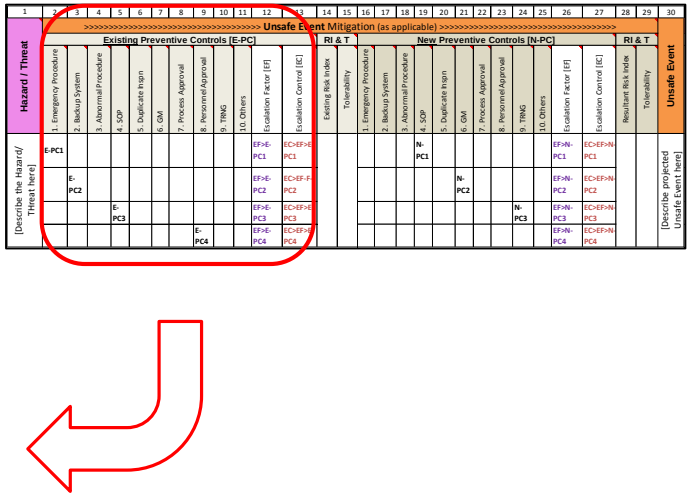
Annotate the EC identifier code in the Escalation Control column next to the relevant Escalation Factor

Existing Preventive Controls [E-PC]											
1. Emergency Procedure	2. Backup System	3. Abnormal Procedure	4. SOP	5. Duplicate Inspn	6. GM	7. Process Approval	8. Personnel Approval	9. TRNG	10. Others	Escalation Factor [EF]	Escalation Control [EC]
E-PC1										**EF>E-PC1**	**EC>EF>E-PC1**
	E-PC2									**EF>E-PC2**	**EC>EF-F-PC2**
			E-PC3							**EF>E-PC3**	**EC>EF>E-PC3**
							E-PC4			**EF>E-PC4**	**EC>EF>E-PC4**



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Risk Index

- Risk Index* refers to the combined Likelihood & Severity values of an Unsafe Event or Ultimate Consequence, as projected from an identified Hazard.
- Assessment of Risk Index takes into consideration the robustness of an Unsafe-Event's or Consequence's barriers

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Hazard / Threat	>>>>

8. Assess Existing Risk Index of Unsafe-Event

i. Determine Severity value of Unsafe-Event based on Severity Table [Sheet 5]

ii. Determine Likelihood value of Unsafe-Event, taking into consideration the strength or robustness of the Existing Preventive Controls

iii. Determine Existing Risk Index of Unsafe-Event based on Risk Index>Tolerability table [Sheet 7/8]

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i. Determine Severity Value of Unsafe-Event

Sheet 5: Severity Table (Basic)

Level	Descriptor	Severity Description
1	Insignificant	No significance to aircraft related operational safety.
2	Minor	Degrade or affect normal aircraft operational procedures or performance.
3	Moderate	Partial loss of significant/ major aircraft systems or result in abnormal F/Ops procedure application.
4	Major	Complete failure of significant/ major aircraft systems or result in emergency F/Ops procedure application.
5	Catastrophic	Loss of aircraft or multiple lives.

Example – Severity Value 3 (Moderate)

Note: Assessment of severity level should take into consideration any PCs which may lessen the severity level of an Unsafe-Event

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ii. 2. Determine Likelihood Value of Unsafe-Event

Sheet 6: Likelihood Table 07-Jan-14

Level	Descriptor	Likelihood Description
E	Certain/ frequent	Is expected to occur in most circumstances.
D	Likely/ occasional	Will probably occur at some time.
C	Possible/ remote	Might occur at some time.
B	Unlikely/ improbable	Could occur at some time.
A	Exceptional/ impossible	May occur only in exceptional circumstances.

Example – Likelihood Value "D" (Likely/ occasional)

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iii. Determine Existing Risk Index of UE

Risk Index of our UE, based on a Severity value of “3” and Likelihood value of “D”, is “3D” (Moderate)

Sheet 7: Risk Index Matrix (Severity x Likelihood) <<< 07-Jan-14

Likelihood	Severity				
	1. Insignificant	2. Minor	3. Moderate	4. Major	5. Catastrophic
A. (exceptional/ impossible)	Negligible (1A)	Negligible (2A)	Low (3A)	Low (4A)	Moderate (5A)
B. (unlikely/ improbable)	Negligible (1B)	Low (2B)	Low (3B)	Moderate (4B)	Moderate (5B)
C. (possible/ remote)	Low (1C)	Low (2C)	Moderate (3C)	Moderate (4C)	High (5C)
D. (likely/ occasional)	Low (1D)	Moderate (2D)	Moderate (3D)	High (4D)	Extreme (5D)
E. (certain/ frequent)	Moderate (1E)	Moderate (2E)	High (3E)	Extreme (4E)	Extreme (5E)

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Annotate the UE's Existing Risk Index in the Existing Risk Index & Tolerability column (14 & 15)

RI & T	
Existing Risk Index	Tolerability
3D	Moderate

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Hazard / Threat	>>>>

9. Identify New Preventive Controls (N-PC) [H>UE]

- New PCs will need to be considered whenever an Existing Risk Index value is deemed not acceptable/ tolerable
- Identify New PCs as well as consider possible enhancement of Existing PCs
- Look for New PCs that are pertinent to the specific Hazard > Unsafe-Event scenario
- Go through the New PC categories systematically (from category 1 to 10) to guide the SRM team in their search for New PCs
- Identified N-PCs that are outside of the indicated categories shall also be considered accordingly and annotated under “Others” (new PC category can also be added if necessary).

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New Preventive Control identifier code

Assign an identifier code to each New PC

Example:

“N-PC1” – New Preventive Control No 1

“N-PC2” – New Preventive Control No 2

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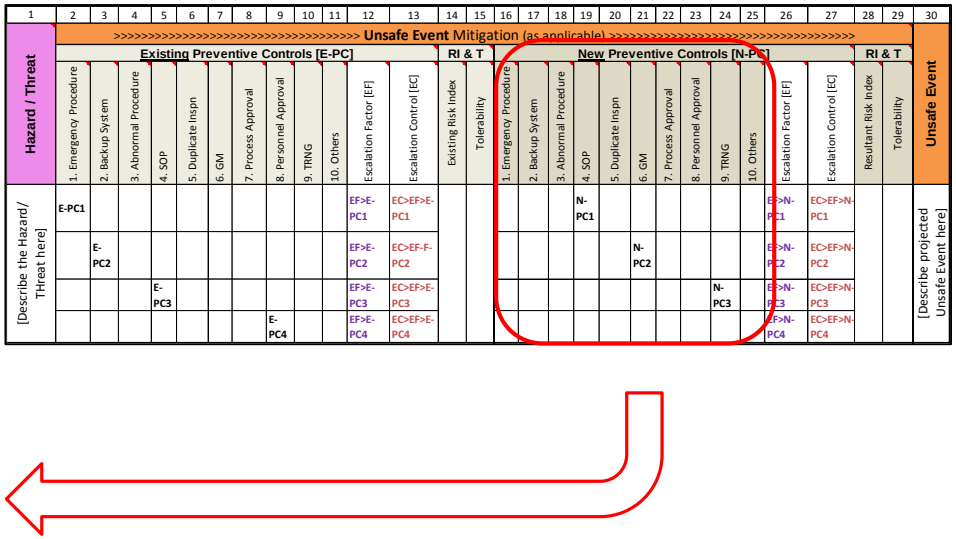
- Annotate the identifier code of each New PC in the relevant N-PC category column, as illustrated here
- Each New PC shall be annotated on a new row

New Preventive Controls [N-PC]											
1. Emergency Procedure	2. Backup System	3. Abnormal Procedure	4. SOP	5. Duplicate Inspn	6. GM	7. Process Approval	8. Personnel Approval	9. TRNG	10. Others	Escalation Factor [EF]	Escalation Control [EC]
			N-PC1							EF>N-PC1	EC>EF>N-PC1
					N-PC2					EF>N-PC2	EC>EF>N-PC2
								N-PC3		EF>N-PC3	EC>EF>N-PC3
										EF>N-PC4	EC>EF>N-PC4



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New Preventive Controls [N-PC]											
1. Emergency Procedure	2. Backup System	3. Abnormal Procedure	4. SOP	5. Duplicate Inspn	6. GM	7. Process Approval	8. Personnel Approval	9. TRNG	10. Others	Escalation Factor [EF]	Escalation Control [EC]
			N-PC1							EF>N-PC1	EC>EF>N-PC1
					N-PC2					EF>N-PC2	EC>EF>N-PC2
								N-PC3		EF>N-PC3	EC>EF>N-PC3
										EF>N-PC4	EC>EF>N-PC4

Description of New Preventive Controls [N-PC]
N-PC1:
EF>N-PC1:
EC>EF>N-PC1:
N-PC2:
EF>N-PC2:
EC>EF>N-PC2:
N-PC3:
EF>N-PC3:
EC>EF>N-PC3:
N-PC4:
EF>N-PC4:
EC>EF>N-PC4:

Annotate the description of each New PC in the *"Description of N-PCs"* table (below the N-PC columns)

Example of N-PC1 description below:

Description of New Preventive Controls [N-PC]
N-PC1: SOP to be put in place to require flight crew and maintenance personnel to report rats sighting within aircraft cabin (FOP 3.2; SOP 5.1)

Annotate documentary references alongside each existing preventive control's description

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10. Identify Escalation Factors (EF) [EF>N-PC]

- Examine each New PC for any credible or known Escalation Factor
- Assign an EF identifier code to each identified Escalation Factor. Example:
  - "EF>N-PC1" – Escalation Factor affecting New Preventive Control No 1
  - "EF>N-PC2" – Escalation Factor affecting New Preventive Control No 2

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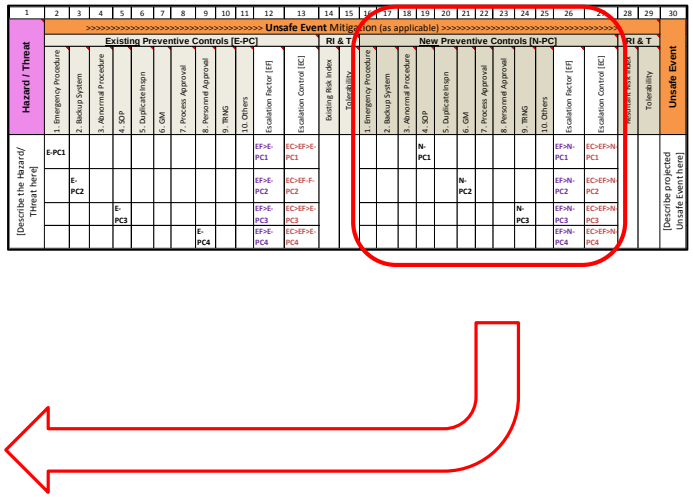
Annotate the EF identifier code in the Escalation Factor column of the affected N-PC's row

New Preventive Controls [N-PC]

1. Emergency Procedure	2. Backup System	3. Abnormal Procedure	4. SOP	5. Duplicate Inspn	6. GM	7. Process Approval	8. Personnel Approval	9. TRNG	10. Others	Escalation Factor [EF]	Escalation Control [EC]
			N-PC1							EF>N-PC1	EC>EF>N-PC1
					N-PC2					EF>N-PC2	EC>EF>N-PC2
								N-PC3		EF>N-PC3	EC>EF>N-PC3
										EF>N-PC4	EC>EF>N-PC4



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11. Identify Escalation Controls (EC) [EC>EF>N-PC]

- Examine each Escalation Factor for any credible or known Escalation Control
- Assign an EC identifier code to each identified Escalation Control. Example:
  - "EC>EF>N-PC1" – Escalation Control for EF affecting N-PC No 1
  - "EC>EF1>N-PC2" – Escalation Control for EF No 1 affecting N-PC No 2; etc

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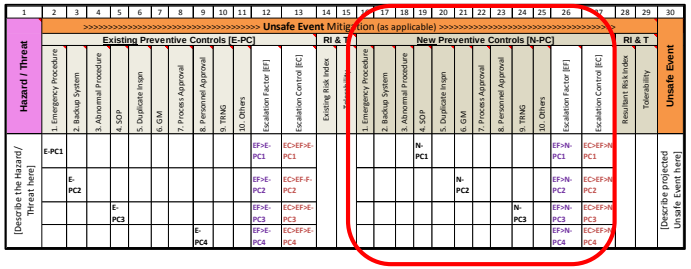
Annotate the EC identifier code in the Escalation Control column next to the relevant Escalation Factor

New Preventive Controls [N-PC]											
1. Emergency Procedure	2. Backup System	3. Abnormal Procedure	4. SOP	5. Duplicate Inspn	6. GM	7. Process Approval	8. Personnel Approval	9. TRNG	10. Others	Escalation Factor [EF]	Escalation Control [EC]
			N-PC1							EF>N-PC1	EC>EF>N-PC1
					N-PC2					EF>N-PC2	EC>EF>N-PC2
								N-PC3		EF>N-PC3	EC>EF>N-PC3
										EF>N-PC4	EC>EF>N-PC4



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Resultant Risk Index (of UE)

- Risk Index refers to the combined Likelihood & Severity value of an Unsafe Event or Ultimate Consequence, as projected from an identified Hazard.
- Assessment of Resultant Risk Index takes into consideration an Unsafe-Event's Existing plus New Preventive Controls

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Hazard / Threat	>> **Unsafe Event** Mitigation (as applicable) >>																												
	Existing Preventive Controls [E-PC]												**RI & T**		**New Preventive Controls [N-PC]**												**RI & T**		**Unsafe Event**
	1. Emergency Procedure	2. Backup System	3. Abnormal Procedure	4. SOP	5. Duplicate Inspn	6. GM	7. Process Approval	8. Personnel Approval	9. TRNG	10. Others	Escalation Factor [EF]	Escalation Control [EC]	Existing Risk Index	Tolerability	1. Emergency Procedure	2. Backup System	3. Abnormal Procedure	4. SOP	5. Duplicate Inspn	6. GM	7. Process Approval	8. Personnel Approval	9. TRNG	10. Others	Escalation Factor [EF]	Escalation Control [EC]	Resultant Risk Index	Tolerability	
[Describe the Hazard/ THreat here]	E-PC1										EF>E-PC1	EC>EF>E-PC1						N-PC1							EF>N-PC1	EC>EF>N-PC1			[Describe projected Unsafe Event here]
		E-PC2									EF>E-PC2	EC>EF-F-PC2								N-PC2					EF>N-PC2	EC>EF>N-PC2			
				E-PC3							EF>E-PC3	EC>EF>E-PC3											N-PC3		EF>N-PC3	EC>EF>N-PC3			
								E-PC4			EF>E-PC4	EC>EF>E-PC4													EF>N-PC4	EC>EF>N-PC4			

- HIRM Wsht Basic, Sheet 2, item 15

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12. Assess Resultant Risk Index of Unsafe-Event

1. Determine Severity value of Unsafe-Event based on Severity Table [Sheet 5]
2. Determine Likelihood value of Unsafe-Event, taking into consideration the strength or robustness of the Existing + New Preventive Controls
3. Determine Resultant Risk Index of Unsafe-Event based on Risk Index>Tolerability table [Sheet 7/8]

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Determine Severity Value of Unsafe-Event

Sheet 5: Severity Table (Basic)

Level	Descriptor	Severity Description
1	Insignificant	No significance to aircraft related operational safety.
2	Minor	Degrade or affect normal aircraft operational procedures or performance.
3	Moderate	Partial loss of significant/ major aircraft systems or result in abnormal F/Ops procedure application.
4	Major	Complete failure of significant/ major aircraft systems or result in emergency F/Ops procedure application.
5	Catastrophic	Loss of aircraft or multiple lives.

Example – Severity Value 3 (Moderate)

Note: Assessment of severity level should take into consideration any PCs which may lower the severity level of an Unsafe-Event

- HIRM Wsht Basic, Sheet 5

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Determine Likelihood Value of Unsafe-Event

Sheet 6: Likelihood Table 07-Jan-14

Level	Descriptor	Likelihood Description
E	Certain/ frequent	Is expected to occur in most circumstances.
D	Likely/ occasional	Will probably occur at some time.
C	Possible/ remote	Might occur at some time.
B	Unlikely/ improbable	Could occur at some time.
A	Exceptional/ impossible	May occur only in exceptional circumstances.

Example – Likelihood Value “B” (Unlikely/ improbable)

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Determine Resultant Risk Index of UE

Resultant Risk Index of our UE, based on a Severity value of "3" and Likelihood value of "B", is "3B" (Low)

Sheet 7: Risk Index Matrix (Severity x Likelihood) <<< 07-Jan-14

Likelihood	Severity				
	1. Insignificant	2. Minor	3. Moderate	4. Major	5. Catastrophic
A. (exceptional/ impossible)	Negligible (1A)	Negligible (2A)	Low (3A)	Low (4A)	Moderate (5A)
B. (unlikely/ improbable)	Negligible (1B)	Low (2B)	Low (3B)	Moderate (4B)	Moderate (5B)
C. (possible/	Low (1C)	Low (2C)	Moderate (3C)	Moderate (4C)	High (5C)
D. (likely/ occasional)	Low (1D)	Moderate (2D)	Moderate (3D)	High (4D)	Extreme (5D)
E. (certain/	Moderate (1E)	Moderate (2E)	High (3E)	Extreme (4E)	Extreme (5E)

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Annotate the UE's Resultant Risk Index in the Resultant Risk Index & Tolerability column (28 & 29)

RI & T	
Resultant Risk Index	Tolerability
3B	LOW

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Hazard / Threat	>>>>

Risk Mitigation -

Unsafe-Event > Consequence

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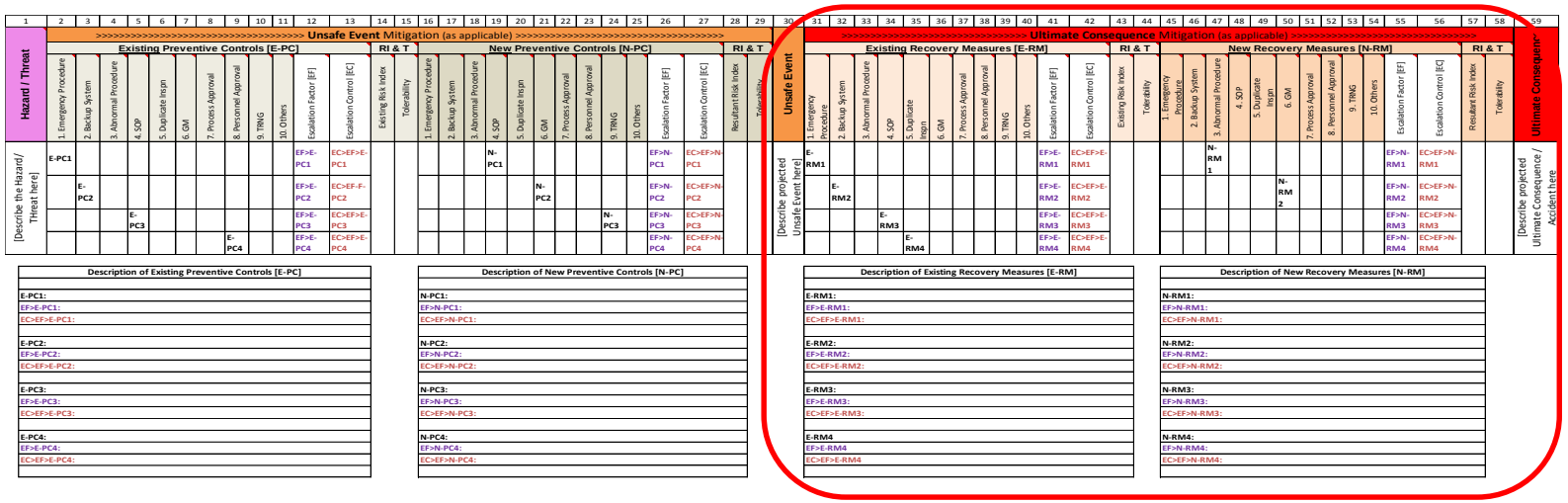
Risk Mitigation between Unsafe-Event to Consequence

- Account for defenses to recover from an Unsafe-Event and to mitigate for the projected Consequence
- Same procedure as for preceding Hazard to Unsafe-Event risk mitigation scenario



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❖ CBSV Methodology to assess Likelihood Value

"The main challenge of a SRM process is the methodology to assess the Likelihood Value of an Event, in order to derive the Risk Index."

"The likelihood of an Event's occurrence (in relation to a specific Hazard) is directly related to the effectiveness/ robustness of its package of Barriers/ Defences (between that Hazard and the Event) ".

"The CBSV methodology is a process for the qualitative-quantification of a package of Barriers' consolidated robustness; and thereby correlating that CBSV value with the corresponding Likelihood value".

>>> SRM Excel Template

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2018 SAA Courses incorporating HIRM Module

- Operational HIRM, 7-10 May, SAA (4 days)
- SMS Implementation, 2-6 Jul, SAA (5 days)
- SMS Implementation, 1-5 Oct, SAA (5 days)
- SSP Implementation, 22-26 Oct, SAA (5 days)

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Link to Download the HIRM Wsht

https://goo.gl/7m8a12

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