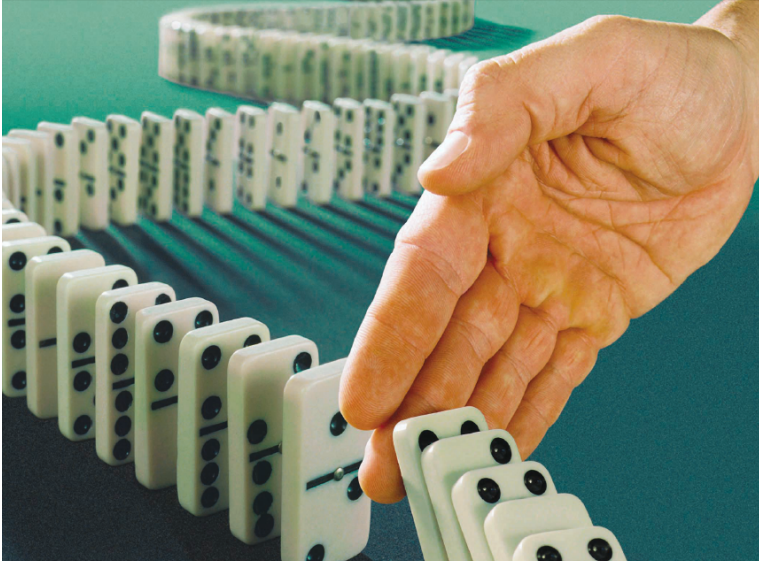




Risk Management

What is Risk?

- Risk is the probability that a hazard (Threat) will turn into a disaster (Harm)
- Vulnerability and hazards are not dangerous, taken separately
- But if they come together, they become a risk or, in other words, the probability that a disaster will happen
- Nevertheless, risks can be reduced or managed
- If we are ware of our weaknesses and vulnerabilities to existing hazards, then we can take measures to make sure that hazards do not turn into disasters
- Risk management help us prevent disasters



Risk Matrix ICAO Perspective



Risk Assessment Matrix ICAO

SEVERITY OF CONSEQUENCES		
<i>Aviation definition</i>	<i>Meaning</i>	<i>Value</i>
Catastrophic	Aircraft destroyed Multiple deaths	5
Hazardous	A large reduction in safety margins, physical distress or a workload that the crew cannot be relied upon to perform their tasks accurately or completely. Serious injury or death of a proportion of the occupants. Major aircraft damage.	4
Major	A significant reduction in safety margins, a reduction in the ability of the flight crew to cope with adverse operating conditions as a result of increase in workload or as a result of conditions impairing their efficiency. Aircraft serious incident. Injury to occupants.	3
Minor	Nuisance. Operating limitations. Use of emergency procedures. Aircraft minor incident.	2
Negligible	Little consequence	1



Risk Assessment Matrix ICAO

LIKELIHOOD OF OCCURRENCE		
<i>Qualitative definition</i>	<i>Meaning</i>	<i>Value</i>
Frequent	Likely to occur many times	5
Occasional	Likely to occur some times	4
Remote	Unlikely, but possible to occur	3
Improbable	Very unlikely to occur	2
Extremely improbable	Almost inconceivable that the event will occur	1



Risk Matrix

AS/NZS 4360:2004



Risk Assessment Severity

Severity level	Consequences Types					
	Profit reduction	Health and safety	Natural environment	Social/cultural heritage	Community/ govt/ reputation/ media	Legal
V	US\$10M–US\$100M	Multiple fatalities, or significant irreversible effects to >50 persons	Very serious, long-term environmental impairment of ecosystem functions			Significant prosecution and fines Very serious litigation including class actions
IV	US\$1M–US\$10M	Single fatality and/or severe irreversible disability (>30%) to one or more persons		On-going serious social issues. Significant damage to structures/items of cultural significance	Serious public or media outcry (international coverage)	Major breach of regulation Major litigation
III	US\$100 000–US\$1M	Moderate irreversible disability or impairment (<30%) to one or more persons	Serious medium term environmental effects		Significant adverse national media/public/NGO attention	Serious breach of regulation with investigation or report to authority with prosecution and/or moderate fine possible
II	US\$10 000–US\$100 000	Objective but reversible disability requiring hospitalization	Moderate, short-term effects but not affecting ecosystem functions	On-going social issues. Permanent damage to items of cultural significance	Attention from media and/or heightened concern by local community. Criticism by NGOs	Minor legal issues, non-compliances and breaches or regulation
I	<US\$10 000	No medical treatment required	Minor effects on biological of physical environment	Minor medium-term social impacts on local population. Mostly repairable	Minor, adverse local public or medical attention or complaints	

Severity Regarding Objectives

Descriptive	Definition
Severe	Most objectives cannot be achieved
Major	Some important objectives cannot be achieved
Moderate	Some objectives affected
Minor	Minor effects that are easily remedied
Negligible	Negligible impact upon objectives

Probability Scale

Level	Descriptor	Description	Indicative Frequency (expected to occur)
A	Almost certain	The event will occur on an annual basis	Once a year or more frequently
B	Likely	The event has occurred several times or more in your career	Once every three years
C	Possible	The event might occur once in your career	Once every ten years
D	Unlikely	The event does occur somewhere from time to time	Once every thirty years
E	Rare	Heard of something like the occurring elsewhere	Once every 100 years
F	Very rare	Have never heard of this happening	One in 1000 years
G	Almost incredible	Theoretically possible but not expected to occur	One in 10 000 years

Descriptor	Description	Alternative Descriptor
Probable	Can be expected to occur during the project	Good odds
Possible	Not expected to occur during the project	Low to even odds
Improbable	Conceivable but highly unlikely to occur during the project	Poor odds

Level of Risk



Likelihood Label	Consequences Label				
	I	II	III	IV	V
A	Medium	High	High	Very high	Very high
B	Medium	Medium	High	High	Very high
C	Low	Medium	High	High	High
D	Low	Low	Medium	Medium	High
E	Low	Low	Medium	Medium	High



Risk Matrix FAA Perspective

FAA Risk Matrix



SEVERITY:

- 1 CATASTROPHIC – Death, system or aircraft loss, permanent total disability
- 2 HAZARDOUS - Severe injury or major aircraft or system damage
- 3 MAJOR - Minor injury or minor aircraft or system damage
- 4 MINOR – Less than minor injury or aircraft or system damage
- 5 NO SAFETY EFFECT

PROBABILITY:

- A PROBABLE - Likely to occur in lifetime of each system ($> 1E-5$)
- B REMOTE – Possible for each item, several for system ($< 1E-5$)
- C EXTREMELY REMOTE – Unlikely for item, may occur few in system ($< 1E-7$)
- D EXTREMELY IMPROBABLE – so unlikely, not expected in system ($< 1E-9$)

SEVERITY	PROBABILITY			
	A	B	C	D
1				
2				
3				
4				
5	No risk			



Severity Definitions

Catastrophic	Results in multiple fatalities and/or loss of the system
Hazardous	Reduces the capability of the system or the operator ability to cope with adverse conditions to the extent that there would be: Large reduction in safety margin or functional capability Crew physical distress/excessive workload such that operators cannot be relied upon to perform required tasks accurately or completely (1) Serious or fatal injury to small number of occupants of aircraft (except operators) Fatal injury to ground personnel and/or general public
Major	Reduces the capability of the system or the operators to cope with adverse operating condition to the extent that there would be – Significant reduction in safety margin or functional capability Significant increase in operator workload Conditions impairing operator efficiency or creating significant discomfort Physical distress to occupants of aircraft (except operator) including injuries Major occupant illness and/or major environmental damage, and/or major property damage
Minor	Does not significantly reduce system safety. Actions required by operators are well within their capabilities. Include Slight reduction in safety margin or functional capabilities Slight increase in workload such as routine flight plan changes Some physical discomfort to occupants or aircraft (except operators)
No Safety Effect	Has no effect on safety



Risk Matrix Exercise

Exercise Steps

Severity Scale



1. Define the dimension or element that is affected (Examples: People, Machines, Infrastructure, Image, Environment, Organizational Environment, Customers, Services, Operational Processes, Systems, Objectives, Economics, etc.)
2. Define the different levels of severity (3, 4 , 5 or more)
3. Define the value symbols that you are going to use (numbers, letters, other symbols)
4. Define the terms used for each value
5. Describe each term
6. Prepare your chart presentation

Severity Scale:



Value	Term	Description

Severity of occurrences		
Aviation definition	Meaning	Value
Catastrophic	• <i>Equipment destroyed</i> • <i>Multiple deaths</i>	A
Hazardous	• <i>A large reduction in safety margins, physical distress or a workload such that the operators cannot be relied upon to perform their tasks accurately or completely.</i> • <i>Serious injury or death to a number of people.</i> • <i>Major equipment damage</i>	B
Major	• <i>A significant reduction in safety margins, a reduction in the ability of the operators to cope with adverse operating conditions as a result of increase in workload, or as a result of conditions impairing their efficiency</i> • <i>Serious incident</i> • <i>Injury to persons</i>	C
Minor	• <i>Nuisance</i> • <i>Operating limitations</i> • <i>Use of emergency procedures</i> • <i>Minor incident</i>	D
Negligible	• <i>Little consequences</i>	E

Probability of occurrence

Qualitative definition	Meaning	Value
Frequent	<i>Likely to occur many times (has occurred frequently)</i>	5
Occasional	<i>Likely to occur some times (has occurred infrequently)</i>	4
Remote	<i>Unlikely, but possible to occur (has occurred rarely)</i>	3
Improbable	<i>Very unlikely to occur (not known to have occurred)</i>	2
Extremely improbable	<i>Almost inconceivable that the event will occur</i>	1

Risk assessment matrix



Risk probability	Risk severity				
	Catastrophic A	Hazardous B	Major C	Minor D	Negligible E
5 – Frequent	5A	5B	5C	5D	5E
4 – Occasional	4A	4B	4C	4D	4E
3 – Remote	3A	3B	3C	3D	3E
2 – Improbable	2A	2B	2C	2D	2E
1 – Extremely improbable	1A	1B	1C	1D	1E

RISK ASSESSMENT CRITERIA



Assessment risk index	Suggested criteria
5A, 5B, 5C, 4A, 4B, 3A	Unacceptable under the existing circumstances
5D, 5E, 4C, 3B, 3C, 2A, 2B	Risk control/mitigation requires management decision
4D, 4E, 3D, 2C, 1A, 1B	Acceptable after review of the operation
3E, 2D, 2E, 1C, 1D, 1E	Acceptable

Definitions



- **Risk identification** is the process of determining what, where, when, why and how something could happen
- **Risk assessment** is the determination of quantitative or qualitative value of risk related to a concrete situation and a recognized threat
- Quantitative risk assessment requires calculations of two components of risk: the magnitude of the potential loss, and the probability that the loss will occur
- **Acceptable risk** is a risk that is understood and tolerated usually because the cost or difficulty of implementing an effective countermeasure for the associated vulnerability exceeds the expectation of loss

Risk Assessment Matrix Jr.



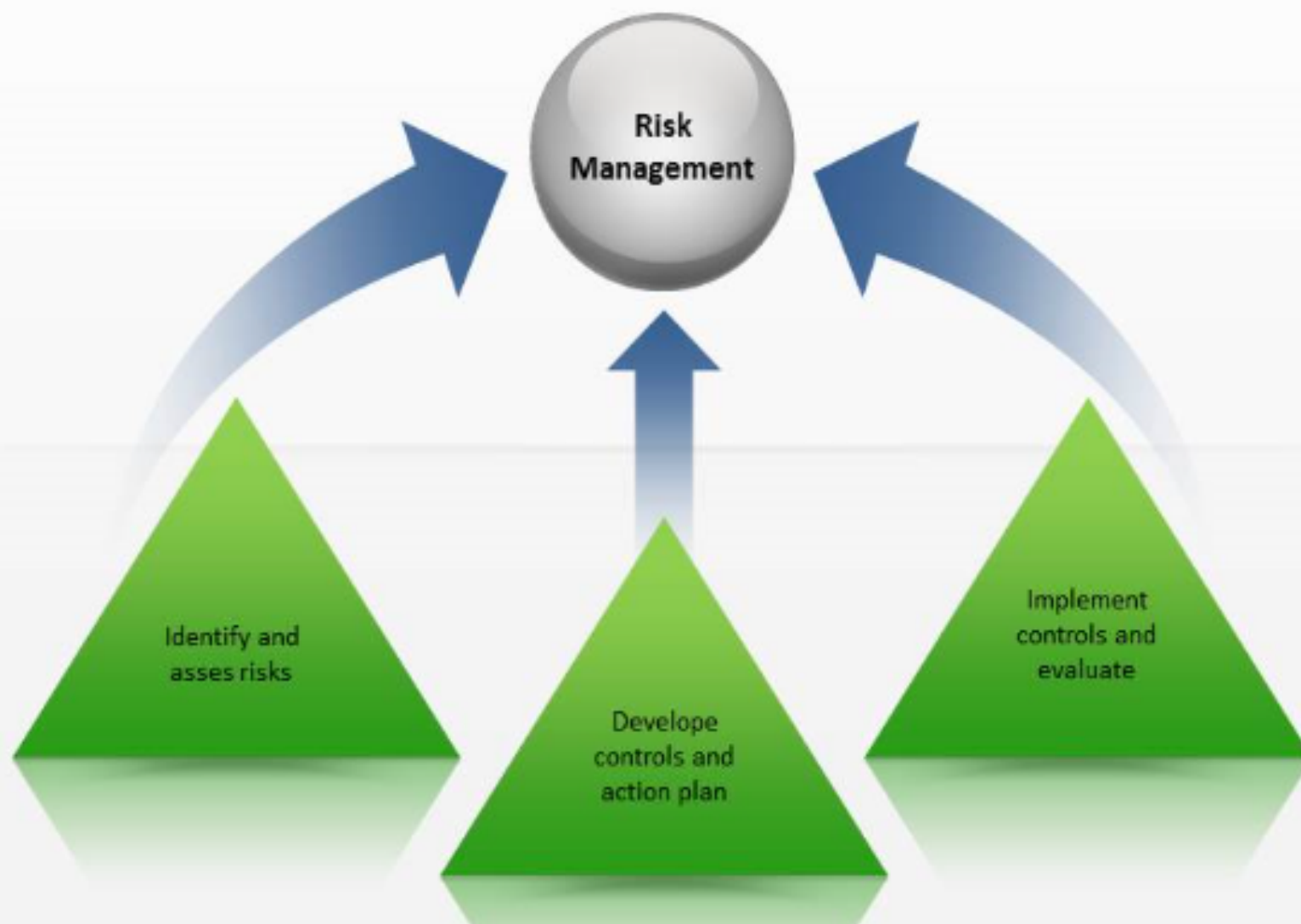
Risk Assessment Matrix				
Likelihood	Severity			
	Catastrophic	Critical	Marginal	Negligible
Probable	High	High	Serious	
Occasional	High	Serious		
Remote	Serious	Medium		Low
Improbable				

Risk Assessment Matrix Sr.



RISK ASSESSMENT MATRIX						
	Probability					
Severity		Frequent A	Likely B	Occasional C	Seldom D	Unlikely E
Catastrophic	I	E	E	H	H	M
Critical	II	E	H	H	M	L
Marginal	III	H	M	M	L	L
Negligible	IV	M	L	L	L	L
E-Extremely High		H-High		M-Moderate		L-Low

Risk Management



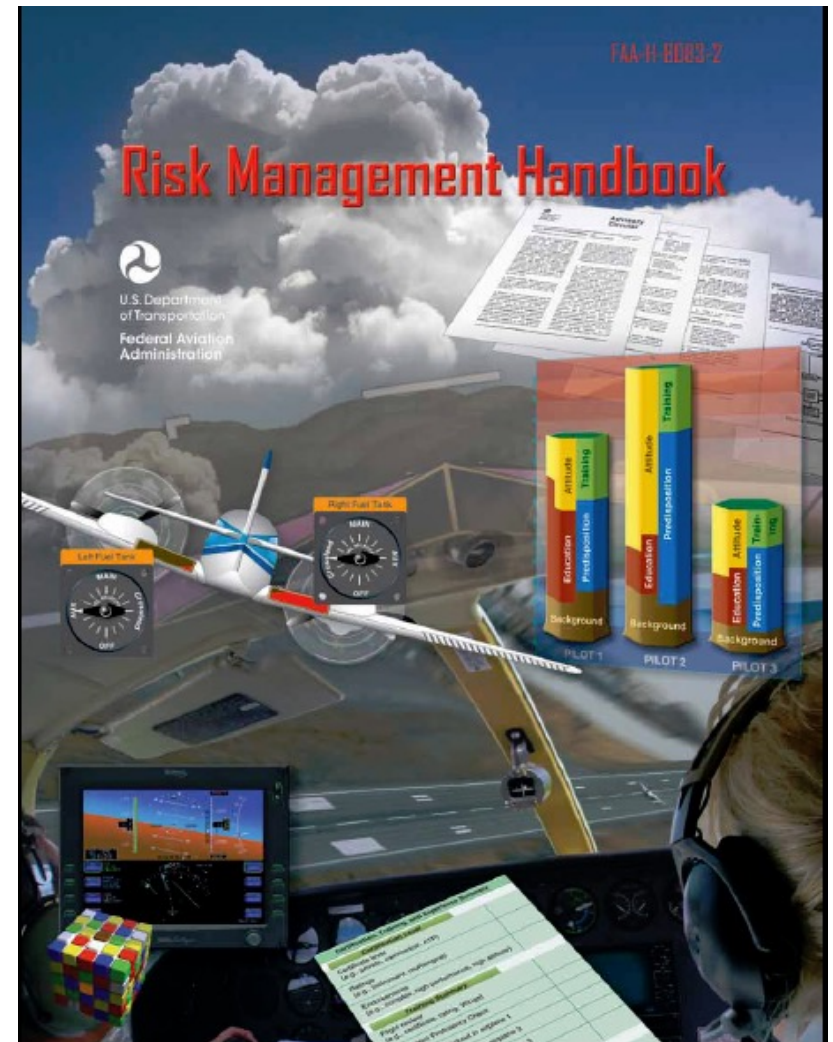
Risk Management: A lousy definition by the FAA



“The part of the decision-making process that relies on

- Situational awareness
- problem recognition, and
- good judgment

to reduce risks associated with each flight” ☹ (FAA)



What is Risk Management? (Two more)



- **Risk Management** is the logical and systematic method of identifying, analyzing, treating and monitoring the risks involved in any activity or process
- **Risk Management** is the identification, assessment, and prioritization of risks followed by coordinated application of resources to minimize, monitor, and control the probability and/or impact of unfortunate events, or to maximize the realization of opportunities



Risk Management for us

- **Risk Management** is the method we use to control, eliminate, or reduce hazards
- **Risk Management** is a decision-making process designed to systematically identify hazards, assess risk, and determine the best course of action
- **Risk Management** is unique to each pilot based on KAS, training, and experience

Basics of Risk Management



- Identifying hazards
 - A present condition, event, object, or circumstance that could lead to or contribute to an unplanned or undesired event such as an accident
- Assessing risk
- Understanding its time-critical nature
- Including risk-management controls

SITUATIONAL AWARENESS



RISK ELEMENTS

Pilot

The pilot's fitness to fly must be evaluated including competency in the airplane, currency, and flight experience.

Airplane

The airplane's performance, limitations, equipment, and airworthiness must be determined.

EnVironment

Factors, such as weather, airport conditions, air traffic and ATC services must be considered

External pressures (Operation)

The operational priorities of the flight are factors which influence the pilot's decision and the course of action

Situation (Our context)

To maintain situational awareness, an accurate perception must be attained of how the pilot, airplane, environment, and operation combine to affect the flight.

When situationally aware, the pilot has an overview of the **TOTAL** of the **risk elements** and **is not fixated on one perceived significant factor**.

FAA outlines risks with the PAVE checklist:



- **P- Pilot**
 - Physical and emotional health, fatigue, medication and stress. The IM SAFE checklist includes illness, medication, stress, alcohol, fatigue and emotion
- **A- Aircraft**
 - Condition of the airplane, its payload and expected performance under certain conditions (passengers, fuel, etc.)
- **V- enVironment**
 - Weather conditions, terrain, airports, and airspace, as well as day and night differences
- **E- External Pressures**
 - Pressure to get to a destination no matter what – called “get-there-it is” by the FAA. **A**irline **O**perational **P**ressure

I'M SAFE Checklist



I'M SAFE CHECKLIST

Illness—Do I have any symptoms?

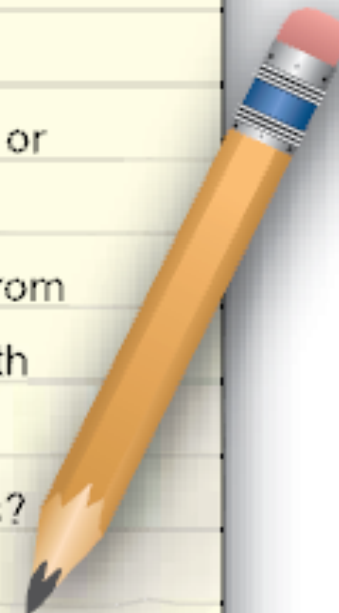
Medication—Have I been taking prescription or over-the-counter drugs?

Stress—Am I under psychological pressure from the job? Worried about financial matters, health problems, or family discord?

Alcohol—Have I been drinking within 8 hours?
Within 24 hours?

Fatigue—Am I tired and not adequately rested?

Emotion—Am I emotionally upset?

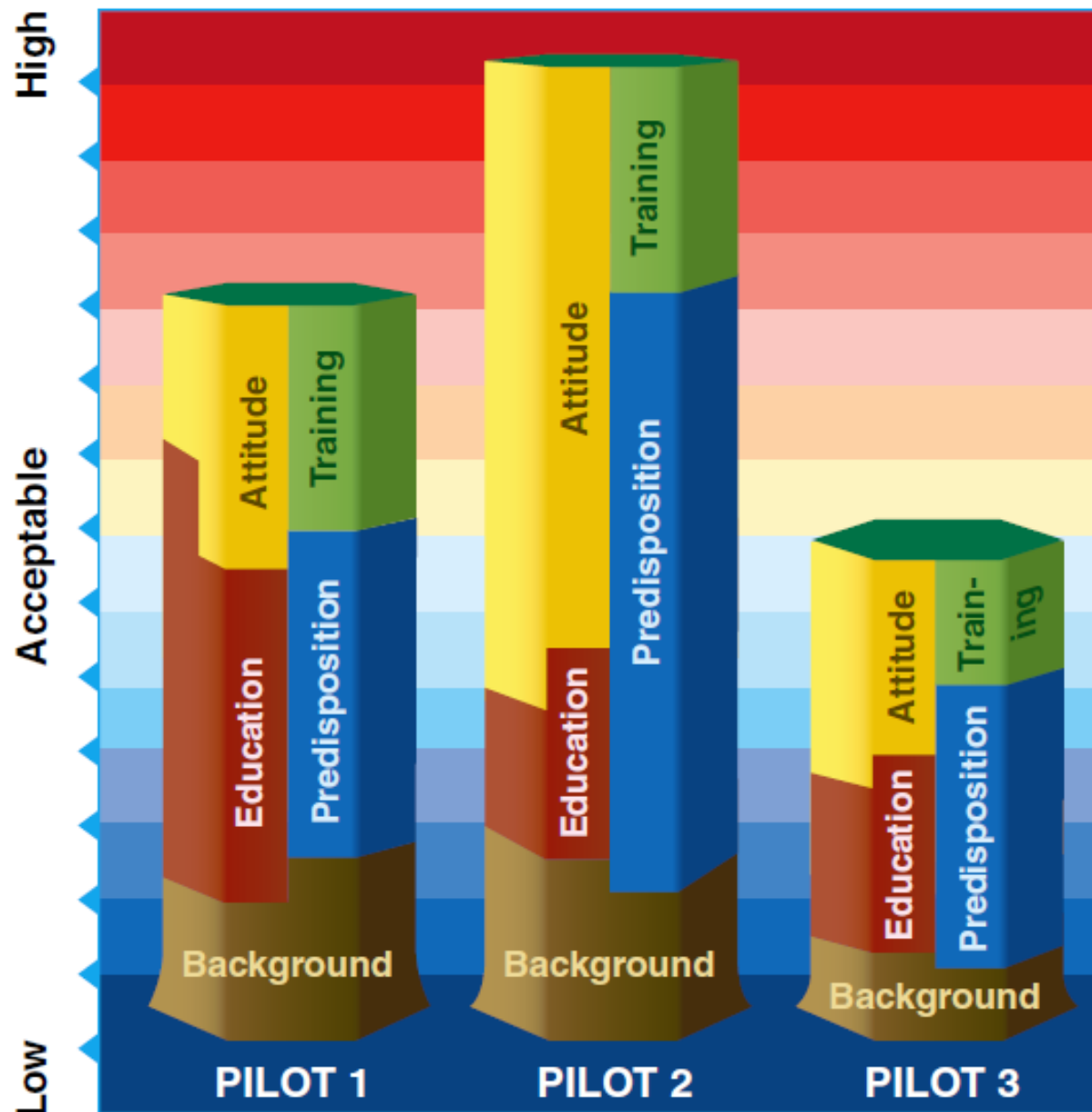


Risk Individual Thresholds

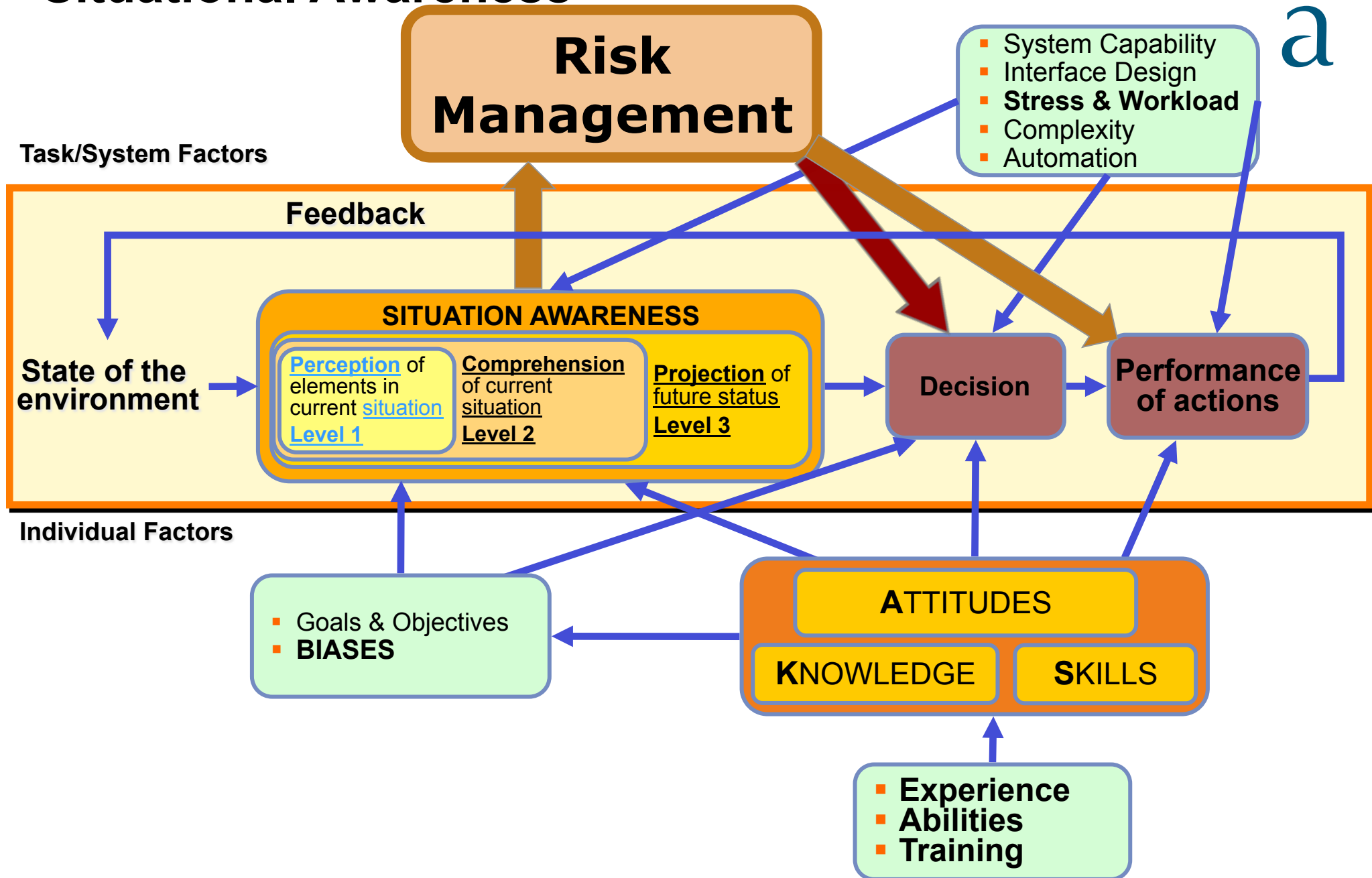


- The risk associated with each hazard varies with each individual pilot
- One pilot might perceive a particular hazard as more of a risk than another
- For example, one pilot might be overcome with stress before a check ride while another pilot will be excited for the challenge
- Neither situation is right or wrong, but the way a pilot manages these risks makes all the difference in the world

Risk Individual Thresholds for FAA ☹

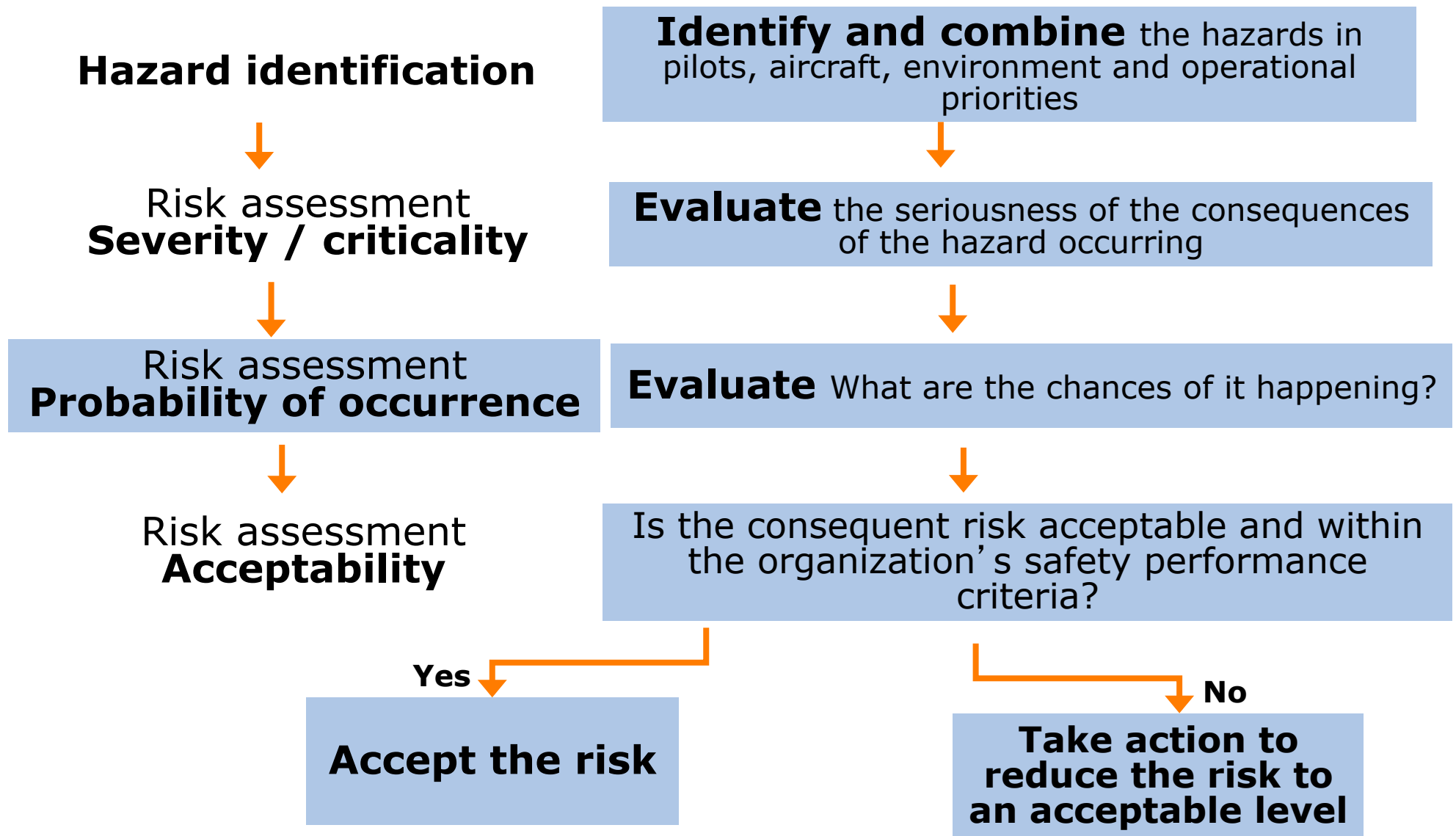


Situational Awareness



Decision Making requires risk management

Risk Management:



What does Risk Management is good for?



- A confident and rigorous basis for decision-making and planning
- Better identification of Threats
- Locates you one step ahead of uncertainty and variability
- Proactive, rather than reactive management
- More effective allocation of resources
- It goes hand by hand with TEM and strategic thinking

More on Risk Management for us



- **Prevention** and **mitigation** are all those actions we can take to make sure that a disaster doesn't happen or, if it does happen, that it doesn't cause as much harm as it could
- What is **prevention**?
 - Taking measures in order to **avoid an event** turning into a disaster Not building close to a fault. Planning, “what if-ing”, flight watch, updating
- What is **mitigation**?
 - Measures that **reduce vulnerability** to certain hazards. There are building techniques that ensure that our buildings will not be knocked down by an earthquake. Active Monitoring, Checklists and Cross checking
- Prevention and mitigation begin with: Knowing which hazards and risks we are exposed to



Pilot's Risk Management

- Assess the potential risk associated with planned flight during preflight planning and in flight
- Explain risk elements with the given scenario and how each was assessed
- Use a tool, such as PAVE to identify the risk elements

Pilot –

Aircraft –

enVironment –

External Pressures (Operation, AOP)

RISK ASSESSMENT

Pilot's Name

Flight From

To

SLEEP

1. Did not sleep well or less than 8 hours ☐ 2
2. Slept well ☐ 0

HOW DO YOU FEEL?

1. Have a cold or ill ☐ 4
2. Feel great ☐ 0
3. Feel a bit off ☐ 2

WEATHER AT TERMINATION

1. Greater than 5 miles visibility and 3,000 feet ceilings ☐ 1
2. At least 3 miles visibility and 1,000 feet ceilings, but less than 3,000 feet ceilings and 5 miles visibility ☐ 3
3. IMC conditions ☐ 4

Column total ☐

HOW IS THE DAY GOING?

1. Seems like one thing after another (late, making errors, out of step) ☐ 3
2. Great day ☐ 0

IS THE FLIGHT

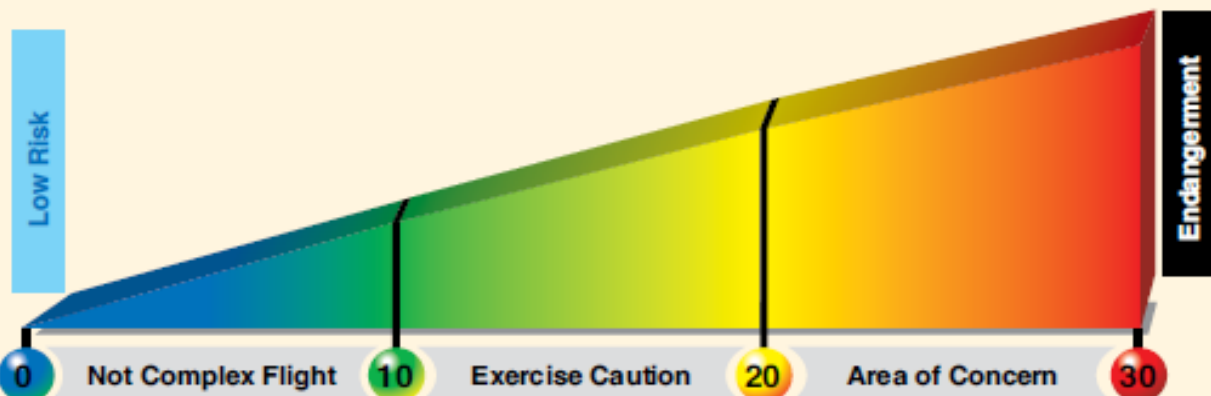
1. Day? ☐ 1
2. Night? ☐ 3

PLANNING

1. Rush to get off ground ☐ 3
2. No hurry ☐ 1
3. Used charts and computer to assist ☐ 0
4. Used computer program for all planning Yes ☐ 3
No ☐ 0
5. Did you verify weight and balance? Yes ☐ 0
No ☐ 3
6. Did you evaluate performance? Yes ☐ 0
No ☐ 3
7. Do you brief your passengers on the ground and in flight? Yes ☐ 0
No ☐ 2

Column total ☐

LEFT COLUMN TOTAL ☐ + RIGHT COLUMN TOTAL ☐ = TOTAL SCORE



Risk Management for dummies

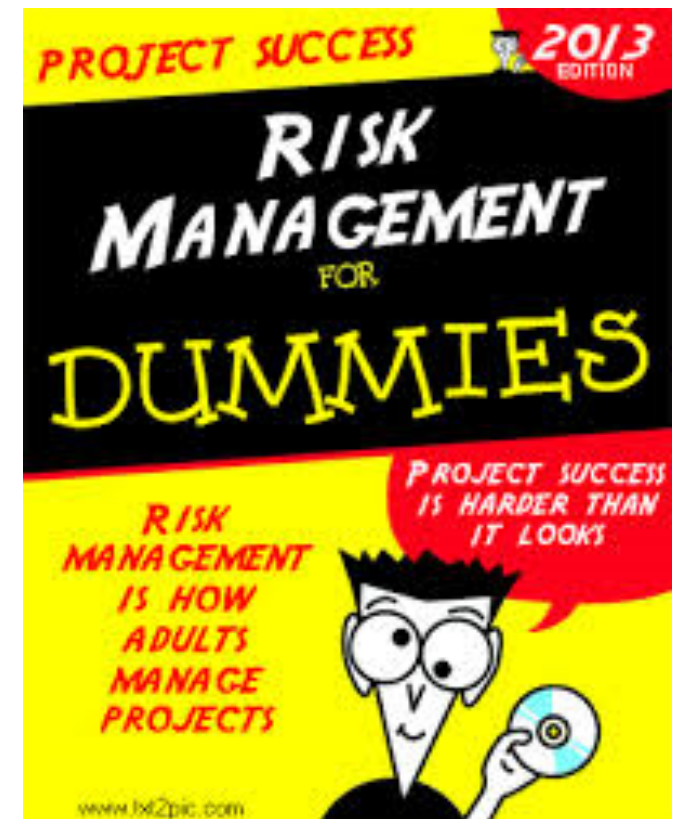


Before you make decisions, you must:

- ✓ **Identify** risk factors (hazards)
- ✓ **Assess** their likelihood
- ✓ **Evaluate** their severity

And ask four basic questions:

- ✓ Is it **safe**?
- ✓ Does it comply with **SOP's**
- ✓ Is it **legal**?
- ✓ Does it **make sense**?

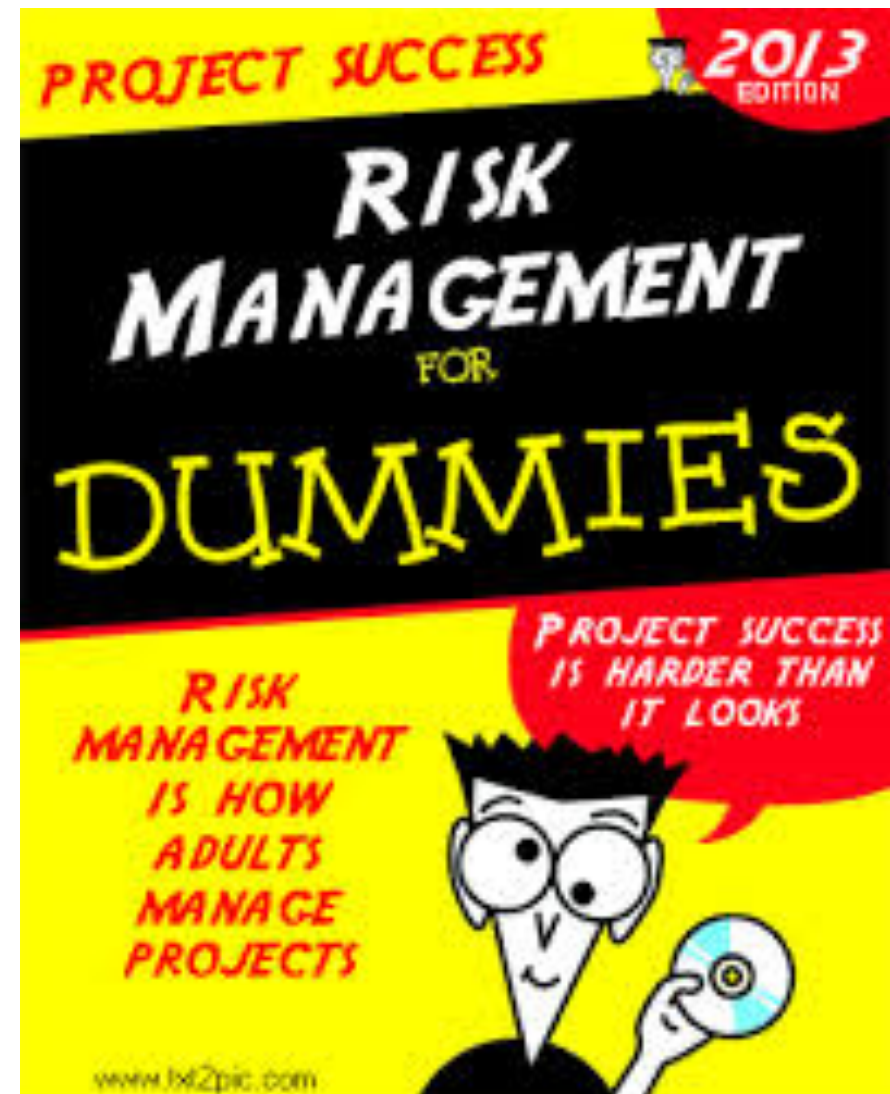


Risk Management for dummies



Review and Workshop!!!!

Risk Assessment Tool & AC
120-92





Risk Matrix

AS/NZS 4360:2004



Risk Assessment Severity

Severity level	Consequences Types					
	Profit reduction	Health and safety	Natural environment	Social/cultural heritage	Community/ govt/ reputation/ media	Legal
V	US\$10M–US\$100M	Multiple fatalities, or significant irreversible effects to >50 persons	Very serious, long-term environmental impairment of ecosystem functions			Significant prosecution and fines Very serious litigation including class actions
IV	US\$1M–US\$10M	Single fatality and/or severe irreversible disability (>30%) to one or more persons		On-going serious social issues. Significant damage to structures/items of cultural significance	Serious public or media outcry (international coverage)	Major breach of regulation Major litigation
III	US\$100 000–US\$1M	Moderate irreversible disability or impairment (<30%) to one or more persons	Serious medium term environmental effects		Significant adverse national media/public/NGO attention	Serious breach of regulation with investigation or report to authority with prosecution and/or moderate find possible
II	US\$10 000–US\$100 000	Objective but reversible disability requiring hospitalization	Moderate, short-term effects but not affecting ecosystem functions	On-going social issues. Permanent damage to items of cultural significance	Attention from media and/or heightened concern by local community. Criticism by NGOs	Minor legal issues, non-compliances and breaches or regulation
I	<US\$10 000	No medical treatment required	Minor effects on biological of physical environment	Minor medium-term social impacts on local population. Mostly repairable	Minor, adverse local public or medical attention or complaints	

Severity Regarding Objectives

Descriptive	Definition
Severe	Most objectives cannot be achieved
Major	Some important objectives cannot be achieved
Moderate	Some objectives affected
Minor	Minor effects that are easily remedied
Negligible	Negligible impact upon objectives

Probability Scale



Level	Descriptor	Description	Indicative Frequency (expected to occur)
A	Almost certain	The event will occur on an annual basis	Once a year or more frequently
B	Likely	The event has occurred several times or more in your career	Once every three years
C	Possible	The event might occur once in your career	Once every ten years
D	Unlikely	The event does occur somewhere from time to time	Once every thirty years
E	Rare	Heard of something like the occurring elsewhere	Once every 100 years
F	Very rare	Have never heard of this happening	One in 1000 years
G	Almost incredible	Theoretically possible but not expected to occur	One in 10 000 years

Descriptor	Description	Alternative Descriptor
Probable	Can be expected to occur during the project	Good odds
Possible	Not expected to occur during the project	Low to even odds
Improbable	Conceivable but highly unlikely to occur during the project	Poor odds

Level of Risk



Likelihood Label	Consequences Label				
	I	II	III	IV	V
A	Medium	High	High	Very high	Very high
B	Medium	Medium	High	High	Very high
C	Low	Medium	High	High	High
D	Low	Low	Medium	Medium	High
E	Low	Low	Medium	Medium	High



Risk Matrix FAA Perspective

FAA Risk Matrix



SEVERITY:

1 CATASTROPHIC – Death, system or aircraft loss, permanent total disability

2 HAZARDOUS - Severe injury or major aircraft or system damage

3 MAJOR - Minor injury or minor aircraft or system damage

4 MINOR – Less than minor injury or aircraft or system damage

5 NO SAFETY EFFECT

PROBABILITY:

A PROBABLE - Likely to occur in lifetime of each system ($> 1E-5$)

B REMOTE – Possible for each item, several for system ($< 1E-5$)

C EXTREMELY REMOTE – Unlikely for item, may occur few in system ($< 1E-7$)

D EXTREMELY IMPROBABLE – so unlikely, not expected in system ($< 1E-9$)

SEVERITY	PROBABILITY			
	A	B	C	D
1				
2				
3				
4				
5	No risk			



Severity Definitions

Catastrophic	Results in multiple fatalities and/or loss of the system
Hazardous	Reduces the capability of the system or the operator ability to cope with adverse conditions to the extent that there would be: Large reduction in safety margin or functional capability Crew physical distress/excessive workload such that operators cannot be relied upon to perform required tasks accurately or completely (1) Serious or fatal injury to small number of occupants of aircraft (except operators) Fatal injury to ground personnel and/or general public
Major	Reduces the capability of the system or the operators to cope with adverse operating condition to the extent that there would be – Significant reduction in safety margin or functional capability Significant increase in operator workload Conditions impairing operator efficiency or creating significant discomfort Physical distress to occupants of aircraft (except operator) including injuries Major occupant illness and/or major environmental damage, and/or major property damage
Minor	Does not significantly reduce system safety. Actions required by operators are well within their capabilities. Include Slight reduction in safety margin or functional capabilities Slight increase in workload such as routine flight plan changes Some physical discomfort to occupants or aircraft (except operators)
No Safety Effect	Has no effect on safety



RISK MATRIX EXERCISE

Exercise Steps

Severity Scale



1. Define the dimension or element that is affected (Examples: People, Machines, Infrastructure, Image, Environment, Organizational Environment, Customers, Services, Operational Processes, Systems, Objectives, Economics, etc.)
2. Define the different levels of severity (3, 4 , 5 or more)
3. Define the value symbols that you are going to use (numbers, letters, other symbols)
4. Define the terms used for each value
5. Describe each term
6. Prepare your chart presentation

Severity Scale:



Value	Term	Description



Questions?