Luxair Human Factors Training Team

Course Concept for Topic Resilience Engineering

Luxair Trainer Handout – Topic Resilience Engineering

Dear Trainers, dear Moderators,

Below you will find a course concept to treat the topics resilience, resilience engineering, resilience development. The course is a joint course for flight crew and cabin crew members and had been imbedded into a full day crew resource management training event. It consists of a PowerPoint presentation and a trainer handout. The course has been created by the Human Factors Team of Luxair, Luxembourg Airlines.
You are free to use the product at your convenience but we reverentially ask to include the source into your presentation.

Luxair, Luxembourg Airlines is the flag carrier of Luxembourg operating airplanes on short and medium routes.
The Luxair Human Factor Team involved in the creation of this course consists of following people:

Captain Marc Frank, CRM Instructor
Gunnar Steinhardt, Aviation Psychologist
Captain Alain Ronk, CRM Instructor
Mrs. Martine Konsbruck, CRM Instructor
Mrs. Sara Ciaccasassi, CRM Instructor
Mr. Rafael Vernhes, CRM Instructor

The course is mainly based on the book “Resilience Engineering in Practice” by Erik Hollnagel, Jean Pariès, David Woods, John Wreathall and others. All references are given below.
The course has been designed in such a way that it uses the definition of resilience, splitting it up into chunks of information to explain the topic step by step. At the end the course will culminate in a single slide representing an easy to remember acronym to summarize the acquired elements. The acronym has been created by the Luxair Human Factors Team. The course uses different methodologies to reach this aim: trainer competence, slides, videos, flipchart posters, moderation cards and group works.
Due to the huge amount of video players on the market, the videos are not provided as such; the internet links are, however, given to assure easy retrieval.

At the end of the course, the Luxair Human Factors Team decided to use a case study to put resilience principles into a real world context. The methodology used was an accident investigation by the participants. Information about the case study is provided below.

PowerPoint Presentation:
The presentation has been designed for the course participants and not for the trainers. This means that there will be only a very limited amount of text on the slides. Indeed it is generally accepted in the scientific world that participants cannot retain text without repetition. It is impossible to stay concentrated and read text of unknown subjects for a longer period of time. Therefore the slides visually underline what the trainer is saying, thus creating stimuli for the participants. For the trainers

this means that a trainer handout is necessary to understand the context of the slides. The trainers will have to commit part of the handout to memory although the slides include hints to guide the trainer to the next subject. In order to simplify the implementation of the course, we provide here the complete PowerPoint presentation, including all animations. The animations are quite subtle and serve a useful purpose: they captivate the audience without disturbing the learning flow. Generally we have very good results with this didactical concept.

Trainer Handout:

The trainer handout provides all necessary information to present the topic in a professional way. The trainer handout has been written in an I-form which makes it easy for the concerned trainer to acquire the necessary information. Trainer freedom is important and the handout should be considered as a guideline providing a solid foundation for the course delivery. The handout includes both instructions on how to use the PowerPoint presentation and supplementary information for trainer comprehension.

Case Study:

In order to link the studied subject to a real case, the Luxair Human Factors Team used the Air India Express IX812 accident at Mangalore airport, India to illustrate the topic. Indeed the accident could have been avoided by applying resilience principles. The case study was designed in such a way to put the course participants in the role of investigators. The accident was analysed thoroughly and several defences were identified which all had the potential to avoid the fatal outcome would resilience principles have been applied.
The case study was well appreciated by the participants and created several “Aha-effects”, seeing resilience in practice.

Time Line:

The theoretical part of the course will take approximately two hours and a half. For the subsequent case study another two hours should be provided. We recommend catering for a 10 minute break in each of the two sections. The number of participants should be 12 to 16 people.

Dear colleagues, we hope we could arouse your enthusiasm for the subject and wish you a successful and high-flying course.

Captain Marc Frank
Dipl-Psych. Gunnar Steinhardt

References:

Hollnagel E., Pariès J., Woods D., Wreathall J.
"Resilience Engineering in Practice" 2011 Ashgate

Woods D., Dekker S., Cook R., Johannesen L., Sarter N.
"Behind Human Error" 2010 2nd Edt. Ashgate

Sidney Dekker on Resilience
http://www.youtube.com/watch?v=mVt9nIf9VJw

How to choose Eyeglasses: Memory Metal Frame Advice
http://www.youtube.com/watch?v=rR2EFH4aJcs

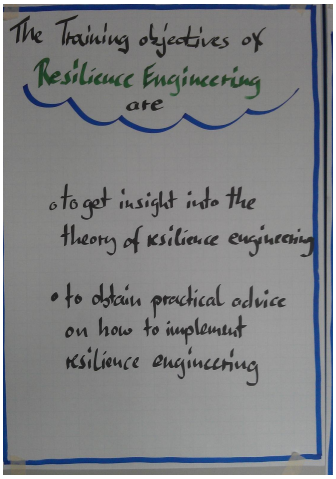
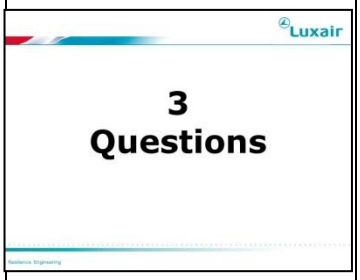
Sidney Dekker on Resilience
http://www.resilience-engineering-association.org/resources/videos/

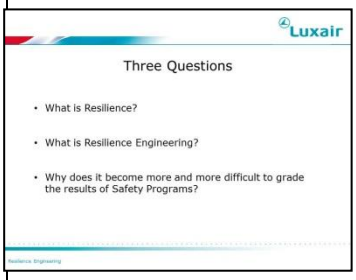
Air India Express IX812 Final Report
http://dgca.nic.in/accident/reports/VT-AXV.pdf

Trainer Handout

CRM – Joint Training CABIN & COCKPIT:

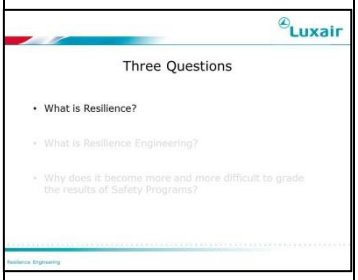
'Resilience Engineering'

Methodology	Content
	One of our training topics of today concerns the field of human error: it is called Resilience Engineering.
	The training objectives are: • To get insight into the theory of resilience engineering • To obtain practical advice on how to implement resilience engineering in our professional life.
	*Info to trainer:* *We advise to prepare the training objectives on a flipchart poster and to display them in the class room. In this way the training objectives remain visible to the participants throughout the course.*
	Let's start the subject by asking 3 questions, which each of you will try to answer individually. We provide a sheet of paper and of course you are allowed to exchange your opinion with one or two neighbours. It is not important if you find an answer to all three questions or to just one; what we are asking for is just your opinion. The sheet of paper will remain with you. You have about 5 or 6 minutes at your disposal and the questions are the following:



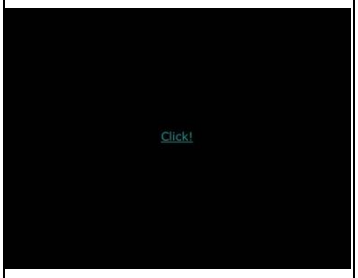
- In your eyes, what is resilience?
- In your eyes, what is resilience engineering?
- Why does it become more and more difficult to grade the results of safety programs?

Allow 5-10 minutes to answer the questions.
Info to trainer:
Copy this slide to distribute to the participants.



Let's start with the first question: In your eyes, what is resilience?

Ask some participants directly, acknowledge but make no comments.

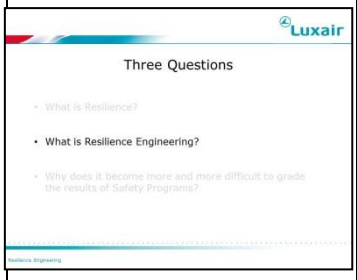


Let me show you what resilience is.

Show video.
Video link: http://www.youtube.com/watch?v=rR2EFH4aJcs

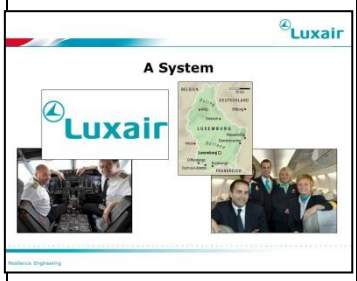
Info to trainer:
At your convenience, you might want to copy the video and insert it directly into the presentation.

Glasses consist of two components. The frame and the lenses. The frame is designed to maintain the lenses in place. Under the influence of external pressure, or let's call it external stress, the frame will bent; but it will still maintain its basic operation, which is to maintain the lenses in place. Once the external force is removed, they revert back to their normal shape and normal operation again. That is resilience. As said in the video, it does not mean that the frame is unbreakable, no, if you twist it too much it will eventually break.
(If a participant mentioned the psychological aspect of resilience, acknowledge this now.)
Nowadays there is also this psychological aspect of the term resilience: it is used to describe the ability to recover from tragedy. This is, however, not what we would like to talk about today.

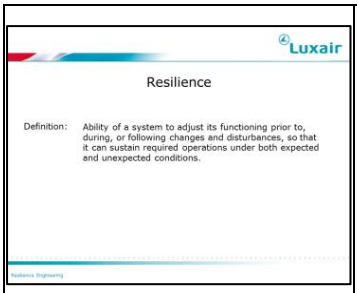


Let's then come to our second question:
In your eyes, what is Resilience Engineering?

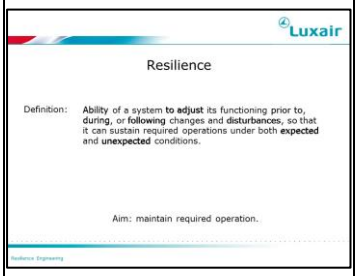
Ask some participants directly, acknowledge but make no comments.
Info to trainer:
In the following you might want to replace Luxair by your own company and Luxembourg by your own country.



Well, Resilience Engineering is talking about a system.
So, first we have to define what a system is. A system means more than one.
(click) Two pilots in a cockpit is a system.
(click) A crew of an airplane is a system.
(click) Luxair as a company is a system.
(click) Luxembourg as a country is a system and so on.
Everything that is more than one is a system. You together with a computer, is a system; you alone, is not a system.



We can now come to a definition of resilience in systems:

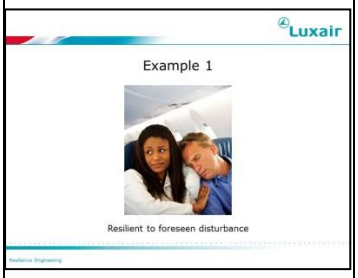


(click) Resilience is the ability of a system to adjust its functioning prior to, during, or following changes and disturbances, so that it can sustain required operations under both expected and unexpected conditions.

OK, at first sight this sounds a bit complicated, so let's try to simplify this a bit.

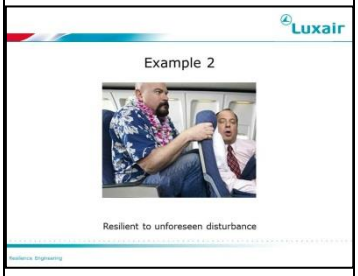
(click) It's the …ability…to adjust…prior to, during, or following disturbances which might be expected or unexpected. The aim is (click) to maintain required operation.
Expected or unexpected disturbances; actually has the following meaning: the disturbance itself is always unexpected. We did not foresee that this event would happen right now. But this kind of disturbance was known, it could happen during a flight. Therefore procedures exist. But maybe no one was thinking about this problem before and you are the first person in such a situation, well then obviously procedures do not exist for this disturbance. It is unexpected. Just to make it clear: the disturbance itself is always unexpected; it might just be that there are procedures for it or not.

Let's see some examples.



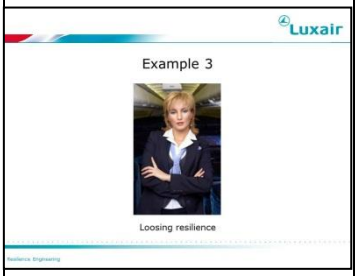
A cabin attendant is walking through the cabin. A passenger is stopping her. (click) "Excuse me please; I think my neighbour has a heart attack." The cabin attendant has to react now. Procedures do exist for this situation and after application of these procedures; the system "cabin" is reverting back to normal operation. This means that (click) we are resilient to foreseen disturbances.

Let's see a second example.

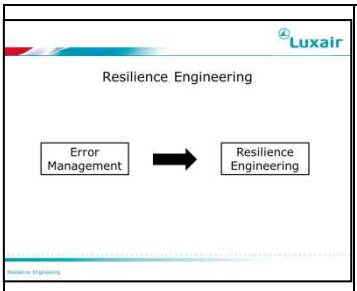


A cabin attendant is walking through the cabin. A passenger is stopping her. (click) "Excuse me please; give me a bottle of whiskey or I will kill my neighbour."
The cabin attendant has to react now. Procedures do not exist for this situation; after the situation is cleared, the system "cabin" is reverting back to normal operation. This means that (click) we are resilient to unforeseen disturbances.

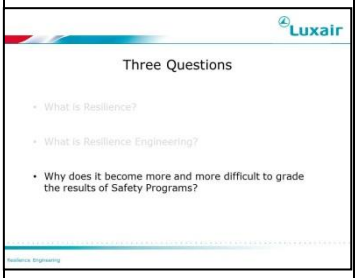
And let's see a last example.



We are inflight on a Boeing 737, CCM2 is coming to the front to talk to the purser. She says: "Since the rear coffee makers do not work, I have a good idea how to rearrange the service and…" The purser is stopping her right there: "No, no. I don't even want to hear this. We do it my way. I have always done it like that and it works." In this case (click) we are losing resilience. Of course these examples are overdone, to make the message clearer.



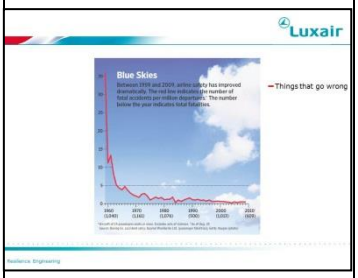
Resilience Engineering is the logical consequence of error management. In our previous courses we were talking about human error, that was a first step and today we take the next step, which is resilience engineering.



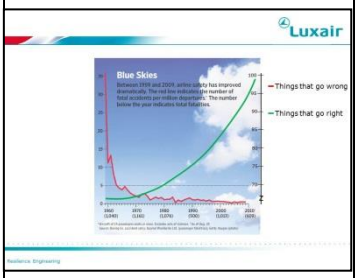
Before we continue, let's come to our third question:

Why does it become more and more difficult to grade the results of safety programs?

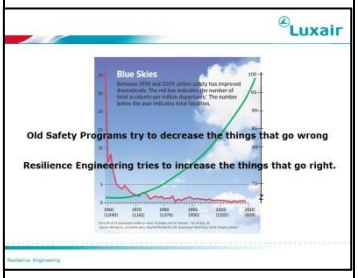
Ask some participants directly, acknowledge but make no comments.



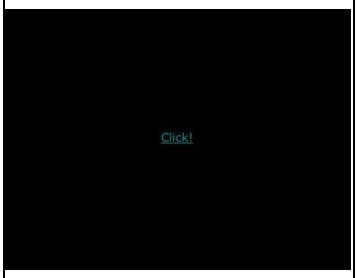
On this picture we see the aviation accident rate over the years. The scale starts around 1960 and goes up to 2010. The red curve shows the accidents that happened. We see that in the beginning, quite a lot of accidents happened, but then the rate was tremendously reduced over the years. The last 20 years only very few accidents happen. This is a very good thing and aviation industry has made a tremendous effort. Aviation has become a highly reliable industry. Well, on the end of the scale near 2010, the red curve is almost horizontal. That means if a new program is implemented; it is very difficult to find out if there is a certain impact. Because so few accidents happen, the curve will not change.
Since this red line represents accidents, we could also say, these are the things that went wrong.



Well then by analogy we could integrate a line which would represent the things with a positive outcome, the things that went right.
This line would then look like this. In the beginning not everything has a positive outcome, but then over the years, the curve expands to the top. And now you see that here it is easier to see if a certain program has an impact since a lot of things go right, You just have a higher sampling rate. And that is the difference between "old" safety programs and Resilience Engineering.

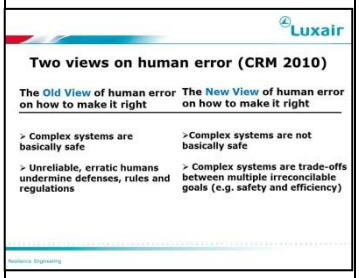


"Old" safety programs try to decrease the things that go wrong; (click) Resilience Engineering tries to increase the things that go right. To some extend Resilience Engineering is the anti-polar to safety programs, however, both having the same ultimate aim. By increasing the things that go right, of course you also reduce the things that go wrong but even on top of that, you become more efficient, as well.



We have now a short video, in which Sidney Dekker is explaining what Resilience Engineering is. Sidney Dekker is a Professor, best-selling author on human factors and a pilot. He is currently Professor at Griffith University in Australia.
The video is running for about 4 minutes. Let's have a look.

Show video.
Video link: http://www.youtube.com/watch?v=mVt9nIf9VJw
Info to trainer:
At your convenience, you might want to copy the video and insert it directly into the presentation.

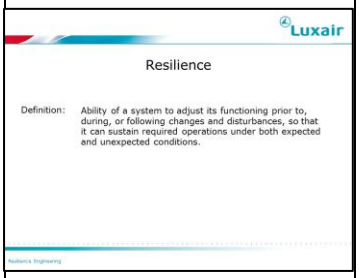


It's not about the absence of something; it's about the presence of something. It's about identifying and enhancing the positives.

Well after this video, maybe you say: that reminds me of something. I heard that already somewhere. And you would be correct.

Indeed, in our previous courses we presented two views on human error to you. There was the old view on human error and how to make it right and the new view on human error and how to make it right.
The old view on human error said (click):
Complex….(read slide)

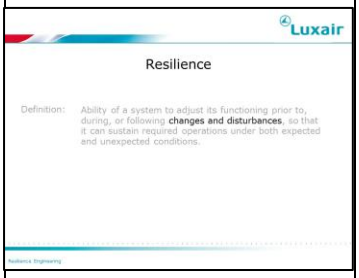
(click)
Unreliable…(read slide)



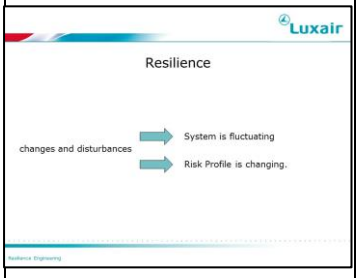
That is as well what Mr Dekker said. Indeed it started with error management, but now we take the next logical step: Resilience Engineering.

Let's come back to the definition of Resilience.

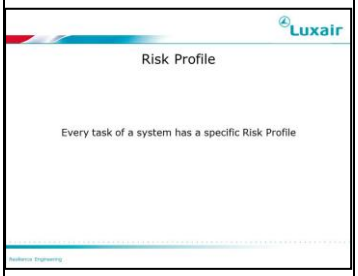
Resilience is the ability of a system to adjust its functioning prior to, during, or following changes and disturbances, so that it can sustain required operations under both expected and unexpected conditions.



And now let's focus on changes and disturbances.



(click) Changes and disturbances will make the system fluctuate. That means that its risk profile is changing.



Indeed every task of a system has a specific risk profile, which is known beforehand. And this profile is different for every task of the system.

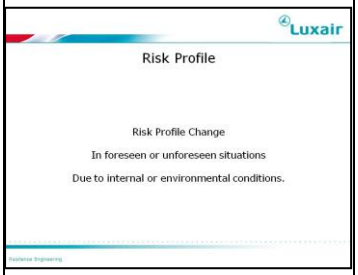
If you are flying to Funchal with a difficult approach, this has a specific risk profile, which is known to you even before you take-off. You know already beforehand what it will look like.

(click) And this flight has a different risk profile as a flight to Frankfurt with high traffic density. And that flight, as well, has a specific risk profile which you know even before leaving home base. You know that there will be a lot of traffic.

(click) And that flight has a different risk profile as a flight to Marrakech with difficult ATC. And also that you know already before take-off. It does not mean that one flight is more dangerous than another; no, it just means that it is different. Things that you would qualify as “normal”, “standard” in RAK like somewhat strange ATC, would ring your alarm bells if that would happen in FRA. So, for every flight, there is a specific risk profile and that profile is known.

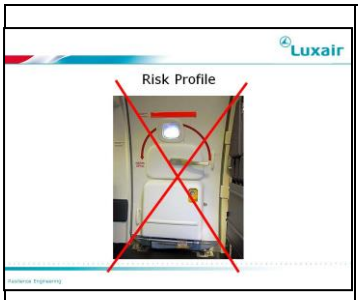
That is for the cockpit, but in the cabin we have the same.

A flight to Mallorca in high season with a full load of pax has a certain risk profile and that as well you know before leaving home. You know what you can expect. And this profile is different from a flight to Nice on a Bombardier Q400 with only 50 pax. And there are things that you may see on a PMI flight, which will annoy you but which you would qualify as “normal”; it’s PMI, but if those things would happen on a flight to NCE you would see them as very strange and your alarm bells will ring.

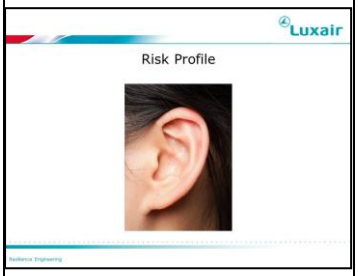


We just have to notice when this given profile is changing. And the risk profile will change in expected or unexpected situations, due to internal or environmental conditions; internal meaning that the disturbance comes from the system itself, environmental means that it comes from outside of the system.

For instance if all of a sudden a thunderstorm develops over your destination airfield, the risk profile is changing.



Or, if before departure a cabin door is inoperative, the risk profile is changing.

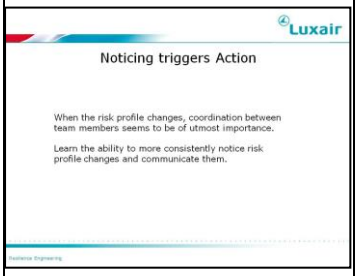


These examples are obvious, now a bit more subtle, if you here a strange unfamiliar noise, the risk profile is changing.
It does not mean that the flight is at danger now, no, it just means that there was a change.

A change away from the standard setting is always a change in risk profile.
Normally a Purser (SCCM) is flying together with a CCM; normally a Captain is flying with a co-pilot. But sometimes (click) two SCCM have to fly together and sometimes to Captains have to fly together. That is a change in risk profile. It does not mean that it is more dangerous, now. Maybe it's even safer now. But the risk profile has changed.

We have to notice this change.

Noticing triggers action. If you notice something (click) you can do something. If you notice that the glass is falling off the table, you can try to catch it. If you do not notice, it will fall to the floor.
Noticing is very important. Noticing triggers action.



When the risk profile changes, coordination between team members seems to be of utmost importance.
Accident investigations have shown that very often towards the end of the event, coordination between team members is lost. Everybody is doing something but they are not acting as a team anymore.

Learn the ability to more consistently notice risk profile changes and communicate them. Maybe you are the first one to notice it. Do not assume that the other one saw it as well. Say it. Communicate to bring your team into the boat.

We have now a small exercise which you should complete together with your neighbour. We have small situation cards, for you to decide if your card represents a risk profile change or not. You have about 5 minutes for discussion.

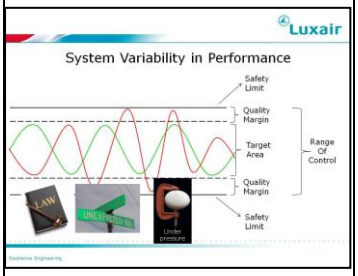
Ask every team for their opinion and then explain the scenario.
Info to trainer:

- *At the end of this trainer handout you will find generic text samples. If convenient, print these samples on moderation cards to distribute to the participants. The trainer may choose*

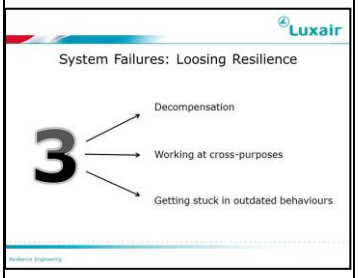
the card according to the rank (Pilot/Cabin Attendant).

- *The aim of this exercise is to show that not everything is a risk profile change. The text cards are selected in such a way that a same event will represent a change or not, depending on circumstances.*

We saw now quite some profile changes, actually why is this so? Why is a system changing?

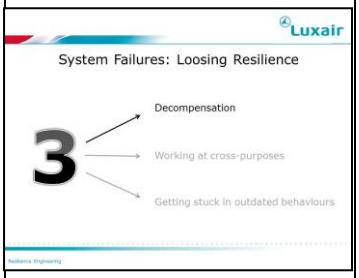


Well, any system has certain variability. It is not always the same. Not two flights are the same. The system is fluctuating within a certain area. It is not a straight line but more kind of a curve. This middle part here represents the target area. Normally the system should stay within this area.
There are some limits and some margins. The dashed line represents the quality limit. Normally the system should stay within the target area. If it fluctuates to beyond the quality boundary, the situation is not inherently dangerous but it is non-desirable. The system should be manoeuvred back into the target area quickly.
The solid lines represent the safety limits. If the system goes out of this limit then the situation becomes dangerous.
Normally the system stays well in the target area. (click)
However, if you want it or not, every system will from time to time challenge the safety boundaries of its operation. (click) It will from time to time fluctuate towards the safety limit.
Why is this so? (click)
Well, rules and regulations have fundamental limits. You can not foresee everything. That's just not possible. And the environment is changing in very surprising ways. You did not intend to see this situation appear but now you are in. And there might be some internal pressures which make the system fluctuate. This could for instance be: efficiency. Your system might be very safe already and then now it has to become more efficient. This makes the system fluctuate.

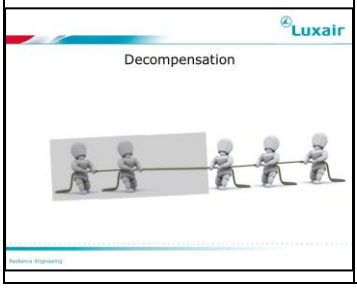


There are 3 conditions that could make a system fail. Pay attention, not to get it wrong. If your system is resilient already, then there are only 3 conditions why your system could still fail. If your system is not resilient then there are maybe 30, 50, plenty of conditions why it could fail. So, if it is resilient then there are 3 conditions why it could fail; only three.

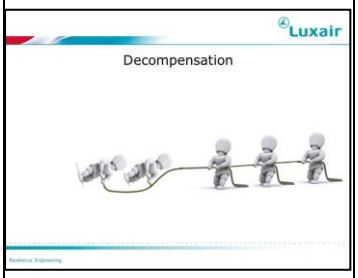
These 3 conditions are:
(click) decompensation,
(click) working at cross-purposes
(click) getting stuck in outdated behaviours.



We will see each of them a bit more in detail now and we start with (click) decompensation.

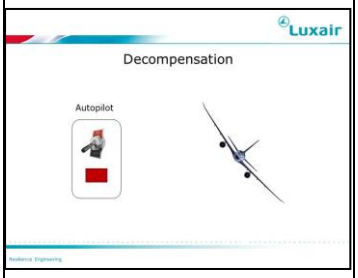


Compensation means that something is happening and you compensate for it.
(click)
Then something else happens and you compensate again. You got the picture, right.
(click)

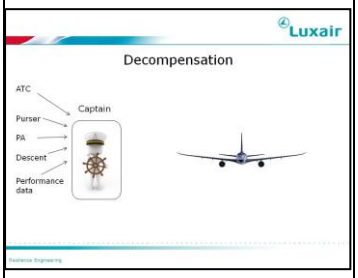


And then something else happens. But of course there is a certain point where you cannot compensate anymore. You just have no free capacity anymore; you are at your limit. You cannot handle more. Well, then de-compensation will occur and the system will (click) collapse. You have reached the decompensation phase.

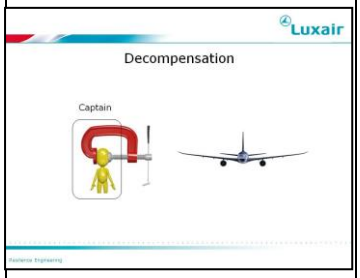
Let's see an example. We are inflight during cruise, when suddenly an engine is failing. Initially the autopilot will try to compensate but its limits will be reached and the autopilot will drop off.



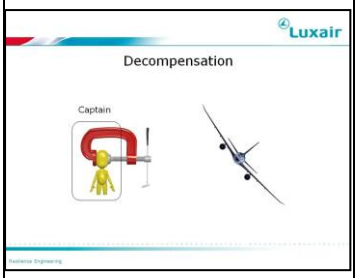
(click) The aircraft will turn. That is when we have to interfere.



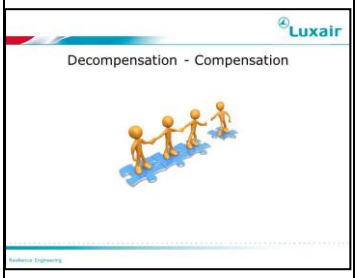
In our case, the Captain is taking over controls. So, basically the Captain is compensating the malfunction. But then the Captain decides to talk to (click) ATC to explain the situation and to ask for descent since we cannot maintain the altitude single engine. He is talking to ATC while he is flying the airplane.
The he decides to call the purser (click) to explain the situation, while he is listen to ATC and flying the airplane.
Besides that the Captain thinks already about his PA and what he will tell the passengers, while he is talking to the purser, listening to ATC and flying the aircraft.
ATC allows descent and the Captain initiates descent, while he is thinking about his PA, talking to the purser, listening to ATC and flying the aircraft.
And the Captain reflects already about the landing (click) and related performance issues, while he is initiating the descent, thinking about his PA, talking to the purser, listening to ATC and flying the aircraft.



You can imagine how the Captain will feel. Sooner or later his limits will be reached and he cannot compensate anymore. That is when decompensation will occur (click)…



… and the aircraft will do funny things.

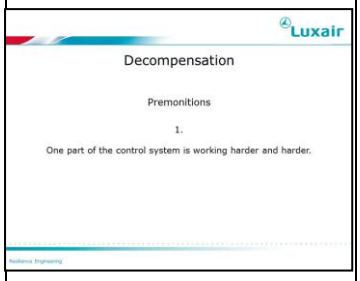


The remedy here is easy to see: the team. Don't try to do everything on your own, use the team.

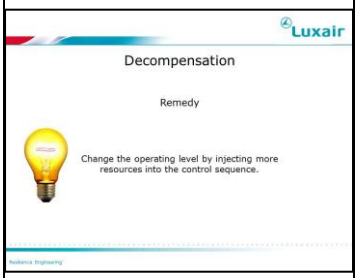
Interesting to remark is that the part of the system which is under pressure will not see the approaching decompensation phase. In our example, the Captain will not see that we are about to enter decompensation. But the team will see it. And the team can remedy the situation by helping.

What matters most is team success, not individual success.

In short, decompensation occurs if one part of the control system is working harder and harder and cannot compensate the events anymore. The system collapses.



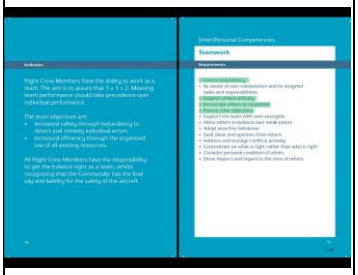
There are some premonitions, some signs indicating that we are approaching the decompensation phase.
(click) One part of the control system is working harder and harder.



There is a remedy as well:
Change the operating level by injecting more resources into the control sequence or in other words, help!

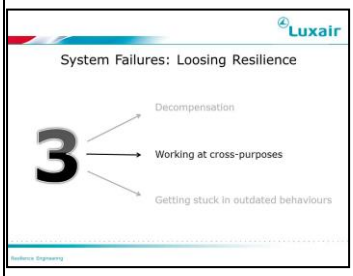
And there we have this nice piece of equipment to help you.

Info to trainer:
Luxair Human Factors Department created a booklet called Pilot's Competencies. In this booklet we regroup definitions and requirements of human factor topics to ensure that our pilot population has a common base. If you require a copy, you may contact us on Luxair Crew Training Department, Human Factors Team at hfinstructors@luxair.lu.
Otherwise you might use these slides and the following ones as examples or replace them by your own.



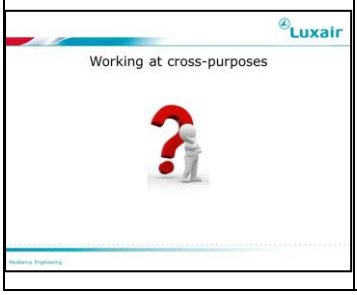
And if you open this booklet at the prominent page which is "Teamwork", you will find on one page a definition of teamwork and on the other page some requirements, yes some good requirements for good teamwork.
Please allow us to just point out a few of them:

(click) Ensure redundancy.
Use the team to accomplish the task; assure that there is a backup if needed.
(click) Support others actively.
If you see that one of your colleagues is working harder and harder, then help, assist.
(click) Encourage others to cooperate.
Allow others to help you. Do not try to do everything by your own.
(click) Pursue crew objectives.
Act towards achieving the common goal; the success of the team is the first priority, here.
The other points are also interesting and important, but we just wanted to point out these four.
(click =>)



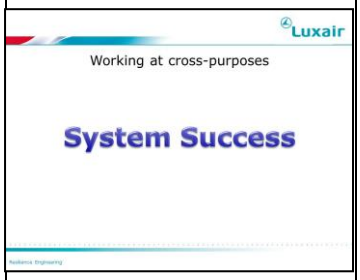
The next condition which could make your system fail is: working at cross-purposes.

Let's imagine, we are flying to PMI. We have a nice tailwind, therefore we arrive in Palma half an hour early.
Now, I say to myself, since we had tailwind coming here, we will have headwind going back home. We will fly half an hour longer and we will have half an hour delay arriving back in Luxembourg. The aircraft continues to fly, so our colleagues will also have delay and that continues like that over the day.



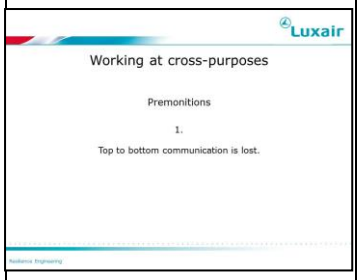
So, why not leave half an hour early and we will be on time in LUX and no one will be delayed. Quite understandable, isn't it?

But then the airport authorities come and say Luxair is not considering the airport slots so we take it away and Luxair cannot fly to PMI anymore. The system collapses. What seemed quite logical and understandable at a local level becomes wrong and inappropriate, seen from a wider perspective.



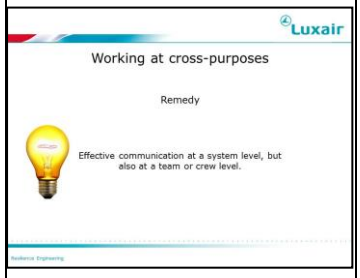
What matters most here is the success of the system as a whole and not the success of an individual part of it.

Working at cross-purposes occurs if one part of a system is working against another part of it without knowing this.

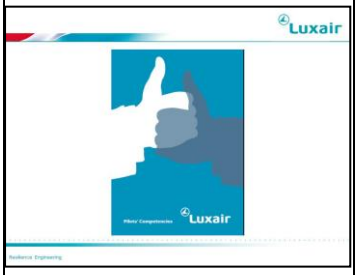


There are some premonitions, some signs indicating this:

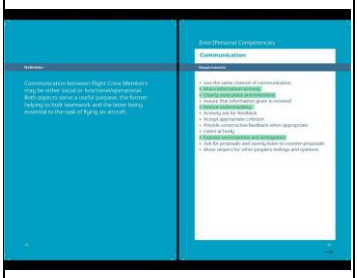
(click) Top to bottom communication is lost.



There is a remedy, as well:
Effective communication at a system level, but also at a team or crew level.
If we all know what we are doing and why, we will be able to reach our common goal.

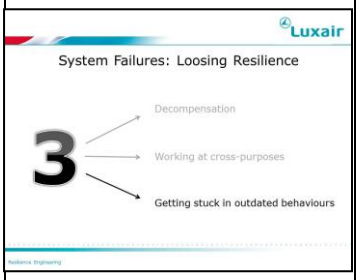


There we have something to help you. The booklet, again, and if you open this booklet at the prominent page which is “Communication”,

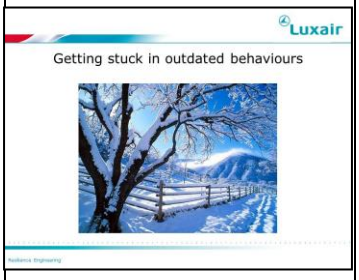


… you will find on one page a definition of communication and on the other page some requirements, yes some good requirements for good communication.
Please allow us to just point out a few of them:

(click) Share information actively.
Assure the whole team gets relevant information and is aware about the goals.
(click) Clearly state plans and intentions.
Avoid misunderstandings; assure that the team knows about the desired path.
(click) Assure understanding.
From the point of view of the sender of the information, assure that the information given is also the information received.
(click) Express uncertainties and ambiguities.
From the point of view of the receiver, if you have any doubt, then ask.
The other points are also interesting and important, but we just wanted to point out these four.
(click =>)



The last condition which could make your system fail is: getting stuck in outdated behaviour.



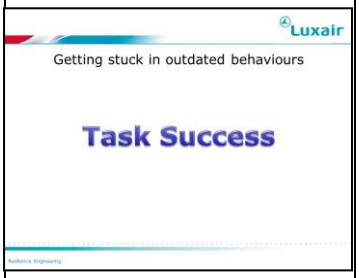
Let’s imagine, it’s wintertime and it is snowing outside. Our airplane needs to be de-iced before departure.

Now we are ready and taking off. During initial climb, the purser reports that there is a small, a small amount of smoke in the cabin together with a strange smell. The Captain says that probably some de-icing fluid entered the air-conditioning system somehow and therefore there is this smoke and smell in the cabin. It will dissipate soon.

A little bit later the purser shows up in the cockpit again and reports that there is still this small amount of smoke and a funny smell in the cabin. The Captain reassures her saying that this is due to de-icing fluid and it will dissipate right now.

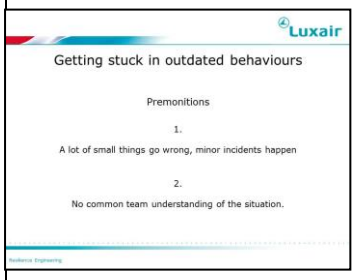
However, today it was not de-icing fluid as it usually is, today there was a structural failure in one air-conditioning pack, which was generating the smoke and smell.
Although there were signs indicating that the situation had changed, the Captain continued to persist on his view of the world. And the system collapses.
There are other, more tragic examples of this kind of system failure.

Maybe you remember the Swissair 111 flight which crashed into the sea near Halifax. There was a fire on board, a fire in the cockpit. Since the aircraft just took off, it was too heavy to land right away, according papers. The Captain decided to implement Standard Operating Procedures, which meant dumping fuel to make the aircraft lighter. However, the environment had changed in such a way that these procedures were no longer adapted to the situation. The temperatures in the cockpit were that excessive that metal was dripping onto the pilot seats. During the crash, there was nobody in the cockpit anymore.



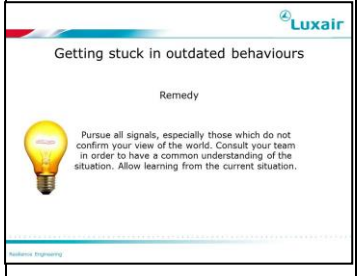
What matters most is task success and not individual success.

Getting stuck in outdated behaviour occurs when one part of the control system is locked in a certain view of the situation, although the situation has changed and the mental model is no longer appropriate.



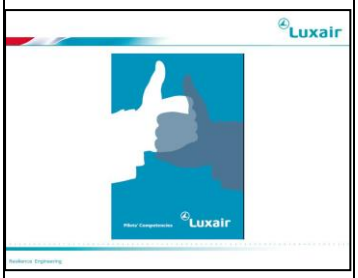
There are some premonitions, some signs indicating this:

(click) A lot of small things go wrong, minor incidents happen;
(click) There is no common team understanding of the situation.

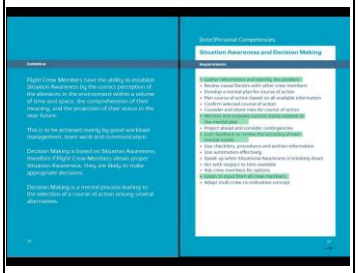


There is a remedy, as well:
Pursue all signs, especially those which do not confirm your view of the world. Consult your team in order to have a common understanding of the situation. Allow learning from the current situation.

Allow learning that the situation may have evolved and therefore your view of the world may be obsolete.

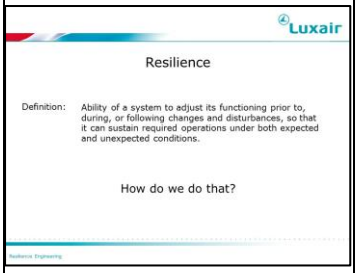


There we have something to help you, as well. The booklet, again, and if you open this booklet at the prominent page which is “Situation Awareness”,



…you will find on one page a definition of situation awareness and on the other page some requirements, yes some good requirements for good situation awareness.
Please allow us to just point out a few of them:

(click) Gather information and identify the problem.
What is the problem?
(click) Monitor and evaluate current status relative to the mental plan.
Is my view of the world still correct?
(click) Gain feedback to review the accuracy of own mental model.
To check if your view of the world is correct ask your team members for their opinion. Do they have the same view?
(click) Listen to inputs from all crewmembers.
Use all your sources of information and that includes all your team.
The other points are also interesting and important, but we just wanted to point out these four.
(click =>)



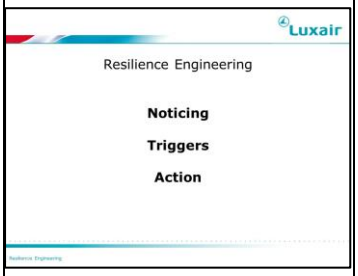
Let’s come back to the definition of Resilience.

Resilience is the ability of a system to adjust its functioning prior to, during, or following changes and disturbances, so that it can sustain required operations under both expected and unexpected conditions.

And the question now is:
(click) How do we do that?

Mr Dekker said in the video that we saw in the beginning:

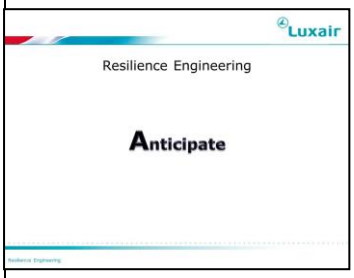
„If things go right under difficult circumstances, it‘s mostly because of peoples adaptive capacity; their ability to recognize, adapt to and absorb changes and disruptions. “
So it’s about people, it’s about you. People’s capacity to absorb changes and disruptions.
Of course in order to be able to do something, you must first notice that there is a change.



You have to notice. Because noticing triggers action. And which action?

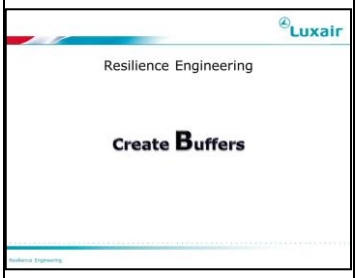
Communicate.

Inform your team. Maybe you are the first one to notice the change. It is wrong to assume that the others will notice as well. You have to say it. Bring your team back into the boat.
And then?



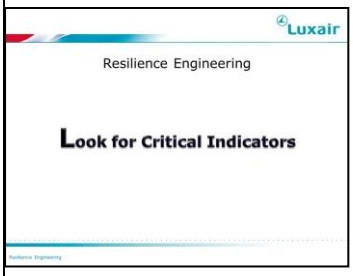
Anticipate.

How will this disturbance influence the rest of the flight? What could happen later on? Will there be a consequence or will the event have no influence on the flight?
Once you found what could happen, well then…



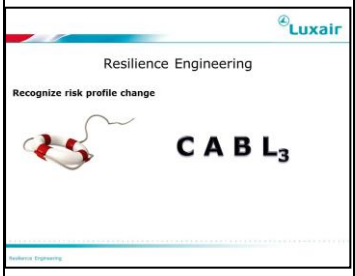
Create Buffers.

That means to have a plan B. If the things we anticipated would happen, then we would do this and this. Buffers could be a lot, as for instance dedicating a specific crew member to a certain task: if this and this happens, you do that and that. Or creating kind of limits: we will continue up to this point and then if these conditions are not fulfilled, we do not continue beyond. We will then execute a go-around, enter a holding, divert, and so on.
Once you have done that, you have to…

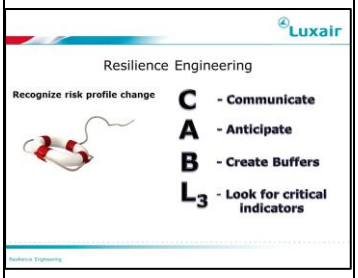


Look for the 3 critical indicators that show that your system might be collapsing. And these indicators we just saw: decompensation, working at cross-purposes and getting stuck in outdated behaviour. And if you find one of those you know what to do:
Decompensation, the remedy is teamwork;
Working at cross purposes, the remedy is communication;
Getting stuck in outdated behaviour, the remedy is situation awareness.

This is kind of a safety net, a safety line, a safety cable, yes a safety cable!



So the first thing is to recognize the risk profile change and then you throw your safety cable; your safety $CABL_3$;
(click)

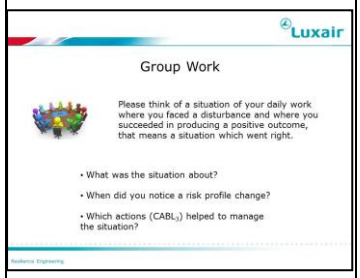


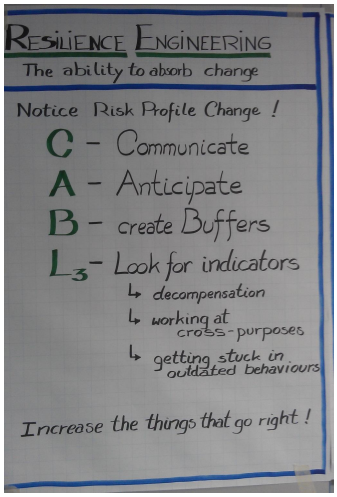
CABL$_3$; (click)
Communicate,
Anticipate,
Create Buffers,
Look for the 3 critical indicators that we just saw: decompensation, working at cross-purposes, getting stuck in outdated behaviour.
CABL$_3$.
Info to trainer:
Allow some time for the participants to internalize the acronym.

Let's do a short group work about this. We will divide you in three groups.
-Make 3 groups.
We prepared some material for you:
On this flipchart we have a summary of CABL$_3$;
-Uncover flipchart;
We also have a folder for each group, in which you will find the Cable, Risk profile change and the 3 critical indicators, decompensation, cross-purposes and outdated behaviour.
-Show material while talking.
And your task is the following:
Please think of a situation of your daily work where you faced a disturbance and where you succeeded in producing a positive outcome that means a situation which went right.
We have some leading questions:

- What was the situation about?
- Did you notice a risk profile change?
- Which actions (CABL$_3$) helped to manage the situation?

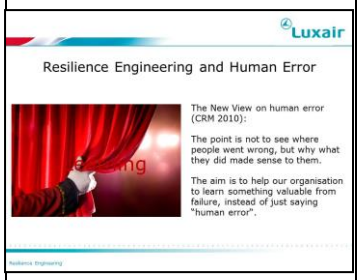
So discuss in your group and agree on one situation which you will present to the plenum later on.
You have about 15 minutes for your work.
Info to trainer:
Print following slides to hand over to the participants: risk profile change slides 25 and 27; Cable slide 83; indicators slides 36, 49, 59, 71.
Prepare a flipchart on which the participants can write.
You will need 3 sets.
Allow participants to work; if necessary assist. Thereafter each group will present the developed case. During the presentation try to recognize one prominent aspect, a profile change that made a big difference for instance, and point this aspect out after the presentation. Proceed this way for every team.
At the end of the presentation, go back to the flipchart for a summary.





Flipchart-Summary

As a summary, the first thing that should happen is to notice a risk profile change. This is very important because if you notice something, you can do something. Noticing triggers action. And then use the CABL$_3$.
Communicate, to have your team with you;
Anticipate, what influence could this event have in the near future;
Create Buffers, what will we do if…;
And Look for the 3 critical indicators that your system might be failing:
Decompensation and here the remedy is teamwork;
Working at cross-purposes, the remedy is communication;
Getting stuck in outdated behaviour, the remedy is situation awareness.



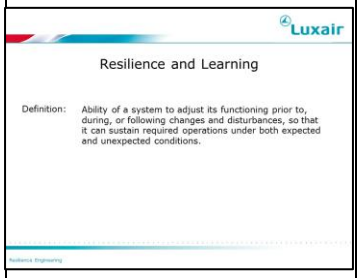
And finally the aim is to increase the things that go right.
And that is indeed one more important cornerstone about Resilience Engineering.

In our previous course about human error we said:

The point is not to see where people went wrong, but why what they did made sense to them.
The aim is to help our organisation to learn something valuable from failure, instead of just saying “human error“.
The aim is to look behind the curtain instead of saying human error and to learn something valuable.
To learn something.
(click)

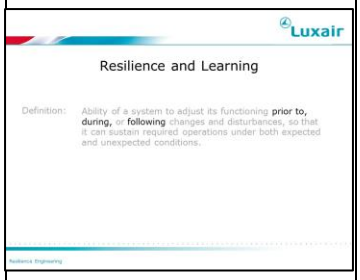
Learning is an integral part of Resilience.

OK, and what do we have to learn?



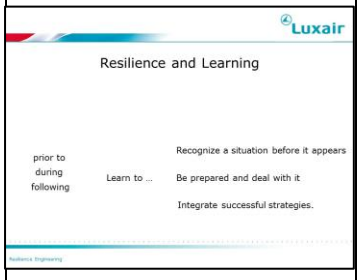
Let’s come back to the definition of Resilience that we saw now already several times.

It is the ability of a system to adjust its functioning prior to, during, or following changes and disturbances, so that it can sustain required operations under both expected and unexpected conditions.



And now let’s focus on these three words,

Prior to, during or following…



Prior to we have to learn to (click) recognize a situation before it appears;
During we have to learn to (click) be prepared and deal with it;
And following we have to learn to (click) integrate successful strategies.

Prior to we have to learn to recognize the risk profile change,
During, well that is the $CABL_3$,
And following, following an event is a new impulse, we have to learn to identify and enhance the positives. Identify and enhance the positives.

We have to learn to increase the things that go right.
(click)
Resilience Engineering.

Comments, remarks or questions?

Additional information for trainers:

Resilience Engineering is built on four cornerstones. These four cornerstones or characteristics are:

- **<u>Responding: knowing what to do.</u>**

  Resilient systems know how to respond to regular or irregular disruptions. They adapt and move into different actions.

- **<u>Monitoring: knowing what to look for.</u>**

  Resilient systems monitor conditions which may become a threat and these both in the environment and in the system itself. They notice critical disruptions when they happen.

- **<u>Anticipating: knowing what to expect.</u>**

  Resilient systems know how to anticipate threats but also opportunities. They anticipate critical disruptions and their consequences. They have the capacity to project themselves into the future, taking in account the past.

- **<u>Learning: knowing what has happened.</u>**

  Resilient systems know how to learn from experience, success as well as failure. They integrate responding strategies for future reoccurrences.

These four cornerstones have been integrated into the presentation.

- Responding – CABL3, communicate and create buffers;
- Monitoring – Risk Profile Change
- Anticipating – CABL3, anticipate
- Learning – Conclusion of presentation, identify and enhance successful strategies.

Transcript of video Sidney Dekker

Resilience Engineering emerged a few years ago when leading researchers in safety got together and decided: you know what; we are tired of talking about human error. We don't believe that error or any other negatives, violations, incidents, are useful targets for intervention as if safety lies beyond some incident free horizon. In fact we don't believe that safety should be defined as the absence of something, that you have to count errors and monitor violations, tabulate incidents and then try to make those things go away.

There is this wrong assumption in all kinds of industries, aviation, health care, shipping, process control, finance, that the system is already basically safe and all it needs is protection from unreliable human beings through more automation, more procedures, tighter monitoring…

But you see we're not custodians of already safe systems. These systems themselves are inherently imperfect and deeply conflicted; they always have to meet multiple opposing goals at the same time and always under the pressure of limited resources. So it's only people who can hold together this inherent imperfection; it's only people who create safety through practice at all levels of an organization.

So, safety is not about the absence of something [i.e. incidents] it is about the presence of something. But the presence of what?

When we find that things go right under difficult circumstances, it's mostly because of people's adaptive capacity; their ability to:

- Recognize
- Adapt to
- And absorb

…changes and disruptions, some of which may even fall outside of what the system is designed or trained to handle.

This is why we call it resilience: the ability to accommodate change and absorb disturbances without crumbling, without breaking down, without catastrophic failure.
Resilience is not about reducing negatives, errors, incidents, violations; it is about identifying and enhancing the positive capacities of people and organizations that allow them to adapt safety under pressure.

Here are some of the things that we see teams and organisations do that are really good at this:

- They don't take past success as a guarantee of future safety. Past results are not enough for them to be confident that their adaptive strategies will keep on working.
- They keep a discussion of risk alive even when everything looks safe. That it looks safe doesn't mean that it is. In fact the model may be wrong, obsolete, so they have to keep it up to date.
- They are able to bring in different and fresh perspectives. They invite minority opinion, invite doubt, stay curious and open minded.
- They have somebody or some function with the resources to invest in safety when everybody else says they can't. That may exactly be the time when such investments are necessary.

	You already know how to measure where the organisation has become faster, better and cheaper, but has it become less resilient as a result? Check yourself on those four points and turn resilience into a fourth management variable that may just help you sustain your business. The design of the slides is such that you can click and see the next slide appear in order to remember the following topic in your lecture sequence. The slides with the booklet are equipped with an arrow in the lower right corner to remind you that on next click the following slide will appear. Wish you an excellent success. Remember: Yes, we can!

Risk Profile Change Exercise – Text Samples

Risk Profile Change? Yes or No?

A Boeing 737 is on approach to an airfield with two parallel runways, in VMC conditions. Both runways are equally long and there are no obstacles. At 5 NM, ATC request the aircraft to swing over to the other runway.

Risk Profile Change? Yes or No?

A Boeing 737 is taxiing towards the southern take-off runway in VMC. The airfield has two parallel runways which are equally long and there are no obstacles. ATC requests the aircraft to taxi to the northern runway instead of the southern runway.

Risk Profile Change? Yes or No?

A Boeing 737 is flying to PMI. During cruise the Captain informs the Purser that the flight time will be 15 min shorter as foreseen. (Total flight time 1h40)

Risk Profile Change? Yes or No?

A Boeing 737 is flying to TFS. During cruise the Captain informs the Purser that the flight time will be 15 min shorter as foreseen. (Total flight time 4h00)

Risk Profile Change? Yes or No?

A Bombardier Q-400 is flying to FCO. During boarding CCM2 (cabin crew member) informs the SCCM (Purser) that a passenger in row 12 told her that he is afraid of flying.

Risk Profile Change? Yes or No?

During approach to the runway in use, ATC offers a shortcut.

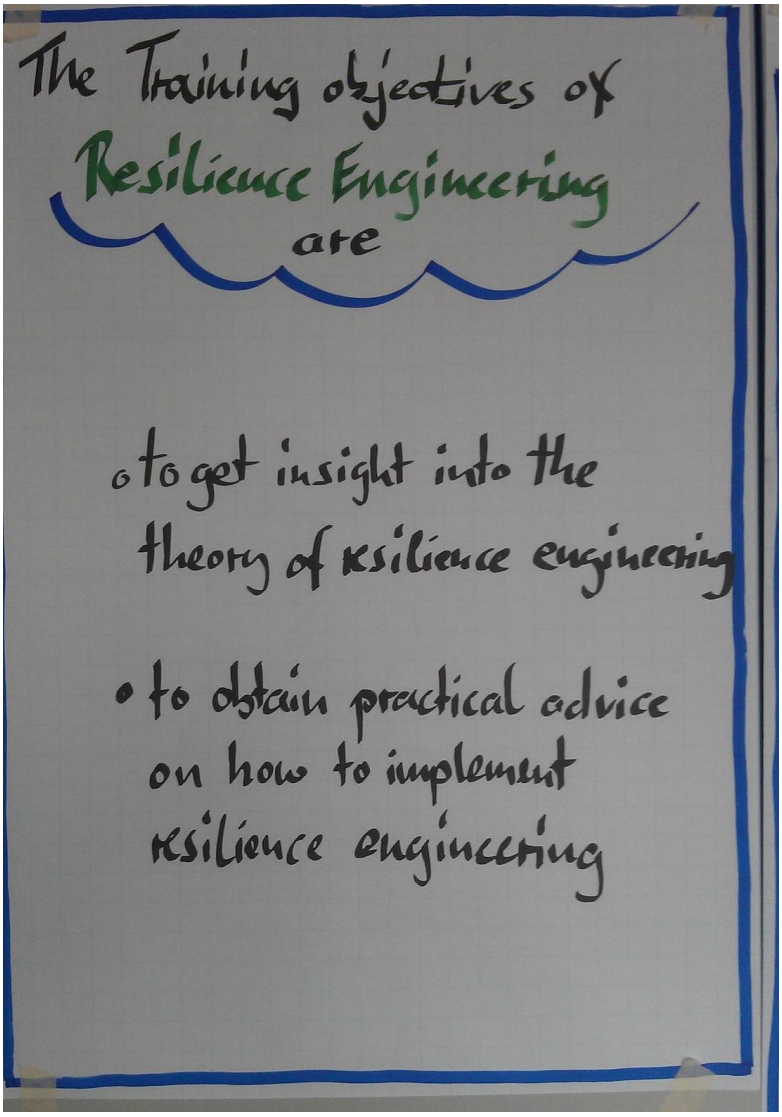
Risk Profile Change? Yes or No?

During cruise ATC offers a shortcut.

Risk Profile Change? Yes or No?

During cruise a passenger informs the Purser that she is at six months pregnant and that her doctor advised her not to fly.

Flipchart 'Training Objectives'



Flipchart 'CABL$_3$'