What is Human Factors Compared to Crew Resource Management?

G.K. Fahlgren
Human Communication HB, Sigtuna, Sweden

ABSTRACT: The expression Human Factors can be interpreted in two different ways.
Firstly: Human Factors is theoretical knowledge based on psychology and CRM is the practical use of that knowledge.
Secondly: Human Factors is a concept, which we all too often hear is to blame for an incident or accident. What we actually should say is Human Failure this is where a person is to blame, instead of using the impersonal expression Human Factors.
Maybe I am a bit provocative when I state that Human Factors do not cause accidents. It is Human Failure that causes accidents not Human Factors. I regard our Human Factors as a fantastic construction and design contributing to a greater quality of life that makes our lives on Earth both safer and more positive. Thanks to the appreciation and understanding of Human Factors, the fatal accident rate within Commercial Airlines has been reduced by 97% during the last 30 years.
As I see it, when our Human Factors stop functioning, accidents can occur. In other words, a Human Factors breakdown will result in Human Failure. This indicates that the most important thing to learn and be aware of is all the external factors that will have a profound and negative influence on our Human Factors.
So let me suggest that the following factors are directly detrimental to our Human Factors. Stress; Fatigue; Illness; Insufficient Training; Drugs; Hunger & Thirst; Lack of oxygen (at high altitude) and an Unsuitable or Bad Attitudes.

This is to be a symposium on maritime navigation. However our navigation today will not take place at sea but instead we will learn to quickly navigate the complexities of our brain.

When we talk about Human Factors it can be interpreted in two different ways.

Firstly: Human Factors is the theoretical knowledge of psychology and CRM is the practical use of that knowledge. That is the most important difference.

Secondly: Human Factors is a concept, which we all too often hear is to blame for an incident or accident. What we actually should say is Human Failure this is where a person is to blame, instead of using the impersonal expression Human Factors.

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Due primarily to the introduction and comprehension of Human Factors in the Airline Industry, Flight Safety has improved tremendously since 1956, when I started my career as an Airline Pilot, until 1990 when I retired.

Under that period the accident rate per 1 million take offs has been reduced from around 30 to 0,9.

It means that the accident rate within IATA member Airlines has been reduced by 97% during

a period of 30 years and now we have an accident rate of 0,00009 %!

I do not believe that such a radical improvement in safety has ever been observed in any other transport or industrial branch.

This is not bragging! I am just giving hope and proof to others that it is always possible to improve safety.

As I see it, this rema rkable improvement is a direct result of the excellent work done to increase knowledge and awareness of Human Factors which teaches us all to focus on flight safety and thereby reduce human errors and resulting in excellent CRM amongst airline personnel.

In my opinion, it is when our Human Factors stop functioning, that accidents can occur. In other words, a breakdown in Human Factors will result in Human Failure. This indicates that it is very important to learn and understand which external factors will have a negative influence on our Human Factors and deterioration on CRM.
So let me suggest that the following factors are directly detrimental to our Human Factors.

Stress

Fatigue

Illness

Insufficient Training

Drugs

Hunger & Thirst

Lack of oxygen (at high altitudes)

Unsuitable Attitudes (complacency)

1.1 *Human Errors*

A very common introduction to Human Factors Seminars all over the world is the following:

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"Human errors continue to be the largest casualty factor in aviation accidents. Current statistics indicate that between 70% and 75% of all aviation accidents are directly attributable to human error."

But wait, what is this?
According to my first statement Airline accidents have been reduced by 97% from 30 to 0,9 per one million take offs.

At the same time the percentage of human error has increased from 30% to 75%!
Well, my dear audience, this is perfect! The closer we come to 0% for other reasons, the closer human errors come to 100%. That is simple mathematics.

It is good and, of course, accepted if the other reasons for an accident, e.g. technical problems, are 0%. So 100% for Human Failure is in fact also good.

I would even like to say that it is thanks to our Human Factors, that we have this incredible and wonderful development of increased safety in aviation. The Human Factors of all people engaged in the Airline Industry have been focused on safety and CRM.

And the more we concentrate on improving Technology in order to improve safety, the higher will the percentage for human failure be even if the total number of accidents is reduced.

Let us remember that CRM, Crew Resource Management, is the practical use of the theoretical knowledge of our Human Factors. How we use our resources is so universal, that I have started to call it Life Resource Management instead of Crew Resource Management.

To learn more about Human Factors is not only important for Shipping and Airline Crews, it is of a great value for the whole human race.

Just for your information, during the year of 2004 there were zero fatalities in airline accidents among the airlines of the Western World. In the rest of the World there were 485 persons killed.

During the same period worldwide traffic accident victims were so many, that it compares the total loss of 5-6 Jumbo Jets for each and every day of the year.

During a meeting in Montreal, arranged by IATA and ICAO, Human Factors Training for pilots was discussed. Suddenly one Chief of Flight Operations in a major airline stood up, red in his face, and indignantly shouted: *"Human Factors shall not be trained, they have to be removed!"*

He expressed his frustration and the old way of looking at Human Factors and I started to reflect.
"If my Human Factors are to be removed, I must know where they are in my brain?"

So please let me present a simple explanation about where in the brain, I consider, we store our Human Factors. I will also explain which parts of that system are influenced by stress and the effect it will have on our own and others behavior.

1.2 *The Central Nervous System*

Our brain and our spinal cord form the central nervous system. The brain might be seen as a super computer controlling the system. The spinal cord is an electrical bus bar connecting the central system to the peripheral system sending and receiving information to and from the rest of our body.

The spinal cord has nothing to do with decision-making. The only actions the spinal cord can

produce are reflexes and our medical doctors check those reflexes for function, when they tickle the soles of our feet or tap the tendon in front of the kneecap.

1.3 *The Brain*

Let me now give you a brief schematic explanation of the brain.

Very early in our evolution a rather primitive brain was formed on top of the spinal cord. Dr. Paul Mc Lean, National Institute of Mental Health, Washington DC, has named it the Reptile Brain Our feelings are formed and stored in this Reptile Brain. Some memory functions and the balance, which makes it possible for us to stand-up and walk on two legs, can also be found in this Reptile Brain. We can find basic needs such as hunger, thirst and sexuality here.

If our Cerebrum and its cerebral cortex, constructed much later in evolution, do not control the Reptile Brain the consequences of our decisions can be catastrophic because our Reptile brain has only 3 decisions to choose between and those are:

1. Shall I run away and flee from the situation.

2. Shall I stay and fight.

3. Shall I stay, make love and copulate.

If the moderating device in the Controlling Brain is out of order hampered by drugs or under a high degree of stress the strong feelings created in the Reptile Brain might turn into such aggressiveness that it is highly dangerous for both the bearer of the brain and those closest to him.

Those controlling signals are transported in "threads", which are quite fragile, nerves, which are easily blocked if feelings grow too strong, and the bearer of the uncontrolled Reptile Brain might easily end up in jail due to his actions.

Another effect of an uncontrolled Reptile Brain is panic.

One of my students once asked me: *"Why is it so easy to immediately answer NO and then, after some time, I realise that I should have in fact answered YES!"*

We discussed it and after some time realized that it is our Reptile Brain, which answers "NO", but when the question, some micro seconds later, has been received and treated in the Controlling Brain, we realize that it was possible and even very good if we had answered YES instead.

As an instructor in a flight simulator I have many times noted that Captain often answer NO even after a very good suggestion from the First Officer.

I am quite sure that the same response can also be heard on the bridge from time to time.

How can that be?

Well, our Reptile Brain is the first receiver of the sensory input. It supervises our lives, so we can survive .It is very conservative and it has formed all our attitudes and expectations.

If my wife, my children, my employees or my First Officer should ask or suggest something, my Reptile Brain immediately regards it as a change in a stable and safe situation, and, as every change could be dangerous, the natural and immediate answer is of course NO!

However, when you feel safe, do not let your Reptile Brain give an immediate answer as was necessary millions of years ago instead you let your Controlling Brain decide if the proposal is good or bad before you answer. This is the difference between using the brain in a civilized way and using it in a primitive way. It is also the difference between a good and a bad leader.

So, check that your Controlling brain is connected, before you open your mouth.

I just said, that our spinal cord couldn't make any decisions. And the Reptile Brain only has a capacity for three decisions.

But our Controlling brain can make billions of decisions

A coarse classification of the Controlling Brain, as you know, is to talk about the left and the right hemispheres. Simply speaking, the left side, when seen from behind, is the analytic, calculating, critical, unforgiving, digital side. The right side is more creative, spatial, artistic, analogous and forgiving.

It has empathy and situational awareness.

A person who is highly stressed will loose his/her empathy, because the right hemisphere is easily blocked by stress and the more robust left hemisphere and the Reptile brain will then take over and make him/her a very egocentric person. Other people will become objects instead of humans in their eyes.

Psychologists test the balance between the left and right hemispheres and the balance between the Controlling Brain and the Reptile Brain when we apply for employment as Pilots and they are also "tested" in interviews before being accepted. This balance forms our personality.

Personally I regard this to be the center of our Human Factors, and I have a strong feeling that we can also find our soul and our spirit here.

1.4 *Conclusions*

To have good knowledge of Human Factors, which means a basic knowledge of Human Psychology, is extremely important for practicing of Crew Resource Management on a chip.

But it is also an important base for Management of our life as a whole. A successful life will need the knowledge of how we handle our personal and social life. We must have the skill to handle, what I call, LIFE Resource Management.