New Century, Same Humanity
on a collision course

C. Robert Nelms, Failsafe Network, Inc.

Abstract – Having become recently immersed in the paradigms of Nuclear Power Generation, especially as they relate to "human performance," the author is somewhat aghast at the current trend in thinking: "we have finally figured out how to operate our equipment without failure – now we're going to do the same with the human." Human beings have always been the same, and will always be the same. We make mistakes. Interestingly, "honest" mistakes are the ones that we can do something about – we can actually prevent them. It's not honest mistakes that are the problem. It's the "dishonest" ones that are truly at the root of everything that goes wrong. We all do things we know we shouldn't do, many times per day. We've always been like this. We will always be like this. This paper, written by an outsider to the Power Generation industry, explores this reality, provides historical and practical evidence of its truth, and then draws some conclusions about how to approach these "human performance" problems.

I. INTRODUCTION

The thought of Nuclear Power does things to my mind and emotions that are similar to that of the Space Shuttle. When I take the time to try to apprehend the complexity of the Shuttle, or when I consider what is at risk in the operation of a Nuclear Power Plant I feel almost overwhelmed by a sense of awe. I have thought for a number of years that true progress lies at the leading edge of human endeavor – not in the endeavor itself, but in the debate and dialogue that occurs when such monumental efforts are attempted and then, inevitably, when these efforts result in catastrophe.

I cannot think of these leading-edge endeavors without also thinking of the word "excellence." NASA and its vendors exude excellence, as does the Nuclear Power community. Therefore, before I begin my observations, I categorically state that I am proud to be a citizen of the country that produces such excellence, and feel privileged to have come in contact with some of the people in these leading-edge industries.

Somehow, however, I sense that many people at these leading edges feel something aside from pride, privilege, and excellence. I sense, from listening, that they are under monumental pressure to do something that they cannot do, at least not in the long run. They are being pressured to be inhuman. More than that, they are being coaxed into believing that they must be more than human, i.e., PERFECT.

Although our technologies are certainly increasing in complexity, we're the same human beings as we were thousands and thousands of years ago. Depending on us to exist outside of our nature is like putting a closed lid on a pot of boiling water. Eventually, it'll erupt.

This is not to say that we shouldn't try to maximize "human performance." In order to safely and effectively operate our complex and dangerous systems, we must perform at our peak. Anyway, it feels good to be a member of a high performance team, whether at work or play.

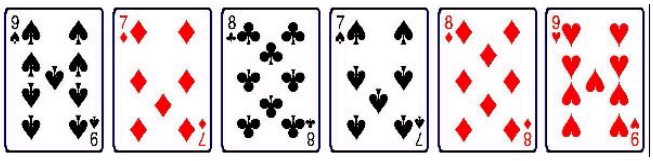
But as more and more is expected of our physical systems, the same is true with the humans in support of these systems. More of one leads to more of the other – the whirling, spiraling, rotating merry-go-round – faster and faster with everyone doing the best they can to hold it together at ever increasing speeds.

Eventually, the "laws of probability" will kick-in, and someone (in spite of our best efforts) will make a mistake. At "low speeds," the mistake is not too costly. But at the high speeds we've driven ourselves, we're a baby step away from disaster.

II. AS HUMANS, WE WILL MAKE MISTAKES

A recent card trick introduced on a discussion forum on www.rootcauselive.com created a lot of dialogue about humanity – much of which is vitally pertinent to this paper. To fully appreciate the dialogue, the card trick is replicated below (the original card trick was computer-based, and was much more convincing).

Mentally pick one of the following cards at random. It is important to become "one-with" the card. Stare at it intensely, whisper it's name, and imbed it in your brain. It is essential to "know" your card. Remember, STARE AT IT.



What if I told you that before you even picked your card, I knew what card you were going to pick. It's true – I can prove it (and I will)! Before I prove it, however, you'll have to touch the card you've picked – that's right, touch it with your finger – any finger will do.

Have you touched it yet? If so, flip to the last page of this paper to see what happened when you touched your card!

Can't believe your eyes? Flabbergasted? If so, you "made a mistake." You were deceived into thinking something that was not true. We do not want nuclear power plant operators to be deceived! On the other hand, if you figured it out right away, congratulations! By the way, your ability to see past the deception tells quite a bit about yourself – and it's not what you might think (more about this in a few paragraphs)!

The above-mentioned discussion forum is typically attended by close to 150 people interested in root cause analysis, representing almost all business sectors, and is heavily visited by Nuclear Power Plant personnel. It has been an active and challenging forum. This card trick was a much-appreciated diversion from the typically intense debates we had been having. But the humorous, flippant comments did not last too long. Quickly, the conversation turned serious. The following comments are from a variety of people, paraphrased to capture the essence of the dialogue:

Outsider: Your trick had me amazed for two days. But knowing that the illusion was impossible provided enough incentive to finally figure out the sleight-of-hand. Now I need to know the root cause of my under-performance.

Nuclear Perspective: I don't find your performance amusing, or encouraging. If this was not just a cute card trick and your life had depended upon this process, how many people would have been injured before the invalid process was understood? Your companies place its employees in the same situations on a daily basis. Take off your reactive RCA hats and start looking forward – be proactive! You should have figured it out on your first try!

Outsider: Wait a minute – this was just a card trick! I wasn't in the "proactive" frame of mind. Anyway, how could I have been proactive to something I've never seen before? The only way we can be proactive is to learn IN RETROSPECT.

Nuclear Perspective: Many times the person in the field cannot afford to learn from experience. The organization must work to strengthen its processes and controls to help that person be proactive in all circumstances. You can be proactive without having to live through the accidents. "There are no new accidents, only new people."

Outsider: Well then, help me understand. How should I have approached the card trick?

Nuclear Perspective: You could have used the standard questions we (nuclear industry) always ask ourselves upon commencement of an activity:

1. What are the critical steps of my task?
2. How can I make a mistake at these critical steps?
3. What are the consequences of incorrect performance of these steps.
4. What measures am I going to employ to prevent 2&3?

If you won't do this while "making a piece of toast," what makes you think you'll do it while " flying the plane?"

Outsider: You've got to be kidding! Did you really expect me to approach a card trick in this manner? Is there to be no fun in life – no mystery? In fact, as I look at your list of what I should have done, to be honest, I don't want to be the kind of person that would do all that for a mere card trick. It feels so robotic. I delight in being human – I enjoy an occasional surprise.

Nuclear Perspective: Acknowledging human fallibility is not being a robot. And we certainly have no room for "the unexpected" in our nuclear plants. Today 4 electricians, working at Brown's Ferry Nuclear Plant, were taken to the hospital. Information is minimal at this point, but it appears they were working on a 4.16 kV switchgear. The switchgear is backed up by an emergency diesel generator. When they de-energized the switchgear, the diesel re-energized the bus.

The reasons you failed are the same reasons the electricians are in the hospital. Sometimes, you don't get to learn from your mistakes. Practicing on the small stuff helps build the skills required to survive when there is no room for error.

Outsider: Okay, you make a good point. But isn't it possible for a human being to "pick and choose" where and when he's going to be careful? For example, if I were a high-voltage electrician I would DEFINITELY want to go through the mental processes you've suggested. No question! But if I were that same high-voltage electrician at home looking at a card trick on the computer, intentionally trying to unwind and relax, isn't it OKAY for me to "put down my guard" – to think differently?

Nuclear Perspective: No, it is NOT okay to "think differently" at home. One of the top principles of behavioral technology is that PEOPLE DO WHAT THEY'VE DONE BEFORE. Whenever you act or think you establish or strengthen neural patterns in your brain that make it more likely that under similar situations you will act or think the same way. "Just this once" is a slippery slope.

Outsider: But isn't it true that many folks working in the nuclear industry do rather risky things on the outside to satisfy their human-ness? And if so, is that "okay?"

Nuclear Perspective: You're missing the point! There is risk in everything we do, even doing nothing. There is risk in doing a card trick, just as there is risk in flying an airplane. The activity being performed is not really a consideration in trying to avoid an undesirable consequence – it's how we HANDLE the activity that's important. It's better to teach people how to ensure their safety than to instill the mindset of "be safe".

In other words, it is one thing to expose oneself to a hazard. It is quite another to do it in an unplanned way. One could even

engage in challenging activities in such a way as to enhance one's risk-avoiding habits.

Outsider: You're suggesting that people should INTENTIONALLY TAKE RISKS in order to help ensure their safety?????

Nuclear Perspective: I know someone who recently spent about a week in a place where over five hundred people have died. He planned his visit meticulously and encountered no insurmountable problems. I'd say the experience strengthened his risk-averse tendencies.

I personally ride a motorcycle. Every summer I ride it across the country. It helps to recharge my batteries. Every time I get ready to ride, I assume the worst is going to occur and I take steps to ensure that: 1)it doesn't happen, and 2) I am ready if it does. I have never been down in 25 years, but I approach every ride as if I might be this time around.

Outsider: If you are suggesting that because you exposed yourself to known hazards and "got away with it" that you have STRENGTHENED your risk-averse tendencies, I beg to differ. When a person puts himself in harm's way and, as a result, nothing happens but "good memories," doesn't that encourage him to put himself in harms way again? Oh I know, you took all the proper precautions – except one. You DID put yourself in harms way.

As you say, that's a slippery slope. Now you'll be more prone to putting yourself in harms way WHILE BEING DEPENDENT on the "proper" precautions.

If your head is spinning after reading this dialogue, I understand – mine was spinning also. Of course, these viewpoints do not represent the entire Nuclear Power industry – they seemed prevalent only amongst those who engaged in this particular dialogue. Nevertheless, the following was the message that many of us received:

1. Everyone should have figured-out the card trick on the first try.
2. Be proactive to everything, in all circumstances (approach all of life with extreme caution). This includes eating, sleeping, reading a book, conversation, sexual intercourse, engaging in card tricks, as well as complex maintenance tasks. Do not allow yourself to "fail."
3. Be able to learn without failing, because you cannot afford to fail in a hazardous environment. Get into the habit of not failing off the job, so that you're used to not failing on the job.
4. Put aside the things about life that could distract you in a hazardous environment (love of mystery, suspense, gut-feeling, joking, the occasional surprise, etc.). These frivolous feelings and activities are capable of causing serious problems on the job.
5. Do not consider whether or not an activity is worthy, but only how we can engage in an activity without hurting ourselves. In other words, instead of "doing safe things," focus on "doing things safely."
6. Intentionally place yourself in highly hazardous circumstances (after doing a through hazards analysis) so that you can practice being proactive.

Most of these suggestions frighten me. Where is room for humanness? Is there to be no fun, laughter, pleasure, or mystery in life? With the exception of #5 (which at least would get the adrenaline flowing), the other items are downright inhuman.

In reflecting on the card trick that produced all this dialogue, I've come to a startling conclusion that will anger some readers, and cause others to smile. My conclusion: those of you who figured-out the card trick immediately are the losers! You've become a "Golem." On the other hand, those that could not immediately figure-out the card trick are the winners. Congratulations – you're still "human!"

"The danger of the past was that men became slaves. The danger of the future is that men may become robots. True enough, robots do not rebel. But given man's nature, robots cannot live and remain sane, they become "Golems," they will destroy their world and themselves because they cannot stand any longer the BOREDOM of a meaningless life….." Erich Fromm

III. A COLLISION COURSE

Many similarities exist between NASA and the Nuclear Power industry.

On January 28th, 1986 at 11:38 AM the world witnessed the explosion of the Space Shuttle "Challenger" – an event that resulted in international learning for those willing to listen. The Rogers Commission produced volumes of information about the causes of the incident – all currently available in public libraries. After researching their findings, and having explored many additional books, documents, and web sites addressing the causes of the explosion from a number of perspectives, I developed a 60 minute speech that I've been delivering since 1988. Having "tested" the speech for 13 years on approximately 600 people per year, modifying it as I gained new information, I feel confident about characterizing NASA (circa 1985) with the following prevalent attitudes:

Although some people do not agree, space IS the future of mankind. We are proud to be involved in THE endeavor of the century, and will do anything to make sure it continues.

We successfully operate the most complex mechanical system ever devised by man. We did this by systematically solving problems, one problem at a time. Other organizations could learn a lot by looking at us.

We take pride in going where "no man has gone." There is no limit to what we can do.

We fly with known problems all the time. It's all a matter of managing the risks.

The people that work at NASA are the best people in the world.

The undeniable thread that runs through these characterizations is that of excellence and pride within the NASA organization. These attitudes, although valid and even necessary for success, were also the underlying causes of the explosion.

As a novice student of the Titanic story, I understand that the same prevailing attitudes contributed to that incident. I also have read that the same attitudes contributed to "the fall of Rome." Are we seeing similar attitudes in our Nuclear Power Plant organizations?

Although some people do not agree, NUCLEAR POWER is the energy-future of mankind. We are proud to be involved in the MOST VITAL ENDEAVOR of the century, and will do anything to make sure it continues.

Life is NOT about SHYING AWAY from risks, but rather MANAGING the risks.

Other organizations could learn a lot by LOOKING AT US.

We have finally figured-out how to operate our equipment without failure – now we're going to do the same with the HUMAN.

The underlined item (above) was the prevailing statement heard at last year's Nuclear-Industry-Sponsored HPRCT (Human Performance, Root Cause, and Trending) meeting in Baltimore, MD. It is the underlying assumption within this statement that has put us on a collision course. When the understandable and perhaps necessary organizational pride which resulted from almost flawless mechanical performance is directed at making the human "perfect," a deadly situation arises.

We're being dishonest with ourselves. People will never be perfect. We ought to know this.

On the www.rootcauselive.com discussion forum that generated the dialogue on the card trick, an occasional contributor has often caught my mind with a jarring truth. His contributions surface as our dialogue drifts in and out of statistics, probability, and quantum physics. This person masterfully describes a reality I'll always remember: we live in a statistically-oriented, probabilistic existence. Nothing in this life is certain. No matter how much we desire it, we can never think in terms of 100%. We cannot make perfect machines. We certainly cannot make perfect people.

From psychology, Sigmund Freud echoed the message declaring that IRRATIONALITY is the natural condition of humanity. No matter how hard we try, we'll never be able to predict human behavior.

From Philosophy, C.S. Lewis suggested:

There are two points I want to make. First, that human beings, all over the earth, have this curious idea that they ought to behave in a certain way, and cannot really get rid of it. Secondly, that they do not in fact behave in that way. They know the Law of Nature; they break it. These two facts are the foundation for all clear thinking about ourselves and the universe we live in…

G.C. Lichtenberg (German physicist, philosopher) said:

Once we know our weaknesses they cease to do us harm.

Although we're building systems and technologies that increasingly depend on PERFECT people, the cold, hard truth is that we are imperfect. In essence, WE are the straw that will break the camel's back – "we have met the enemy, and it is us."

In contrast to these undeniable truths about ourselves, opposite trends seem to be gaining in popularity as we propel ourselves, full-blast, into the new millennium. Three of these trends are noted below:

Firstly, it is becoming more and more unacceptable to think and talk about the notion of human "sin," i.e., humanity's in-born tendency to yield to temptation. As J.E. Gordon states in his book "Structures, or Why Things Don't Fall Down:"

It is rather fashionable at present to assume that error is one of those things for which it is not really fair to blame people, who, after all were "doing their best" or are the victims of their upbringing, or the social system – and so on. But error shades off into what is now very unpopular to call "sin." In the course of a long professional life examining a lot of accidents, many of them fatal, I have been forced to the conclusion that very few accidents happen in a morally neutral way. Nine out of ten accidents are caused by old-fashion human sin – often verging on plain wickedness…

In contrast to the above, contemporary thought disregards the validity of this "unalterable state in which no earthly escape is possible." The death of the notion of sin might also be the death of man, especially if we DEPEND on people's "sinlessness" for safe operations of our plants. Rather than disregarding sin, we ought to be acknowledging it more than ever as our technologies propel us into dangerous endeavors.

Secondly, more and more people seem to think that we (human beings) are NOT the same as we were thousands of years ago – that we have evolved to a state where we can "be better." Please note: I am not addressing physical evolution in the above statement, but rather moral evolution. In other words, even if sin were a condition of life, more and more people seem to think we have become capable of conquering it to a greater (although not total) extent. But haven't we "reached for the extra cookie" today just as rapidly as our ancestors might have in the past, even though both of us were on "diets?" Isn't jealousy, anger, selfishness, and pride just as

prevalent today as always? If we buy-into the notion that we're truly "getting better," we'll also buy into the notion that one day we'll be perfect (or close enough). Such a notion will be deadly.
Edgar Allen Poe described it as follows:

I have no faith in human perfectibility. I think human exertion will have no appreciable effect upon humanity. Man is now only more active – not more happy – nor more wise, than he was 6,000 years ago.

Lastly, there are growing numbers – MANY others – that think our understanding of the human psyche is such that we can manipulate it at will, producing almost any desired behavior. "Technologies" have been developed, within our own generation, that aim to produce desired behaviors within specific individuals. Not psychology or psychiatry, which attempt to understand the human psyche, and heal it when it's sick – these new concepts are called "technologies" and are meant to produce pre-conceived behaviors.

"We have finally figured-out how to operate our equipment without failure – now we're going to do the same with the human."

On the surface, and in the short term, it might appear as if the results of these manipulations are successful. But when pried into behaving contrary to our nature, we will eventually snap back into place, most likely at the most inopportune time and circumstance.

The above trends lead to a perilous stance – a stance never-before seen through the ages. In the past, when our assumptions about our technologies were a bit haughty, we ended-up killing a few unfortunate people. Today, if our assumptions about human nature are similarly haughty, we are becoming capable of annihilating our race.

We MUST accept our mistake-prone nature.

IV. AVOIDING THE COLLISION

It is said that "pride goeth before the fall." Along these lines, I wonder if excellence and arrogance can ever be separated? Does one always have to lead to the other? Must the most successful organizations, societies, families, and individuals always end up in pieces? History says they will. It seems futile.

But we must remember that nothing in this life is certain – it is a probabilistic "certainty" that nothing is 100%, INCLUDING the COLLISION that seems to be unavoidable.

Given the nature of the issues we've been discussing (our OWN human nature), it seems we should all agree on a course of action. Of course, nothing is farther from the truth. Remember, according to Freud we are irrational – and irrational we seem to be when we discuss these issues. After all, each of us has his/her own impressions about ourselves – impressions to which we cling dearly. I, for one, will not toss aside my impressions of my own humanity too quickly, if ever!

But this might be the most critical issue that has emerged in our lifetimes – the estimation of our human ability to "always do the right thing" and the effect of a negative answer. This is an issue that MUST be discussed – amongst the right parties.

I've learned what helps me to consider a change, and I think it's the same thing that helps most people – discussion, dialogue, and debate. When we are forced to put our ideas on the line, we defend our positions. We are in a battle with opposing ideas. Ideas live and die, like soldiers on a battlefield.

I cannot imagine that the "nuclear perspective" in the card-trick-dialogue walked away from the conversation without THINKING about a few issues. I know I did! It's not until you argue a position that you even begin to consider the opposing viewpoint. It's similar to flight-testing an aircraft – you try to develop a good product, but you really don't know how good it is till you put it through the paces. The same thing is true with our understanding of ourselves.

Therefore, what I propose is a dialogue – a structured, on-going debate about who we are, how close we can come to perfection, and what the consequences of our answers will be to the Nuclear Power (and maybe other) communities.

To help get the ball rolling, I offer the web site www.rootcauselive.com. This is a free site, open and available to all. It has been in existence since November 2000 for the ultimate purpose of helping us (humanity) see the truth about our existence (whatever the truth might be) by engaging people who have been studying "things that go wrong." There is no "agenda" to this offer, other than to bring these issues to the forefront so that they can be debated. The answers will emerge from the debate.

I do not anticipate this small first step to be the end-all of the debate. As I said, I'm offering the web site as a platform to take the <u>first steps</u>. It is unknown what will happen after these first steps.

By the time this paper is published, the site will be ready to do the following:

1. Send Invitations:
    a. Specific invitations to all known root cause analysts, in all fields of endeavor.
    b. General invitations through professional societies, other relevant web-sites.
2. Form the necessary web-based-forums.
3. Facilitate preliminary discussions as people become aware of the initiative, to "whet appetites" as participation builds..

4. Commence a dialogue, once participation levels-off, addressing the following questions:

    a. How close to perfection does humanity have to be in order to operate Nuclear Power Plants safely?
    b. How close can humanity come to the required level of perfection?
    c. What are the ramifications of our answer?
    d. What should we do about the ramifications?

The above plan is intentionally vague and preliminary. Whatever we do, it will not be an easy task. We've already experienced significant division on the web site on topics much less volatile. I see these divisions as a test, i.e., something to learn from, so that when we address the issues identified in this paper we can do so more constructively.

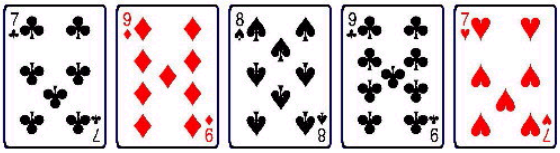
V. IN CONCLUSION

Humanity is on a collision course with it's own technology. We might be creating things that we are incapable of controlling. Rather than continuing down a path that might lead over a cliff, an extended forum is being suggested to probe the main concern: humanity. How close to perfection do we have to be in order to safely operate these technologies? Are we able to attain this level of perfection? What are the ramifications of our answers?

In the original, computer-based card trick the 6 cards immediately vanish as soon as you "touch" one of the cards with your finger.

As soon as the original cards disappear they reappear as follows:

The card you touched disappeared!



All the other cards remain!

In the original card trick, you are asked whether or not you'd like to try again. If you answer "yes," you are immediately dealt 6 new cards.

(please read-on, without trying to "figure-out" the card trick)

Try it yourself at:

http://cs.bluffton.edu/~scoffman/trick.html

Try to use your imagination.