Talk Proposal:

NASA's Strategic Direction and Design in the 21st Century

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Here is my proposal for a small talk on the problem of applying design in the 21st century to the problem of NASA's missing vision:

1. Purpose

NASA is facing a number of problems in this the 21st century that will require new approaches to solve. This talk covers one of NASA's continuing problems, our lack of vision, new design approaches now available to address this particular problem, and an effort, now in-action, that we can use to apply these new ideas.

2. The Gap

In design, problems are now often discussed as the gap between what is happening and what people really need. The purpose of all design, therefore, is to close that gap.

Since the end of the Constellation program it has been clear that NASA has had a major gap between its stated vision and the vision needed to win the enthusiastic support of its stakeholders. This gap has now been formalized in a new report, "NASA's Strategic Direction, and the need for a national consensus." [1] This report does a detailed analysis of the current situation, which it summarizes with phrases like:

- "there is no strong, compelling national vision for human spaceflight program"
- "lack of consensus on the next steps in development of human space flight"
- "could craft a better response to the uncertainty"

In addition to manned space exploration, this report covers all aspects of NASA's mission.

3. Why

There are many reasons why I need to respond to this report and the gap it details, and respond with action:

- It directly affects my work assignments and my future.
- I have clear ideas about how to proceed and would like to invite other to joint me.
- It powerfully effects a field I love, space exploration

- It redefines NASA's relationship with her primary customers, the American People.
- It strongly affects the way we tackle the great problems of the 21st century.

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4. The Hypothesis

As I am foremost a designer and have recently taken on a lengthy study of what is new in design, I will approach this issue as a design problem. I will present the hypothesis that this problem cannot be effectively addressed using the 20th century design procedures currently used by NASA, but it can be addressed with imagination and energy using 21st century design processes, which are now available to us.

5. Design in the 21st Century

Design processes in the 21st century are strangely backwards to design in the 20th. Part of the change is the result of the 21st century being the age of information and that new information is now coming at us as if from a fire hose. Our problem then is not that there is a shortage of information on what to do, but rather too much, coming too fast.

Much of the new design information is taking the form of paper books and lectures on the Internet. Individual authors are providing pieces of the puzzle but it is up to us to fit enough of the pieces together to form a clear picture. Here are just a few of the pieces that we need to address the NASA vision gap:

1. **Why First** – In the 20th century why (usually in the form of a vision statement) was one of the last things you talked about. In the 21st it is the first thing to bring up. The reason has to do with generating buy-in (see below). If people like your why then they will listen and your idea can go forward. If they do not like it; it is a waste of time to present your idea to them at all.
2. **Five Whys** [2, 3] – Why you are doing some specific thing is not good enough. You must start where you are and devise whys all the way up to big picture whys. This leads to the entire workforce enabled to contribute to that big picture.
3. **Fail Fast** – Run lots of small trials, called prototypes, which can either pass or fail quickly. Either way, your object is to be in continuous action and learn from that action. It is only after much such learning that you can expect to come up with a big design that really works.
4. **Plan >> Do >> Test >> Learn >> Iterate** – This is the formula for all those small actions. You commit no more resources to any one action than you are comfortable with. Each little action may then be fragile, but the overall effort is anti-fragile (see below).
5. **Steve Job's Reality Distortion Field** – You must (1) Envision the future, (2) identify your customers, (1) design a new product, (3) envision your product in that future, and then (4) define the needs your customers in that future with that product in existence.

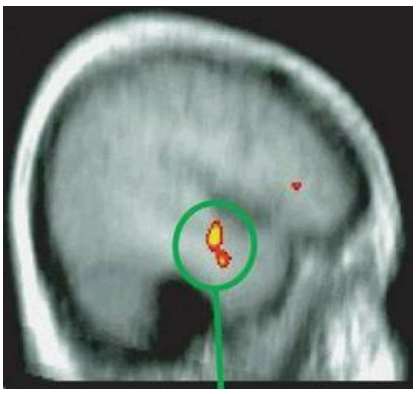

Figure 2: Eureka brain module

6. **Exploit new science** – Many of the ideas for prototypes come specifically from new science that has not yet been worked for commercial potential. Advances that clear away misconceptions are particularly important. Advances In neuroscience vulnerable at this time.
7. **Buy-In** – All human beings have structures in their brain that make them very good at doing very specific things. The big ones, like vision, are easy to understand. Recent intense studies of how the brain works are now shedding light on the lesser ones. One of these is buy-in, a mental process in which a person (1) hears an idea, (2) envisions himself succeeding with the idea, (3) gets in action, and (4) stays in action. The critical test for many of our prototypes is simply how well they generate buy-in.
8. **Frames of Reference** – Human beings cannot hold the entire universe in their heads. What they can hold is a number of complex frames of reference that define who they are and how they think at any given moment. Common frames include good worker, and family person. Imagine being at work and in your good worker frame. Then the telephone rings. It is your significant other with a problem. How long does it take you to mentally switch gears and move to thinking in the family person frame? Typical switching times are less than a second but long enough to notice.
9. **Mindsets** – Throughout American history each generation of our students[5] has faced a different world with different challenges that gave them different mindsets. If we can give future generations a mindset that includes the human exploration of space, then they will do it as a matter of course.
10. **Black Swans** [6] – These are events that are improvable in themselves but if they do happen then they have a great effect on society. They can be good (the Internet), or bad (9/11). The problem is that so many are possible that they have already become a hallmark of the 21st century. The question now is how can you design good Black Swans while working at the edge of chaos?

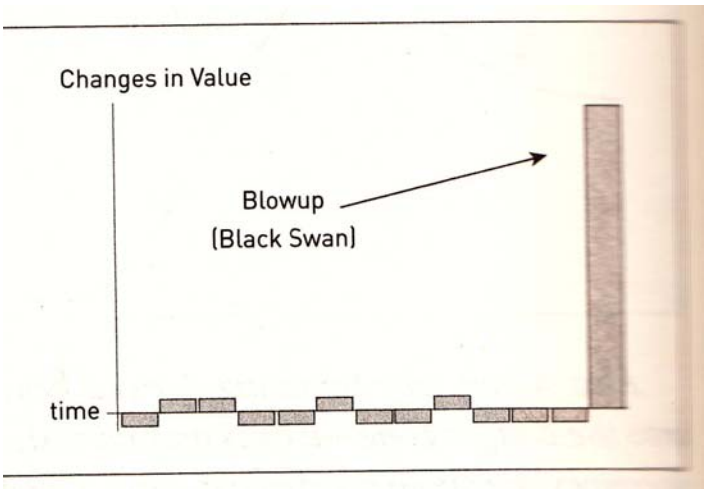

Figure 3: Anti-fragile prototype series

11. **Anti-Fragile** [7] **–** In the 20th century we talked about things being fragile or robust. In the 21st there is a third category, anti-fragile. Fragile elements are easily damaged in a chaotic situation. Robust elements hold up a little better but eventually can break. Anti-fragile elements actually grow in these situations, feeding at the edge of chaos. Life is anti-fragile; good design in the 21st century must be anti-fragile too.
12. **The 10,000 Hour Rule** [8] -- The people in our society who become big successes spend about 10,000 hours practicing. This takes about 10 years. Along the way, the big winners also happen to get lucky multiple times.
13. **TBD** – To Be Determined, this list is growing as we speak.

Figure 1: Fire hose being used for crowd control during civil rights demonstration

The problem then is to pull this fire hose of information into a workable action plan. This in itself demands action. Fortunately, millions of people are already in action. You can check their progress on TED [9].

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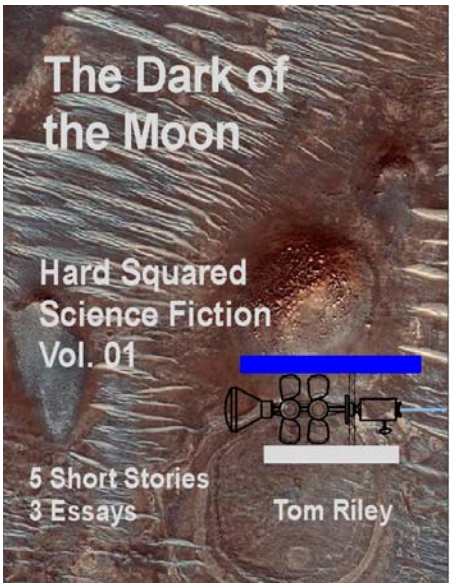

Figure 4: Cover Art

6. Open Prototype on NASA's Strategic Direction

Since the well-deserved demise of Constellation, I have run eight to twelve of this type of prototype related to manned space exploration. Although I normally work robotic missions, a quick run of Five Whys leads to the conclusion that NASA prospers only if human space exploration prospers. My discipline may now be contamination, but if I want steady work, space explorations must prosper.

My current prototype can serve here as an example of how this process works. It is an e-book of science fiction short stories that are written specifically to address the problem detailed in "NASA's Strategic Direction" [1]. A description of the e-book, "Hard Squared Science Fiction Vol. 01, The Dark of the Moon", with an introduction to the stories and the complete essays, can be found on the Web [10].

Historically a class of science fiction stories, hard science fiction, has provided much of the vision that drove human space exploration. This class of media still has some power to provide vision and generate buy-in, particularly among mature, technically-oriented people.

The innovation here is to (1) design the stories specifically to generate buy-in for human space exploration, and (2) exploit the new medium of e-books. The prototype will be tested in the market place which is, at once, one of the most difficult but most effective tests possible.

This approach is limited because science fiction writings are not nearly as popular with current students, who much prefer computer games. After all, they are the ones who will actually fly these missions so their needs must be addressed. Unfortunately, a new computer game is too big a prototype to take on in one step. The lessons learned from this short story prototype can later be applied to more modern media for future prototypes.

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7. Using this Process at NASA

For NASA the overall effect is like a Fourier transform. NASA has highly refined process for technical design, from individual instruments to major space missions. It is unfortunate but true that this particular design process is ineffective against certain classes of problems, like vision. NASA is not going to abandon those processes and is not going to change very fast. Its speed of change is not nearly fast enough to keep pace with the 21st century.

For our Fourier metaphor, let's take those 20th century design process to be the time domain. There are many problems, like the vision problem, that simply cannot be solved in this domain. If they were solvable, we would have solved them long ago.

What NASA can now do is put a relatively small amount of resources into developing a new domain, the 21st century design domain, or simply the Black Swan Domain. In this domain, design is done differently, nearly backwards to the 20th domain. Problems not solvable there are solvable here, solvable with energy and joy. Once we have our answers, we simply return to the 20th century domain to run the actual projects.

8. Who Does It

Only a small number of people who are seriously interested in design will be interested in developing new design concepts for the 21st century:

1. **People who see the 21st century as the edge of chaos** – In contrast, if you see the 21st century as a safe and stable time then you will not be interested in this process.
2. **People to whom the process gives energy** – The process runs crazy fast and feels like playing pin ball while riding on the ball. Sometimes you hit a wall that costs you energy; sometimes you hit a flipper that sends you flying in a new direction. It is scary, but exciting.
3. **Those who want to be part of the 21st century** -- Those who want to embrace the 21st century either from love for the excitement or from a feeling of having no choice.
4. **People who want to manage in the 21st century** – There is currently no reliable plan for managing this kind of design effort. Developing an effective plan would be worth hundreds of millions of dollars.

Are you one of these people?

9. An Invitation to Buy-in

If you are one of those people, let me invite you to envision yourself succeeding in the 21st century; of not being beaten by chaos, but thriving at its edge; of doing one exciting prototype after another, some failing small, some winning small, but always there is the possibility of the really big win. Envision yourself making a contribution to your discipline, to American society, to humanity. Envision yourself on TED [9] celebrating your idea that really worked.

This path is not easy but it is possible. Get into action; stay in action.

10. Conclusion

Sometimes a problem that is intractable with old approaches can be solved with a new approach. I think that this exactly the situation we now have at NASA, especially for vision and national consensus.

- What are your visions?
- Are these ideas of value to you?
- What are you prototypes?
- What is our path forward?

Thanks,

Tom Riley

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References:

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9. “TED, Ideas Worth Spreading,”, (Technology Engineering Design) http://www.ted.com/
10. Tom Riley, “Woodware Designs, E-Book Project” http://woodwaredesigns.com/EBook/EBook.html

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Additional Slides:

1. More Whys

There are even more whys:

- This situation calls for new ideas and new thinking. A field in which I have training, experience and talent.
- The proposed reorganization of NASA centers to be more like JPL is strongly opposed by her unions.
- NASA management has chosen Commercialization as a major effort but it is very difficult for civil servants to participate in this.

2. Inadvertent Good Black Swans

Just a few more good Black Swans (like the internet and cell phones) could make such an enormous contribution to American society as a whole that the financing of a trip to Mars would be a foregone conclusion:

a. **Buy-In and terrorism** – Terrorist recruitment is a rather extreme form of buy-in. We will not defeat terrorism unless we have a deep understanding of buy-in.
b. **Management of 21st century design** – Only a few companies (for example 3M and Apple) have been able to apply these advanced techniques to operation in a large organization. An effective process that can be generally applied would be such a boon to the American economy that financing a trip to Mars would becomes feasible. This talk is a start on that design.

c. **Redesigned support for geniuses** – Lots of people have high IQ's. Only a few generate good Black Swans. A major additional factor required is early support from family, teachers, etc.[8]. Population peaking (see below) will require a complete redesign of the family. Including genius support at just one sigma should produce striking more good Back Swan builders. One such possibility is, the Maven Tech Net, is described in our short story, "Free Rider".
d. **Design a society for a sustainable Earth** – Simply design the new society we will need as we transition from exponential population growth to a stable sustainable population. We have no choice but to go through this transformation; we might as well design our future.

3. Lessons In the Bag

I noted that I have already run a number of prototypes related to human space. Here are a few of the lessons already learned:

a. **Wiki's don't cut it** – Two of the prototypes were large collections of Wiki entries in the standard encyclopedia format. Both failed without fanfare. Although the exact reasons are not clear and we have no new improved entry design, it is clear that Wiki encyclopedia entries are lousy for 21st century design!
b. **Eighth graders don't read science fiction** – They are going to fly our future missions. What they do is watch TV and movies, and play video games. The missions they design will be very different missions if their needs are to be met.

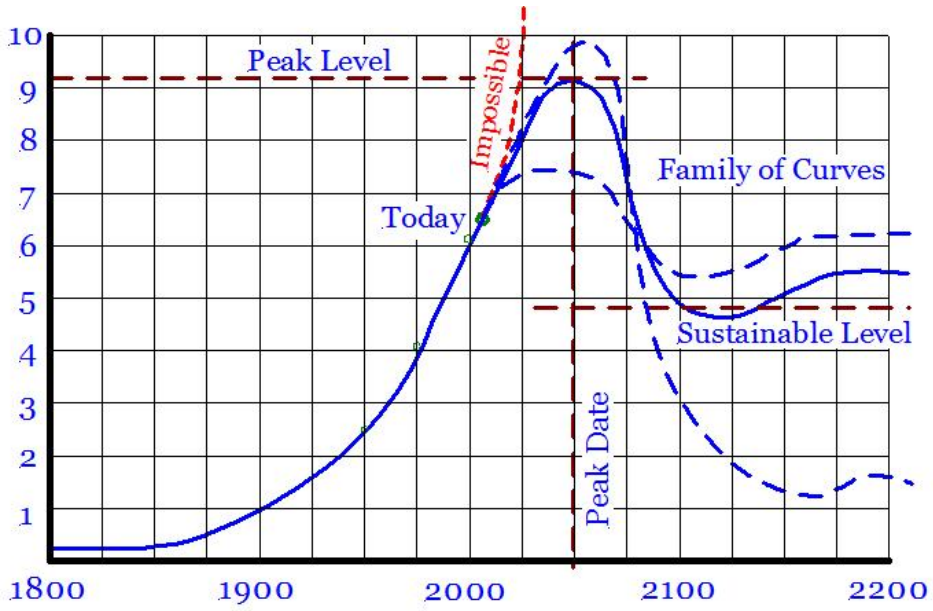

Figure 4: World Population as a Family of Curves, by Tom Riley

4. The Future

Predicting the future turns out to be crucial to a number of 21st century design elements (for example, Reality Distortion Field). Choice of a future prediction is also the most controversial part of the effort. The key element I have been using is the peaking of human world population:

5. Union Involvement in the E-Book Prototype

A strong NASA mean strong unions and strong unions mean a strong NASA.

Because many of its workers are civil servants, NASA does have unions. They are organized in a rather weak form, where only employees in specific skill areas (science, engineering, etc.) at specific centers which are covered by local Collective Bargaining Agreements, may be members of a specific local. The locals do not bargain for wages or benefits and they cannot strike. Union membership and dues are voluntary, but the unions must provide representation to any bargaining unit member requesting assistance, member or not. What the union locals do is support bargaining unit members when they have disputes with management, such as specific grievances.

One way to build an even stronger NASA is to build a strong vision of America's future that powerfully includes space exploration. This e-book is then a new and innovative way to build such a vision and is therefore a logical union effort. The union connection also provides some protection for the authors from a number of criticisms which are very much restrictive under 20th century design rules.

6. Who Wins

Relax; the 21st century has already won. Time always wins.

You can stop worrying about if we don't do something bad things are going to happen. Bad things are going to happen, but so are good things. Great forces are on the move. We cannot fix everything so the pressure is off us to fix **everything**.

"Rejoice, rejoice, we have no choice,"
Crosby, Stills, Nash

But then:

"80% of success is just showing up."
Woody Allen

What we can do is ride the wave, reducing dangers, making people's lives easier, going for the good big Black Swan that will make it all right in the long run. What we can do is show up.

This we can do. This we will do.
