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Produced by the NASA Center for Aerospace Information (CASI)

# Science and Exploration

## ...to Help Us Move Off the Planet

Priscilla Elfrey
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Moving Off the Planet is an awesome idea

Difficult to get good idea accepted.

Common experience

Why, instead, do bad ideas flourish?

How do we turn good ideas into ideas that flourish?

And why do we remember rumors?

Can we make rumors into rules?

Rumors, like stories, allow us to fill-in the blanks
A little mysterious; intuitive
Pose questions & open situations
Turn an abyss into a manageable gap
Intuition requires good data, many sources
Balance information, instinct, analysis &
synthesis with pattern recognition &
bias mitigation to avoid unwise risk.
A colleague said, "Teach with rumors."

# RUMOR:
# WE ARE GOING TO MOVE OFF THE PLANET IN THE TWENTY-FIRST CENTURY

Pass it on

This will be a defining moment in this century
As landing on the Moon was in the last.
When we all became explorers.

Yet science and exploration are not in the center
of our culture… in fact, they are on the
periphery
Our job is to nudge it more to the center
How best can we do that?

Our's is a multi-decadal massively complex adventure

Wicked problems

Huge systems & technical issues

Hostile environment

Highly dispersed teams

Trans-disciplinary skills

We need commitment, dedication as well as technology to make it happen.

Do It Yourself Opportunity?

Science and exploration:
dark, cold, vacuum,
hostile distant environment,
a lot of real estate, minerals and resources
(no trees, flowers, streams or blue skies).

Challenge to move this adventure closer to the
center of our lives.

What I know

Space exploration science is not on political landscape.

Back to the Moon --*to stay*-- is a good message
As is, on to Mars--*to stay*.

Hard Sell

Even George Lucas, Steven Spielberg, Gene Roddenber, Tom Hanks and Carl Sagan have been able to do just so much

Maybe Will Waite

Or toys

Computer ( and simulation) success based on toys

Freeman Dyson
Biotechnology
Need a do-it-yourself robot space explorer kit
Grow your own species
Move easily from place to place
Endure cold darkness
Both humans and automated missions
Toys to resolve Fermi Paradox?

# Rounded Relational Numbers

Billions and billions of Universes/ Landscape?
Billions and billions of stars
Billions and billions of dollars, euros, pounds and yen.
Relate to human scale: Dimes for research
Stories, simulations, models

# Survival of the Adaptive

Not fittest or strongest
Extinction based on over-specialization
Space too important to leave-- only-- to scientists and engineers
This century: breakdown of disciplines
Simulation teams need trans-disciplinary skills
Heads nod "yes" but no action

Add artists, philosophers, storytellers, gatekeepers, ethicists?

Negroponte: in 1980, adding graphic artist to Media Lab was controversial.
Ferran: "Big Idea" vs. Requirements"

Simulation based on models.
Models lie.
How can we trust simulation?
Avoid misuse?

World divided between those who think world is divided and those who do not.
Art vs. technology--Schism since Aristotle
Favors analytic, skeptical, risk aversive thinking
Avoids intuitive, speculative, artistic

Innovator, entrepreneur, artist, scientist
"Look at what everyone looks at and see something different."

"Aha!" is at core of simulation & this century

Fundamental Error Attribution
Overestimate personal & underestimate situational importance
Study of match between mind and environment in its infancy

Huge issue
Especially in terms of living on a different planet

Dispersed teams Require
Shared vision
Tacit & explicit knowledge
Synchronous and asynchronous communication
Print & digital media
Face to face and virtual meetings

Collaboration based on interactive focus, good information, use of time, ability to track and store work accessibly and safely
Acquire what is absent but desired
Destroy, remove or contain undesired

"Wicked" problems

Ill-defined

Complex

Serious

Incremental improvement is often best we can do

"We see the world as we are not as it is.+

Perception frames our choices
history, biases, how we feel… We select, abstract
but most of what we are aware of happens outside
our awareness
To test our assumptions… another wicked
problem

Shared story is at heart of our adventure
Necessary for success
Resonate, energize.
Easy to say. But hard to do
Maintain over time as mission, technology,
language and teams change
100 years? 1000?
No job for amateurs.

More wickedness--making it all work
Integration uncertain
More than large or intricate
No guarantees
Outcome unknown
Unforeseen consequences
Any change can change anything
"Unanticipated interaction can lead to catastrophe."

Persistent Virtual Team
Highly dispersed
Multidisciplinary
Multinational, multicultural
Share common vision over decades
May have no face-to-face time
Interactivity is hard to maintain
Unending giving and taking

# Betterment Opportunity

Disciplined intense "front end" planning
Reduce unwanted changes and rework
Expand decision process
Example of metaphor, story and simulation to improve decision making

Grand and Not-so- grand Challenges… just beginning

Faster than speed of light
Data, simulation, hardware and humans that work together
New and easier, robust interoperable tools
Interactive collaboratve functions
Optimal simplicity

Wicked problems will surface
Thousands of entities and processes
Can never say, "It is finished."

Simulation can reduce uncertainty and ambiguity
discover unexpected problems and opportunities
support consensus & decision-making
Bring order and hope to apparent chaos.

To come full circle: “rumors” require simplicity
Difficult in complex world

Whitehead--measure of civilization
Einstein-- Simple as possible , no simpler
George Miller--7 +/-2
Seek opportunities for ease and fun

It will be a long and bumpy ride
Celebrate and raise a toast to all the explorers--
whatever their roles or where or when