Revolutionary Concepts for Future Aerospace Endeavors

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Creativity and imagination,
inspired by curiosity and the eternal quest for knowledge,
are necessities, not luxuries.
- Robert Cassanova

http://www.niac.usra.edu

Image Courtesy of the Hubble Space Telescope Science Institute, ‘Kepler’s Supernova Remnant’
NIAC Charter

Focus on Revolutionary Advanced Concepts for Architectures & Systems for NASA

Operating Environment –
Enabling technologies may not be available
Science may not be totally understood
Aimed 10 to 40 years into the future

Actively seek credible, technical controversy
NIAC Charter

• Operate as an Independent, Technical Assessment Organization for NASA

Function as a Virtual Institute over the Internet
(http://www.niac.usra.edu)

Use Succinct Technical Proposal Requirements
and Peer Review
What can we learn from the REVOLUTIONARIES in art and sciences?

Creative People
Environment
Visionary Process
What is Revolutionary?

- The genius is in the generalities, and not the details

Einstein’s Theory of Relativity
“Imagination is more important than knowledge.”

“The most beautiful thing we can experience is the mysterious. It is the source of all true art and science.”

“The important thing is not to stop questioning.”

“I have no special talents. I am only passionately curious.”
What is Revolutionary?

- The genius is in the generalities, and not the details

  Einstein’s Theory of Relativity

  Darwin’s Origin of Species
Charles Darwin (1809 - 1882)

“I love fools’ experiments. I am always making them.”

“A man who dares to waste one hour of time has not discovered the value of life.”

What is Revolutionary?
What is Revolutionary?

• The genius is in the generalities, and not the details

  Einstein’s Theory of Relativity

  Darwin’s origin of species

  Galileo
Galileo Gallilei (1564-1642)

“All truths are easy to understand once they are discovered; the point is to discover them.”

“Doubt is the father of invention.”

What is Revolutionary?
What is Revolutionary?

- The genius is in the generalities, and not the details

  Einstein’s Theory of Relativity
  Darwin’s origin of species
  Galileo
  Kepler and many others

Genius is the ability to transcend experience.
Johannes Kepler (1571-1630)

"The diversity of the phenomena of nature is so great, and the treasures hidden in the heavens so rich, that the human mind shall never be lacking in fresh nourishment."

What is Revolutionary?
What is Revolutionary?

• The new idea illuminates a pathway towards a significant expansion of knowledge.

A sense of malfunction can lead to crisis as a prerequisite to revolution.

May be the basis for a new tradition of normal science.

New paradigms seem revolutionary only to those whose paradigms are affected by them.
Leonardo Da Vinci (1452 – 1519)

“You do ill if you praise, but worse if you censure, what you do not understand.”

What is Revolutionary?
What is Revolutionary?

• It inspires others to produce useful science and further elaboration of the fundamental idea.

Imagination and visualization are, generally, the first step in learning, or creating, something radically new.

Revolutionary art and visionary physics are both investigations in the nature of reality.

“A mind, once stretched by a new idea, never regains its original dimensions.”
- Oliver Wendell Holmes (1809 - 1894)
Pablo Picasso (1881 – 1973)

“What is Revolutionary?”

“Every child is an artist. The problem is how to remain an artist once he grows up.”

“I paint objects as I think them, not as I see them.”

“I am always doing that which I can not do, in order that I may learn how to do it.”
Michelangelo Buonarroti (1475 – 1564)

“A man paints with his brains and not with his hands.”
What is Revolutionary?

“Life produces fascinating "designs" in a similar way (to fractal geometry) by repeating the chemical cycles of its cellular growth and reproduction. Order is generated by nonconscious repetitious activities.”

Dr. Lynn Margulis (1938 - )

Microcosm
Symbiosis
Gaia Theory
What is Revolutionary?

- It contributes to a major change in the framework of aerospace possibilities.

“Scientific research is an art form in this sense: it does not matter how you make your discovery, only that your claim is true and convincingly validated.”

- Edward O. Wilson
Robert H. Goddard (1882 – 1945)
U.S. physicist & pioneer rocket engineer

“What is Revolutionary?”

“It is difficult to say what is impossible, for the dream of yesterday is the hope of today and the reality of tomorrow.”

“Goddard's work was virtually ignored in the United States and made little impression upon government officials.”
What is Revolutionary?

- It triggers a transformation of intuition

Theories help to put INTUITION AND observations into context and to create a framework for further understanding

Scientific theories are the product of informed imagination

"Science is not a heartless pursuit of objective information. It is a creative human activity, its geniuses acting more as artists than information processors. Changes in theory are not simply the derivative results of new discoveries but the work of creative imagination influenced by contemporary social and political forces."

- Stephen Jay Gould
Marie Curie (1867 – 1934)

“I am among those who think that science has great beauty. A scientist in his laboratory is not only a technician, he is also a child placed before natural phenomena which impress him like a fairy tale.”

“What is Revolutionary?

“Nothing in life is to be feared, it is only to be understood.”
What is Revolutionary?

- Revolutionary paradigm shifts are often simple, elegant, majestic, beautiful and are characterized by order and symmetry.

Creative paradigm changes are often the result of a non-linear, orthogonal imagination.

Symmetry and order can be visually pleasing.

Non-symmetry may be richer, more diverse and less boring.
Aristotle (384 BC – 322 BC)

“All men by nature desire knowledge.”

“The mathematical sciences particularly exhibit order, symmetry, and limitation; and these are the greatest forms of the beautiful.”

Metaphysica, 3-1078b.
Bulent Atalay

"The artist is interested in interpreting the visible world, the scientist in explaining why and how nature operates."

Synergy between art, mathematics and science.

Photographs by Robert Cassanova

Logarithmic and Hyperbolic Spirals

Spiral Phyllotaxis
“The universe is built on a plan the profound symmetry of which is somehow present in the inner structure of our intellect.”

Paul Valery 1871 – 1945
(Science/Symmetry – French writer)

“Order is the shape upon which beauty depends.”
Pearl Buck (1892-1973)
What is Revolutionary?

Frank Lloyd Wright (1869 – 1959)

“An idea is salvation by imagination.”
What is Revolutionary?

- The genius is in the generalities, and not the details
- The new idea creates a pathway that addresses a roadblock
- It inspires others to produce useful science and further elaboration of the fundamental idea
- It contributes to a major change in the framework of aerospace possibilities
- It triggers a transformation of intuition
- Revolutionary paradigm shifts are often simple, elegant, majestic, beautiful and are characterized by order and symmetry

There is a subtle yet significant difference between a creative and credible concept, and an imaginary pursuit.

- Robert Cassanova, Ron Turner, Pat Russell
Creativity and imagination, inspired by curiosity and the eternal quest for knowledge, are necessities, not luxuries.
- Robert Cassanova
NIAC Student Fellows Prize (Funded by USRA)

NIAC seeks to identify creative and innovative students who possess an extraordinary potential for developing advanced concepts in the fields of aeronautics, space and the sciences.

- Each Student Fellow will receive a total of $9,000 for the Academic year 2005-2006.
- Funds will be directly disbursed to the Student Fellow in three equal increments: September 2005, December 2005, and March 2006.
Future NIAC Events and Deadlines

Phase II Call for Proposals
due date of May 2, 2005

NIAC Student Fellows Prize
Call for Proposals released in January 2005
with a due date of April 15, 2005

NIAC Annual Meeting, October 10-11, 2005
Boulder, Colorado
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<th>Time</th>
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<tr>
<td>8:00am - 8:30am</td>
<td>Registration</td>
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<tr>
<td>8:30am - 9:30am</td>
<td>Welcome and Status of NIAC Activities</td>
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<td>Robert A. Cassanova, NIAC Director</td>
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<td>9:00am - 10:00am</td>
<td>Keynote Speaker - What Do We Really Know about How Animals Develop</td>
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<td>and Behave in Weightlessness? Richard Wassersug, Dalhousie University</td>
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<td>10:00am - 10:30am</td>
<td>Break</td>
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<td>10:30am - 12:00pm</td>
<td>NIAC Phase I Status Reports</td>
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<td>12:00pm - 1:00pm</td>
<td>Buffet Lunch</td>
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<td>Keynote Speaker - Whatever Happened to the Space Age?</td>
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<td>Joel Achenbach, Washington Post</td>
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<td>2:00pm - 3:30pm</td>
<td>NIAC Student Fellow Report</td>
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<td>3:00pm - 5:15pm</td>
<td>NIAC Phase I Status Reports</td>
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<td>5:00pm - 6:30pm</td>
<td>Reception</td>
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**Wednesday, March 16, 2005**

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<tr>
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<td>Welcome</td>
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<td>Robert Cassanova, NIAC Director</td>
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<td>9:00am - 10:00am</td>
<td>Keynote Speaker - Overview of NASA’s Space Technology Program</td>
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<td>Chris Moore, NASA HQ</td>
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