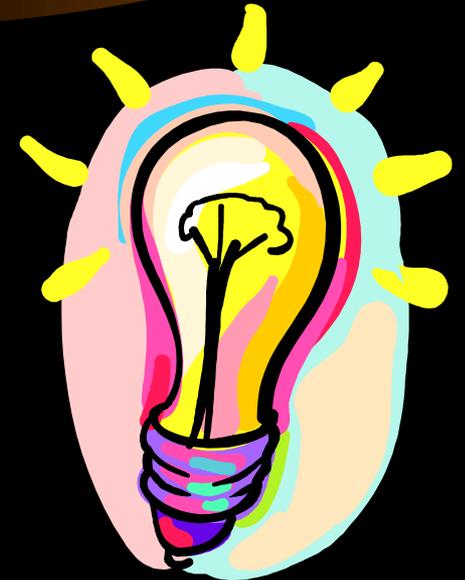


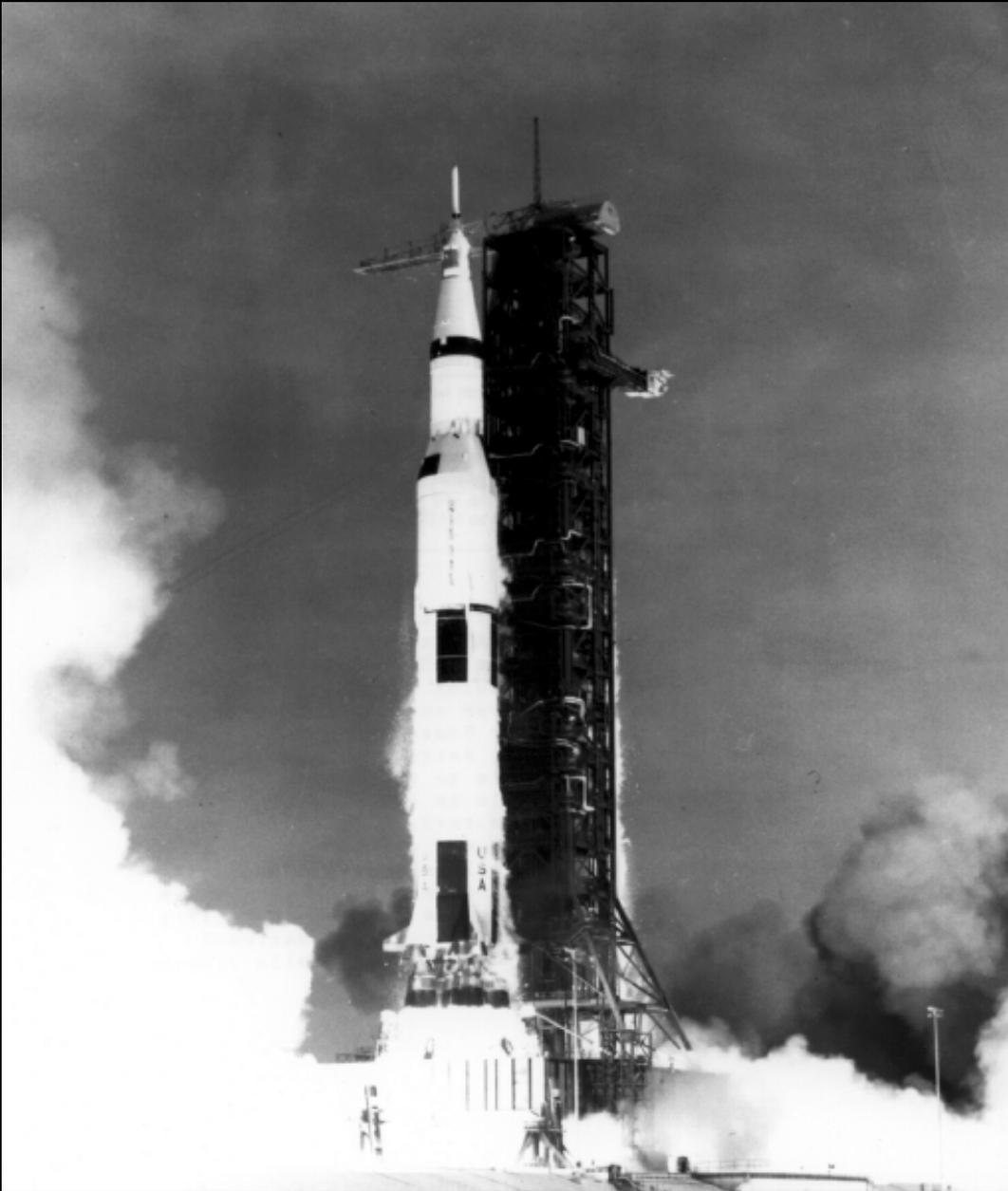
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OF SOUTHERN
CALIFORNIA

Concept Genesis: The Black Art And The Science

Madhu Thangavelu
School Of Engineering and
School Of Architecture

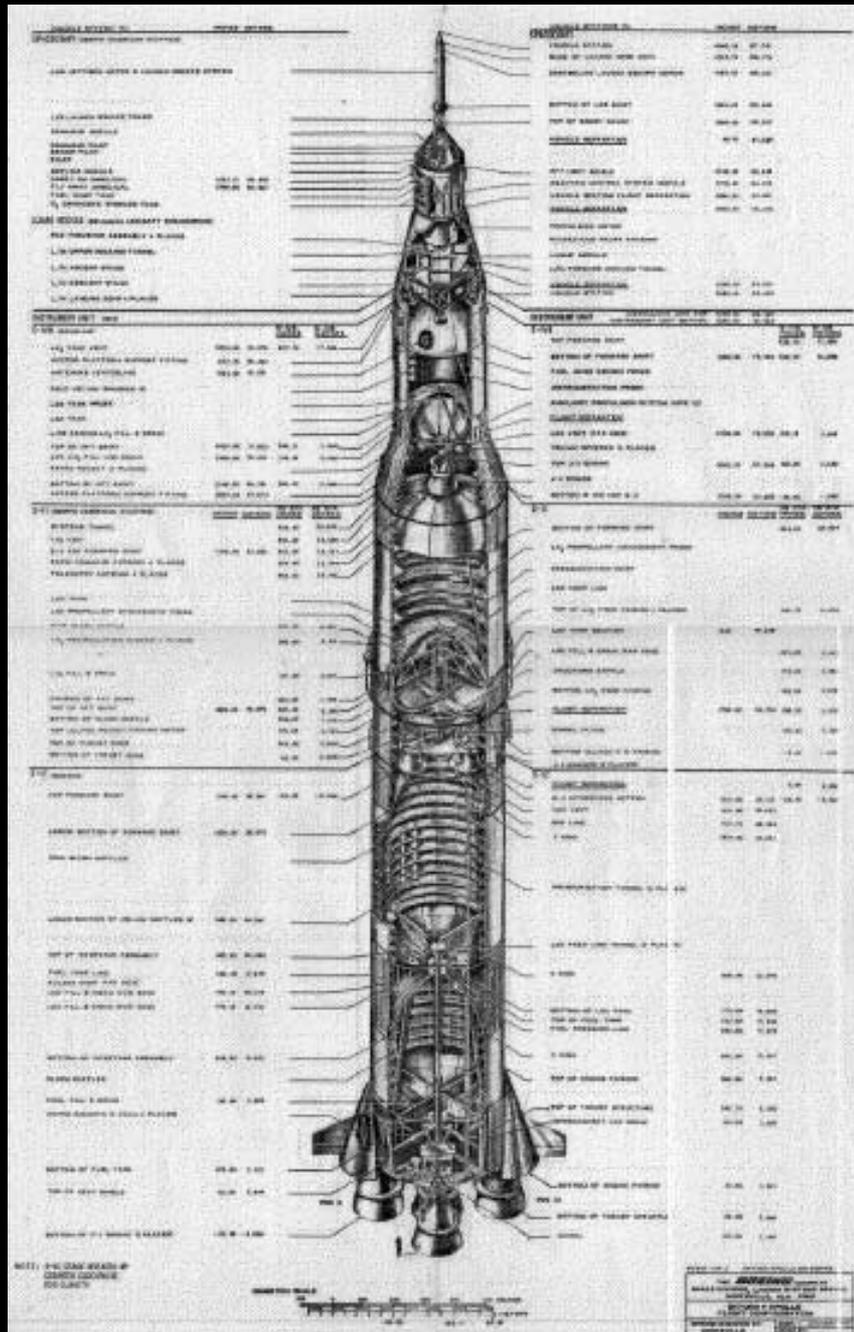


Complex System



- Many smart subsystems
- Separate functions / agendas

Attributes



- One of a kind
- Integrated to work in concert, synergetically
- Many potential failure modes
- System Latency
- Cost, complexity, failures
- Reliability through bestowing intelligence

Complex Architectures

- Human Being
- Software Development
- Government Organization
- Global Financial Markets
- National Missile Defense
- Air Traffic Control
- Power Grids
- International Telecommunications Networks

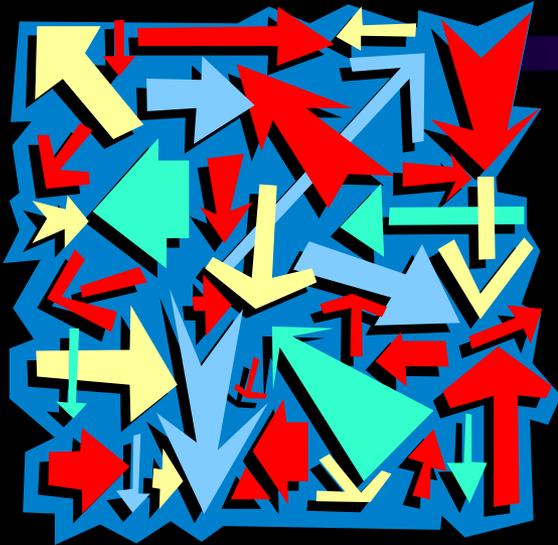


Common Model

- Building the common model
- Communicate, communicate, communicate



In The Beginning.....



Building Processes

- Analysis
- Synthesis



The Tools

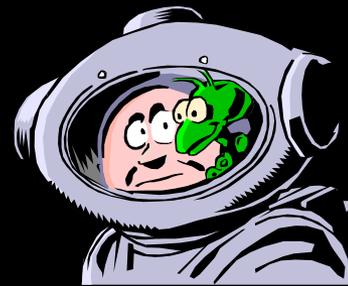
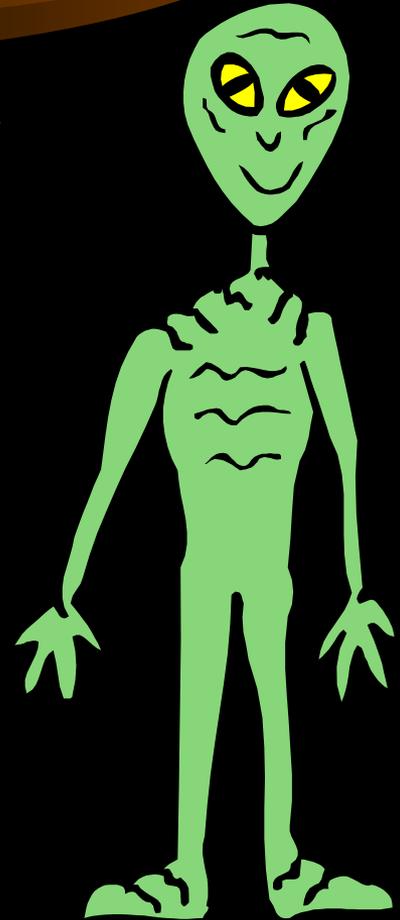
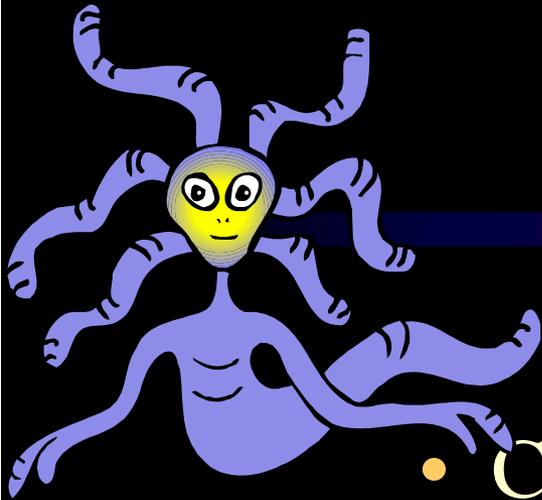


- The Mind
- The Machine



The “Wicked” Problem

- Character changes constantly
 - Introduce new parameters
 - Resolved “out of bounds”



Concept



- A rudimentary synthetic idea
 - Not optimized



Speed!



- Reduce Design Cycle time
 - Create more choice
 - Increase Efficiency



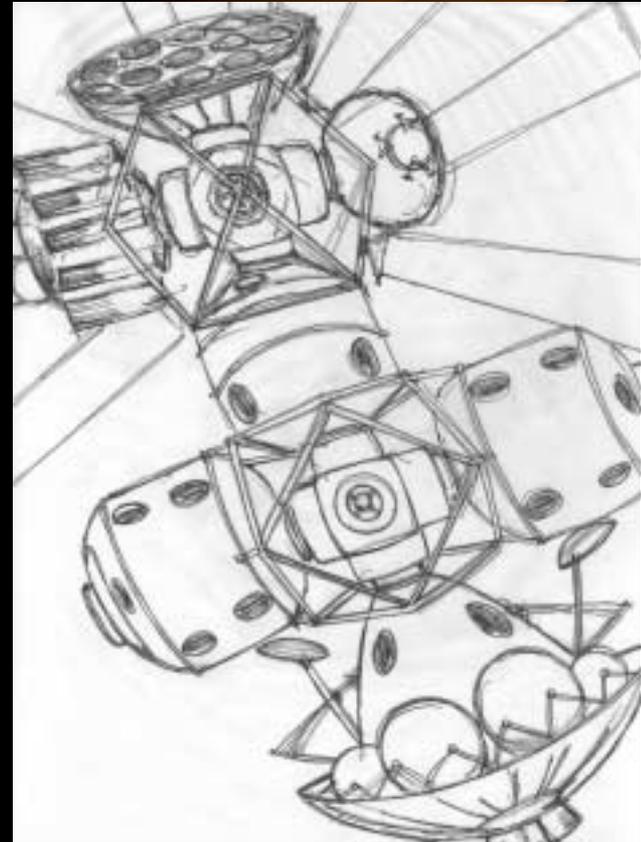
Examples



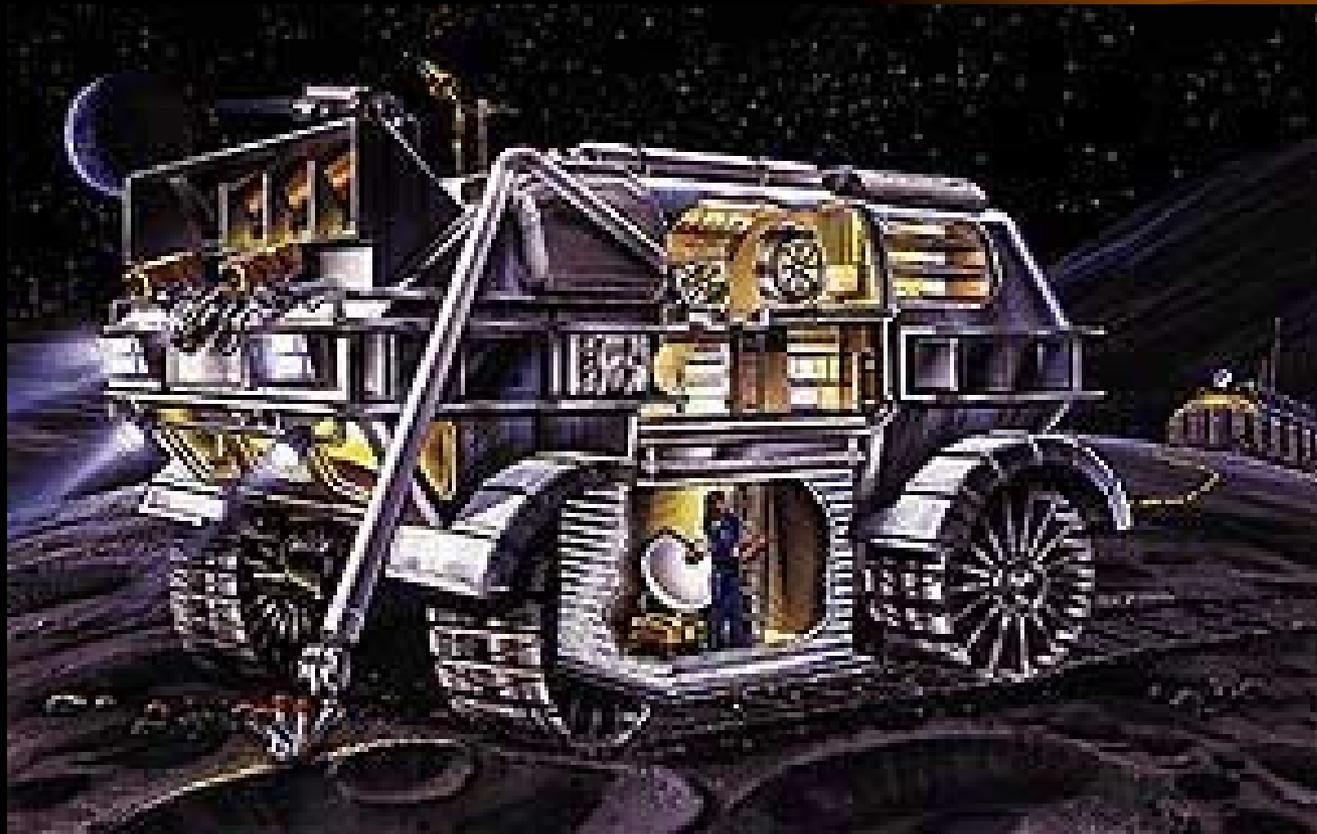
Example



Example



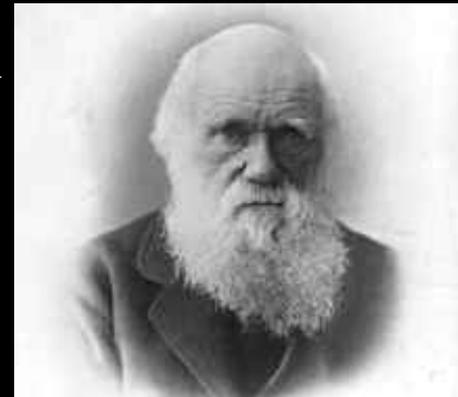
Example



Concept Creation



- Background Activity
 - Brain storming
- Reverse Engineering
- Morphologic Box
- Adaptable, Incremental Approach
- Darwinian Down Selection
 - Highly Empirical



Heuristics

- A lesson learnt or
- A Rule Of Thumb
re. complex systems
from experience



The American Society of Mechanical Engineers, 1954
Arthur E. Raymond.





Heuristics

For complex systems:

- Biggest blunders are made on the first day you commit to concept.
- Evolution, much less revolution.
- Watch, wait.....if more solutions than problems...good concept.
- Before the flight it is opinion, afterward it is obvious.
- Be fast, be quiet, be on time. If you can't do it with brain power, you can't expect to do it with man power, even overtime.
- Maximum leverage exists at the interfaces.
- Common sense is not so common.
- Be wary of abstraction. Every layer puts you back another step from reality.
- If it ain't broke, don't fix it.



Technique

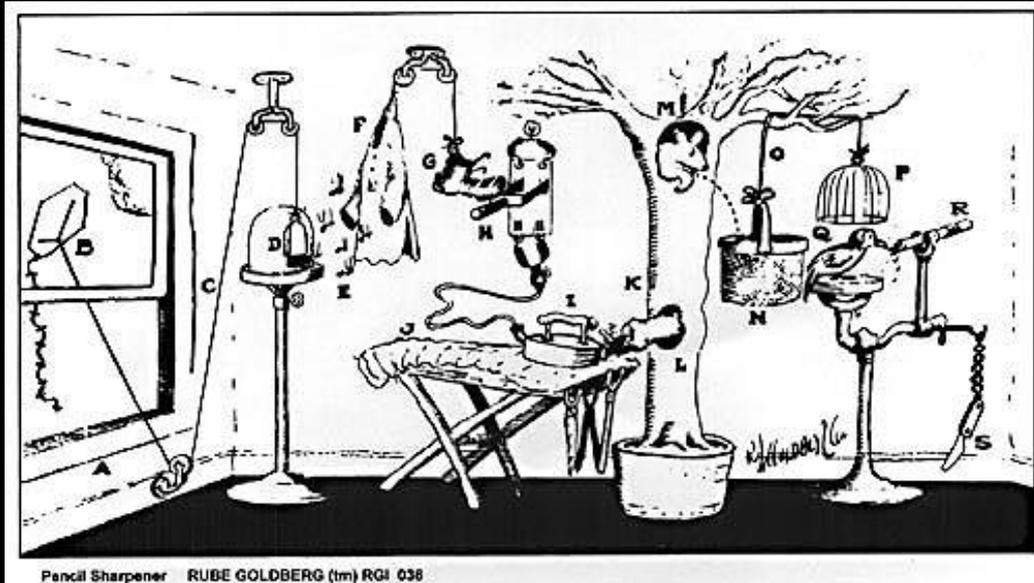


- Interdisciplinary
 - Visualize
- Prime up with programmatic data
- “Play” with a handful of parameters
 - Heuristics
- Create a concept !
 - Repeat !!!

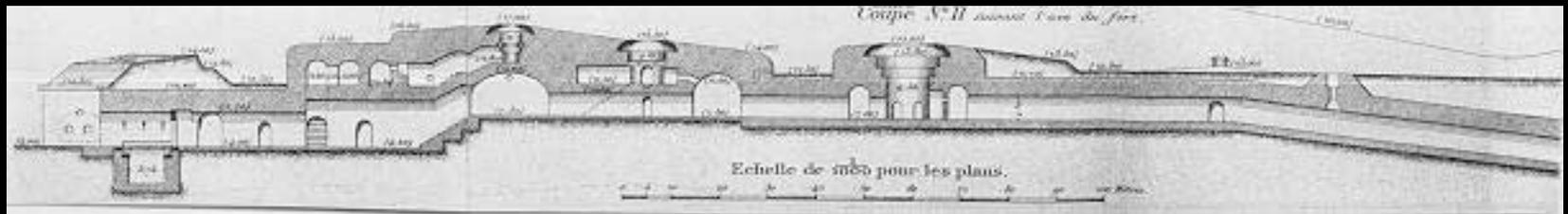
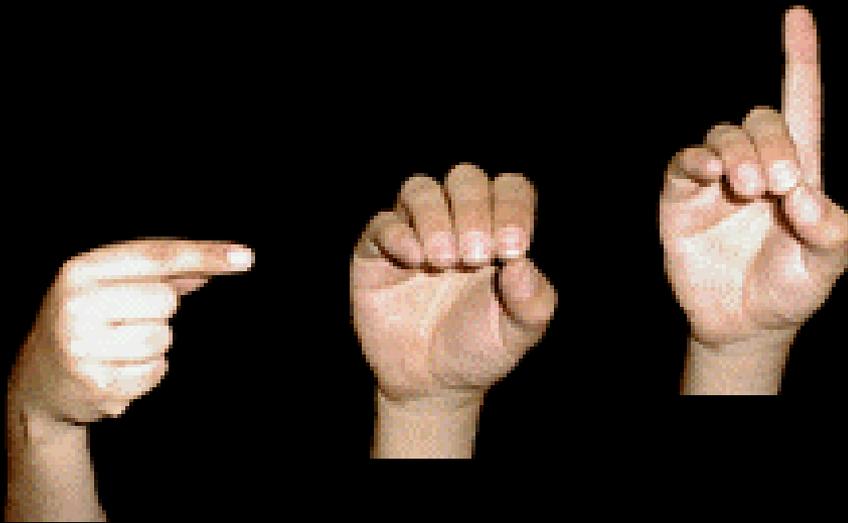


Reality

- No such thing as an “ideal” concept.
- No such thing as ideal design methodology.
- A concept is as good (“strong boned”) as its ability to adapt to changing external / internal parameters imposed upon it.



Strange ?



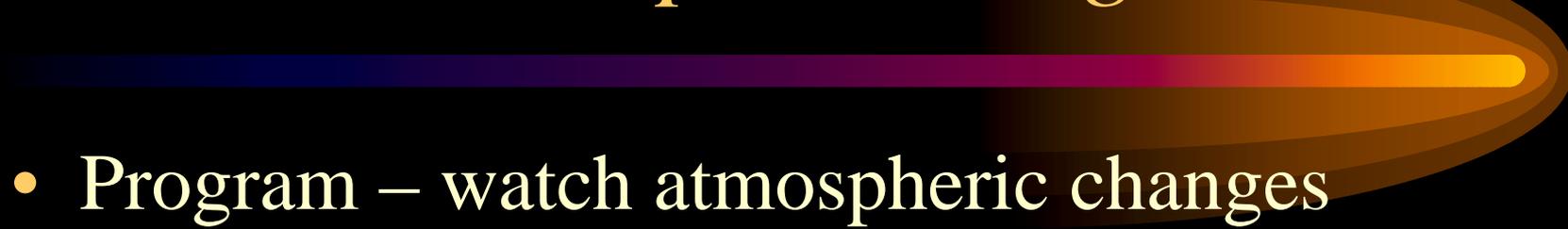


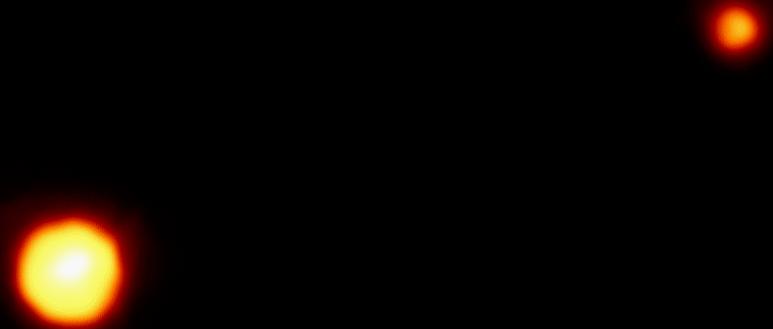
Ruminate.....

- “Wicked” Problem
- “Out Of Bounds” Solution
- Architecting and Engineering
 - Reality and Perception
- Biologically Accurate Modeling
 - Heuristics
- Darwinian Down Selection
- “Strong Boned” Architecture



Concept – Going to Pluto



- Program – watch atmospheric changes
 - 60 year mission
 - Mariner, Voyager legacy
 - Nuclear Power
 - Electric Propulsion
- 

Castles In The Air



*When Castles in the air
Fall to the ground,
It hurts no one
Makes not a sound !
Castles of gold though,
A keystone amiss,
May bring down the city
Boy ! What a pity.
But castles in the air
Sometimes turn into gold
Rarely, rarely, but sometimes they do stand
And in all it's glory
New, new rules they command.*

