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VIRTUAL SUMMIT

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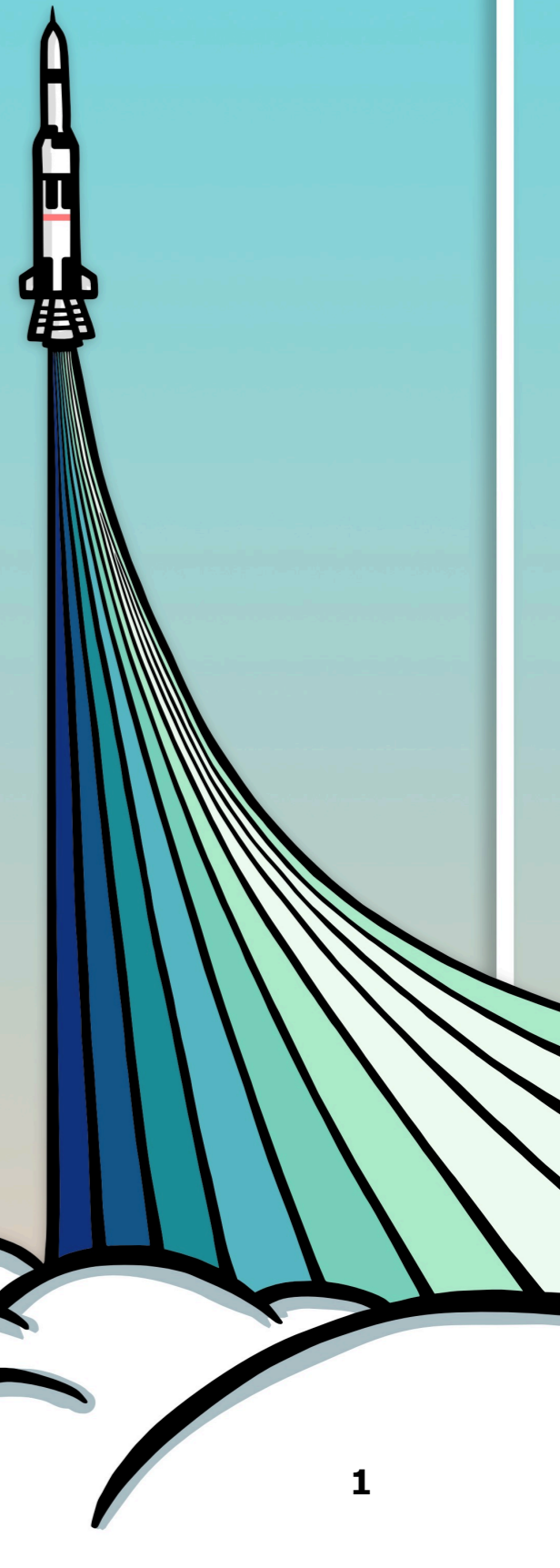
The Anatomy of a Compelling Science Story

CL#21-2324

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Agenda

- Science Goals, Questions, & Objectives
- What Makes a Compelling Science Story
- Science Objectives
- Final Thoughts

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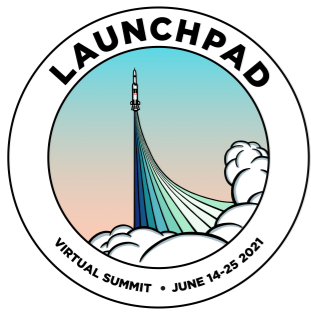
Science Goals, Questions, & Objectives

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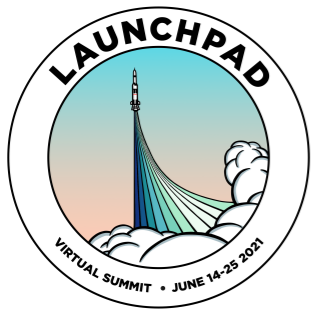
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Science Goals are very Different from Science Objectives

- A science goal is an “aim toward which an experiment or investigation is directed”
 - Must be a goal from a NRC Decadal Survey or NASA Advisory Group
 - Usually qualitative rather than quantitative
 - Example: Ascertain the origin and evolution of the Solar System and to understand the potential for life beyond Earth
- A science **objective** is something that “one’s efforts or actions are intended to attain or accomplish”
 - Must address the science goal
 - Should be quantitative
 - Example: Determine if life exists at this Martian latitude and longitude within the top 5 cm of the surface

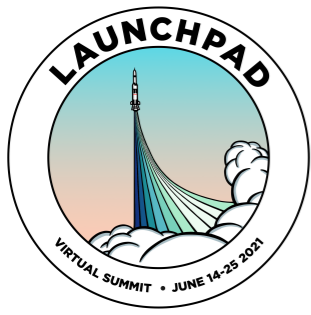


What Makes a Compelling Science Questions?

- A compelling science question goes directly to addressing a NRC Decadal Survey or NASA Advisory Group goal
- The science question must be hypothesis-driven
- It should be devoid of jargon, acronyms and should be easily understandable by an educated person outside of the field
- It should not be composed of more than one question
 - Example: “What governed the accretion, supply of water, chemistry and internal differentiation of the inner planets and the evolution of their atmosphere, and what role did bombardment by large projectiles play?”
- It needs to be answerable by the proposed mission concept

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What Makes a Good Hypothesis?

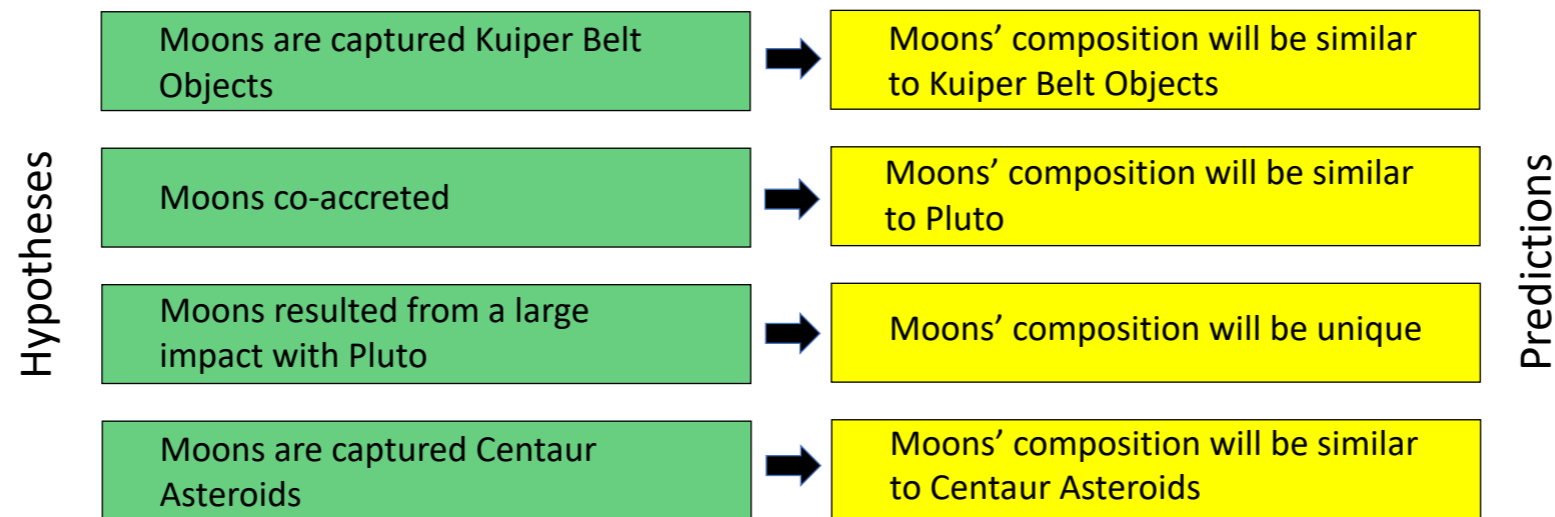
- A strong hypothesis must be able to start a “barroom brawl”
 - Without controversy, the hypothesis is only stating the obvious
- Must be written as a declarative statement
- Every hypothesis must have an associated prediction
- There can be many hypotheses for a given science question
- A science mission that reduces the number of potential hypotheses from “n” to “n-1” for a particular science questions is not very compelling
 - There are still many unknowns



Example: A Pluto Science Story

* Science Goal: To Understand the Evolution of the Pluto System

Science Question: What is the origin of Pluto's moons?



* Objective: Determine the origin of Pluto's moons by measuring their surface composition

* Science Traceability Matrix (STM) required field

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This Pluto Science Story is Consistent with the Scientific Method

- * **Science Goal** To Understand the Evolution of the Pluto System
- Science Question** What is the origin of Pluto's moons?
- Hypothesis** Moons are captured Kuiper Belt Objects
- Prediction** Moons' composition will be similar to Kuiper Belt Objects
- * **Observable** Moons' surface composition
- * **Measurement** Moons' reflected infrared spectral signature

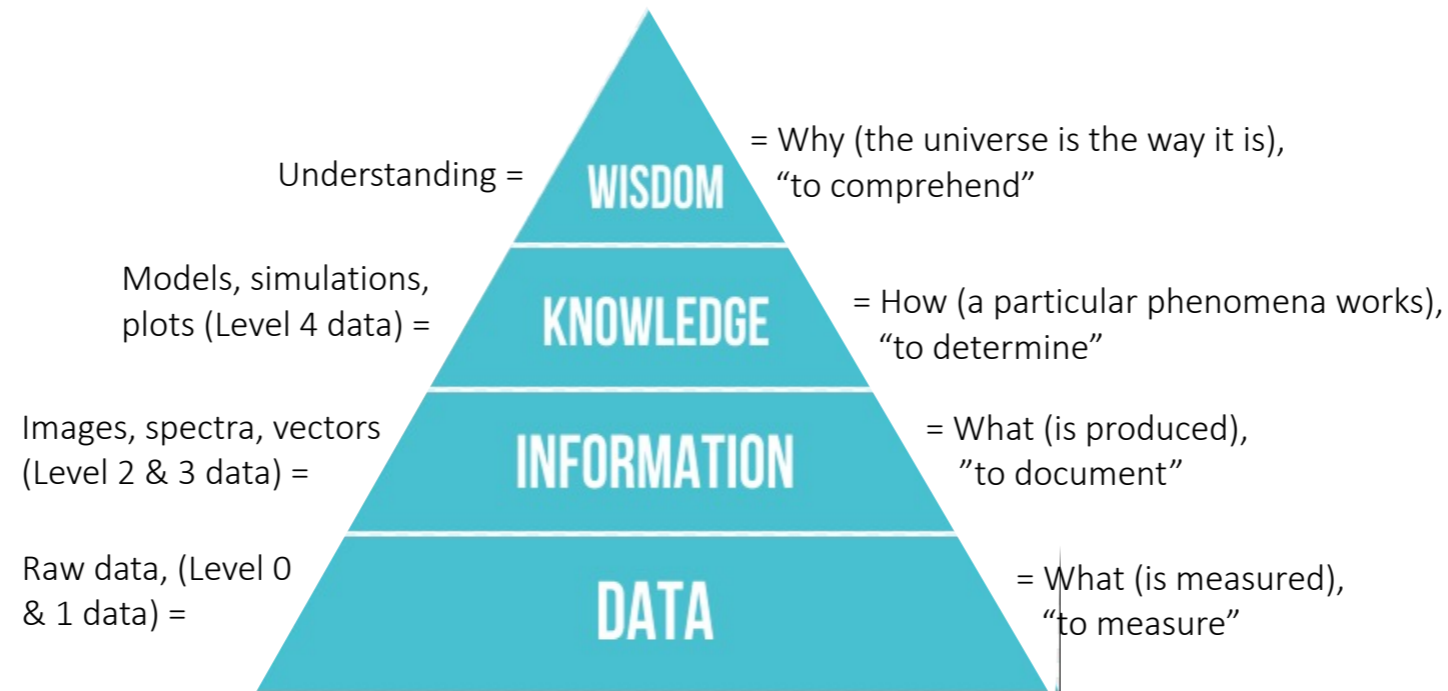
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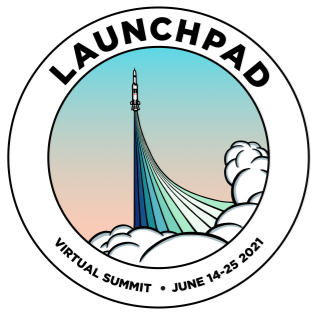
Compelling Objectives are Higher Up the DIKW Pyramid



Henry, Nicholas L. (May–June 1974). "Knowledge Management: A New Concern for Public Administration". *Public Administration Review*. **34**(3): 189. doi:10.2307/974902. JSTOR 974902.

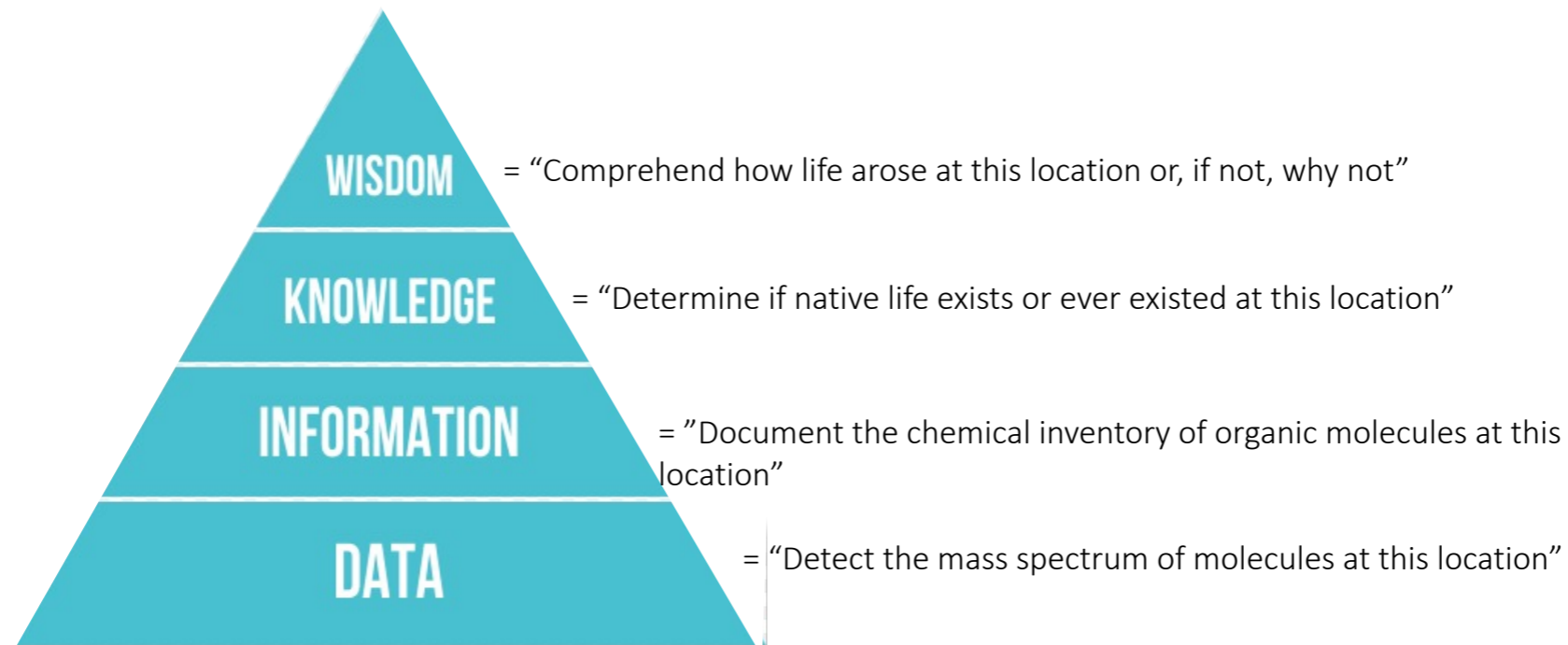
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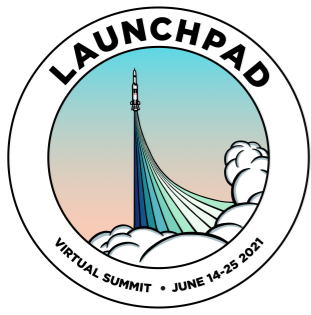
Science Question: Was there ever life on Mars?



Henry, Nicholas L. (May–June 1974). "Knowledge Management: A New Concern for Public Administration". *Public Administration Review*. **34**(3): 189. doi:10.2307/974902. JSTOR 974902.

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Final Thoughts

- Goals are qualitative, objective are quantitative
- Hypotheses must be controversial
- Every hypothesis must have a corresponding prediction
- A compelling investigation strives to increase our understanding of nature rather than obtain a more precise measurement or make measurements in a new environment
- More objectives are not necessarily better