Challenges in the Development of Systems Engineering as a Profession

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June 25th, 2007

Agenda

- **Professions**

- **Systems Engineering**

- **Central Questions**

- **Challenges**

- **Conclusions**

- **Q & A**

Professions

Definition

From the Merriam-Webster Online Dictionary,

Main Entry: profession

4 a : a calling requiring <u>specialized knowledge</u> and often long and <u>intensive academic preparation</u> b : a principal calling, vocation, or <u>employment</u> c : the <u>whole body</u> of persons engaged in a calling

Common Professions: Medicine, Law, Engineering(?)

Initial Ideas

- **History of "Firsts"**
  - First journal, conference, society etc…

- **Different folks, different strokes**
  - Power, social legitimacy etc…

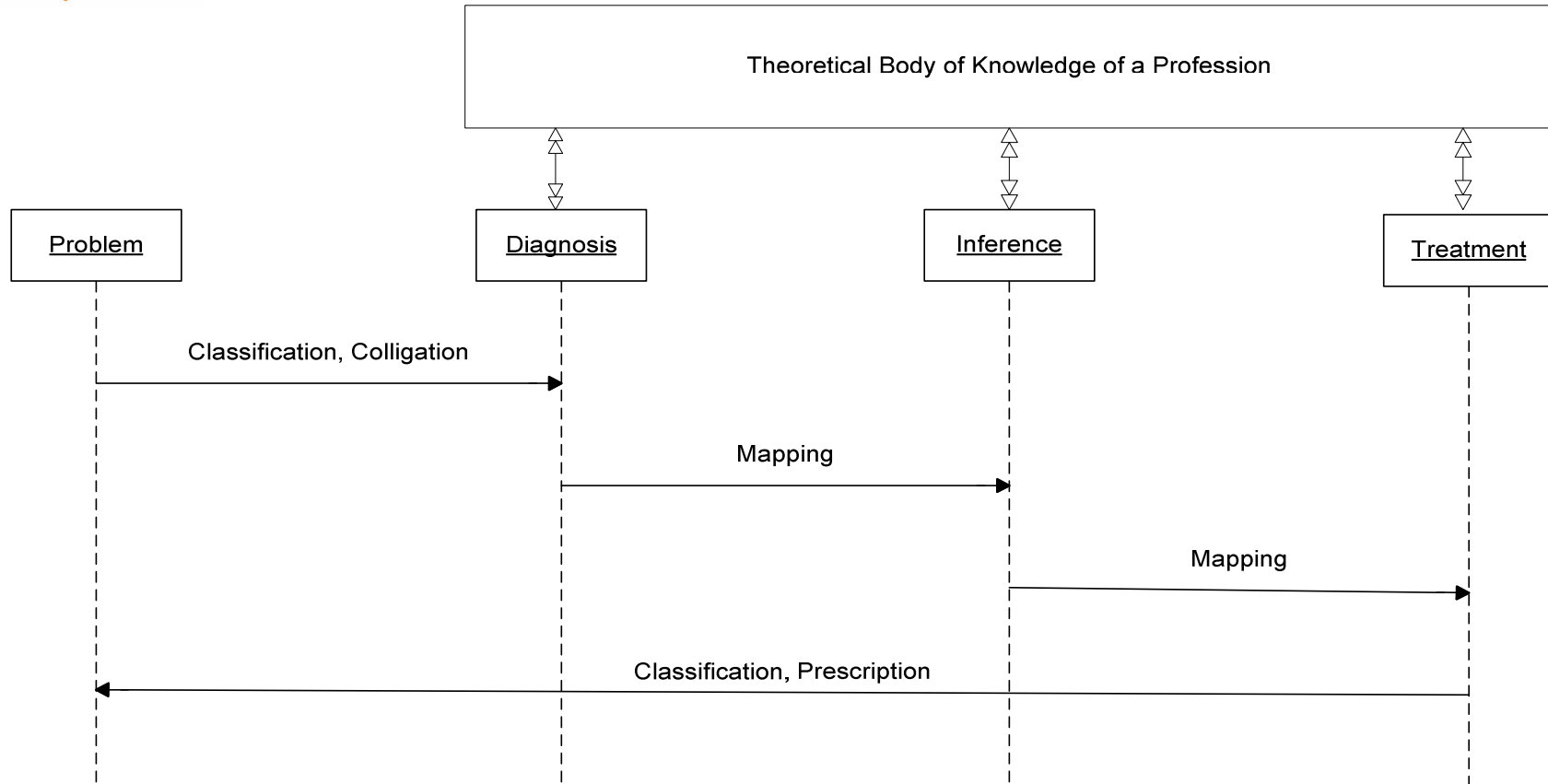- **Adler and Kwon (2006): "engineering is a "semi-profession""**
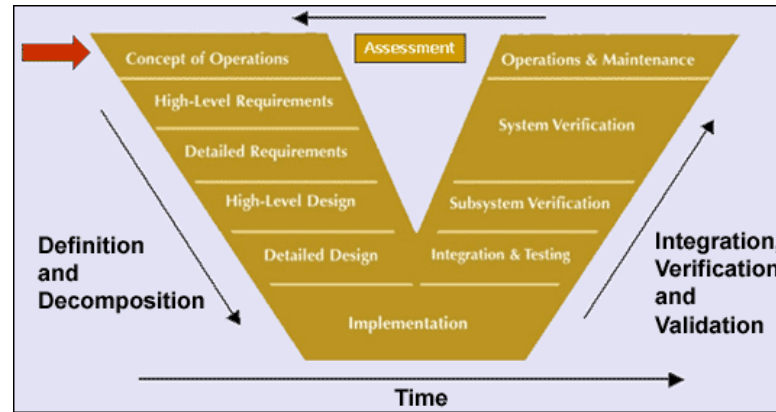
*"System of Professions"**

- **Professionalization**
  - **Nature of the problem**
  - **Competition between professions**
  - **Body of knowledge**
  - **Abstraction in practice**
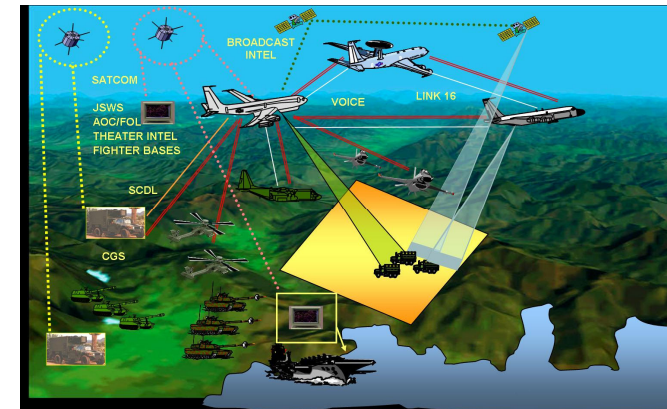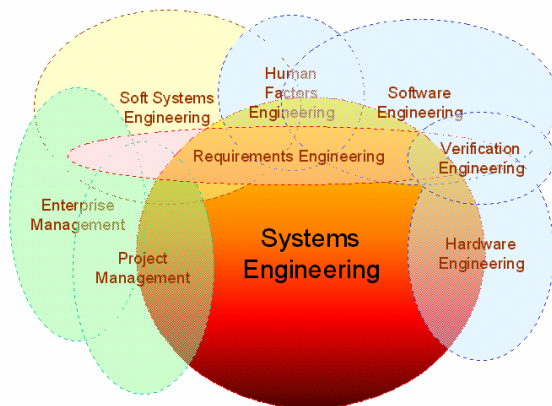- **History of IEEE**
  - **Radio vs. Power engineers**

Abbott, A., (1988),** *System of Professions: An Essay on the Division of Expert Labor, University of Chicago Press.**

Abstraction in Practice

Theoretical Body of Knowledge of a Profession

| Problem | Diagnosis | Inference | Treatment |

Classification, Colligation

Mapping

Mapping

Classification, Prescription

The Diagnosis-Inference-Treatment Mechanism

Systems Engineering

Initial Ideas

"What we've got here is failure to communicate."
Cool Hand Luke (1967)

- **Post-Second World War**
  - Bigger, larger, more complex systems
  - Management of technical effort
  - Response of engineers
  - Several definitions/views

Current Ideas

- **Post-INCOSE**
  - Customer requirement
  - More university programs
  - Greater industry involvement
  - Annual conference and journal
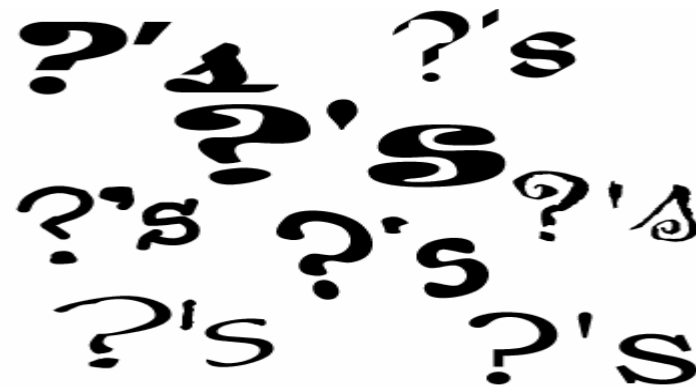 - Several definitions/views?

- **More communication failures?**

The Organization

- **The hierarchy of Systems Engineering**
  - **Micro**
    - Specialty/Discipline Engineer
  - **Meso**
    - Senior Systems Engineer
  - **Macro**
    - Program Manager

- **Every engineer does Systems Engineering**
  - **Caveat: There is something unique in what every engineer does!**

Central Questions

Central Questions

- **What is a Systems Engineering <u>problem</u>?**

- **What are the <u>characteristics</u> of *this* Systems Engineering problem?**

- **How does a System Engineer *know* what the characteristics are?**

State of the Art?

	Rechtin (1991)	Vee Model (Forsberg & Mooz 1995)	SE Standards (ANSI/EIA 1999, ISO/IEC 2002)	Maturity Models (CMMI 2002)	COSYSMO (Valerdi et al 2003)	DoD Architecture Framework (DODAF 2004)	GUTSE[1] (Friedman 2004)	Ontologies (Honour & Valerdi 2006)	VBSE[2] (Jain & Boehm 2006)
Observation	◆				◆		◆		◆
Classification	◆				◆		◆	◆	◆
Abstraction	◆				◆	◆			◆
Quantification & Measurement				◆	◆				
Symbolic Representation			◆						
Symbolic Manipulation		◆							
Prediction					◆				

Challenges

Challenges

1. The problem space in systems engineering remains undefined

2. Lack of a coherent body of knowledge of Systems Engineering

3. The compounding effect of the lifecycle perspective

More Challenges

4. Inability to falsify (overarching) theories of Systems Engineering

5. Lack of standard of proof in Systems Engineering

Conclusions

Final Thoughts

- **Engineering as a Profession**
  - History of pragmatic problem-solving
  - Problem solving preceding theoretical development
  - Pragmatic usefulness, must not be lost in the quest for theorizing.

Q & A