Statistical Influence

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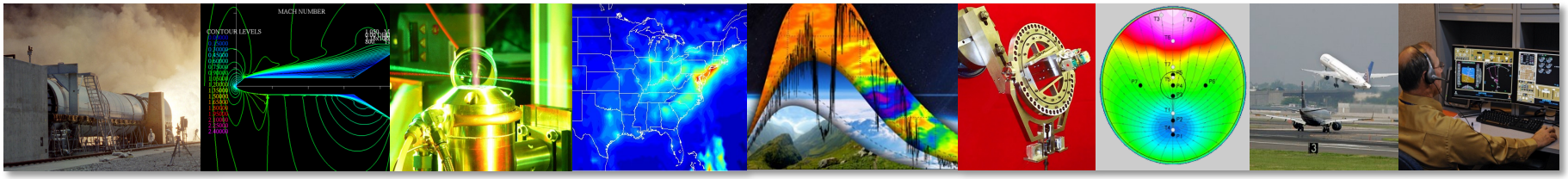
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Essence of Statistical Influence

"…denotes power whose operation is invisible and known only by its effects…," Webster (1828)

- **Statistical influence advances the spread and practice of statistics and enhances an organization's ability to successfully achieve their mission**
- **Statistical concepts become more widely known and engrained primarily through demonstrated organizational impact**
- **Discuss strategic and tactical elements of statistical influence exemplified through my experience at NASA**

Webster, Noah (1828) American Dictionary of the English Language, United States, Editorium.

Maybe a more descriptive title

Organizational Statistical Influence



Maybe an even more descriptive and

a necessary qualifier



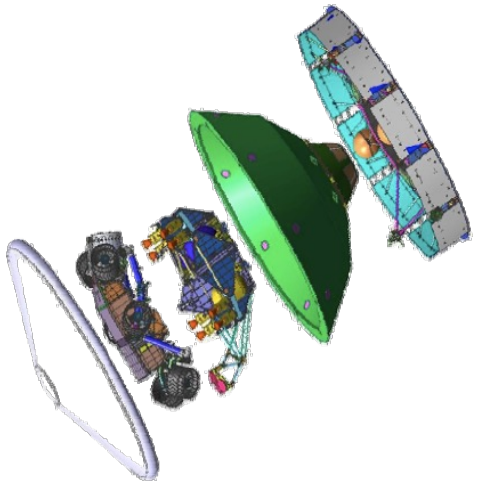
Positive Organizational Statistical Influence

Are statistical methods desired or feared?

Are they sought after or run from?

Are they the first or last considerations?

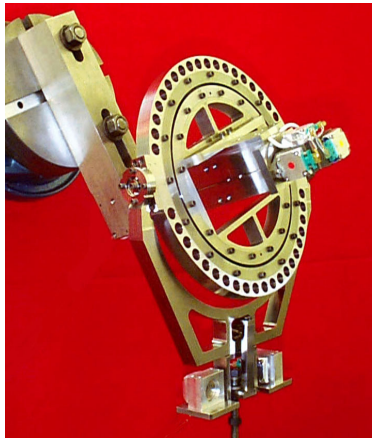
Statistical Influence Opportunities



Mars Entry Measurements

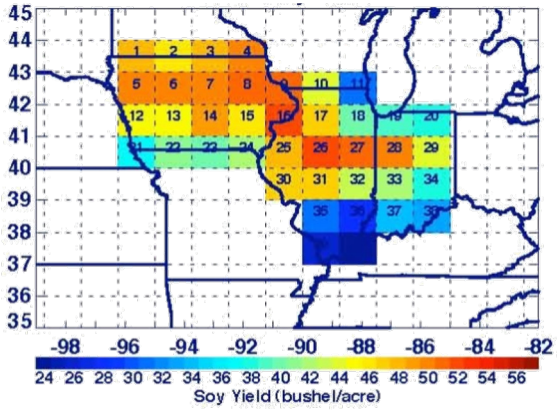


Rocket Characterization



Improving Instrumentation





Informing Crop Yields



Helicopter Capability

Influencing Decisions



Statistical methods extract insights and gain knowledge from data to empower decisions

Influence decisions throughout the organization

Organizational impact through better, informed decisions

Influence through Collaboration

Consultation

Helping others understand a pre-defined problem in a larger system

Cooperation

Dividing a task among team members, where each person is responsible for a portion of the problem solving

Collaboration

Mutual engagement to identify and solve a problem together with a common goal

Communication is a critical skillset

Anderson-Cook, Lu, Parker (2018) "Effective Interdisciplinary collaboration between statisticians and other subject matter experts," *Quality Engineering*.

Evidence of Statistical Influence



- **Broad awareness**
- **Becomes common language in project planning and execution**
- **Ubiquitous practice**
- **Drives applied research**
- **Employees seeking educational development**
- **Influencing other organizations**

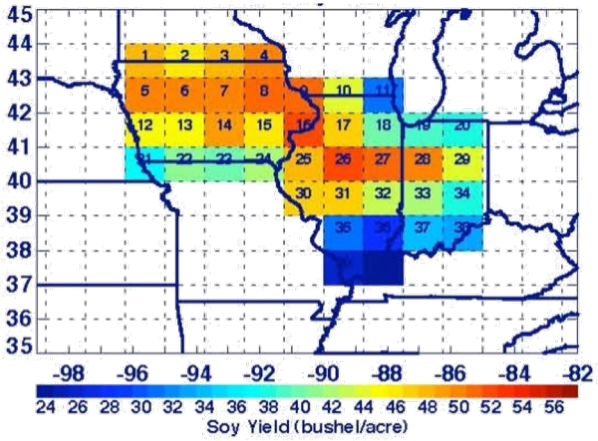
Examples of Influence



Rocket motor performance characterization

Restricted randomization, five-factor second-order inverse prediction response models

Statistical Influence: An experiment starts with research questions, not data acquisition



Satellite models for agricultural decision support

Multiple data scale and fidelity modeling, multiple linear regression, spatial, temporal, and seasonal correlation structures

Statistical Influence: Modeling that captures more than pairwise correlation

Long Term Impact by Changing Thinking and Practice

Fishman, et al. (2006), "An Investigation of Widespread Ozone Damage to the Soybean Crop in the Upper Midwest Determined from Ground-Based and Satellite Measurements," *Atmospheric Environment*, 44, pp. 2248-2256.

Objective(s) of Statistical Influence

Defining what success looks like is vital in accomplishing objective(s)

Organizational Practice

Broad awareness, acceptance, practice, and impact. Achieves the longest, broadest impact of statistical thinking and practice

Team of Experts

Necessary and supportive, can be narrower goal than broadening organizational impact

Personal Career Goals

Important, motivating, but if the sole objective, it can limit organizational influence

Concluding Remarks

- **Discussed elements of statistical influence, illustrated through practice at NASA**
- **Focus on broad, long-term, organizational influence**
- **Effective collaboration is essential to gain influence**
- **Influence is evidenced by awareness, practice, research, education, external influence on other organizations**
- **Success metrics are important to recognize**

Powerful statistical concepts become more widely known and engrained primarily through organizational statistical influence