Design Structure Matrix Methods and Applications
A Half-Day Tutorial with Tyson R. Browning
Friday, 22 June 2012, 8:00 a.m – noon
Location: CNM Workforce Training Center, 5600 Eagle Rock Ave., NE, Albuquerque, NM 87113

ABSTRACT

The *design structure matrix* **(DSM)** is a powerful tool for visualizing, analyzing, innovating, and improving systems, including product architectures, organizational structures, and process flows.

Akin to a traditional N^2 chart and the System-System matrix (SV-3) in the DoD Architecture Framework (DoDAF), the DSM is a square matrix showing relationships between system elements. These elements can be components, teams, activities, or others. By analyzing the DSM, one can prescribe a better (e.g., more modular) system architecture. Adding a time-basis enables one to prescribe a faster, lower-risk process. Because the DSM highlights process feedbacks, it helps identify iterations and rework loops—key drivers of cost and schedule risk.

The DSM is concise and visually appealing and is used in many organizations across diverse industries. Over the past decade the DSM has gained popularity. Users have found the tool extremely useful for fostering architectural innovation and enabling the situation awareness and empowerment that motivates the people executing complex processes.

This tutorial introduces the DSM and three distinctive applications useful to product developers, systems engineers, and project and program managers. Real-life examples are presented from the aerospace, automotive, semiconductor, and other industries. Participants will engage in hands-on exercises and come away with a clearer understanding of the drivers of some critical, emergent behaviors in systems.

Topics include:

1. General Introduction
    Why are interfaces and dependencies important?
    Why are they often mismanaged?
2. Introduction to the DSM
    A) How does it work?
    B) History
    C) Types of applications
3. **Application one: *Product Architecture DSM for systems architecting***
    A) Motivation
    B) Using the DSM
    C) A detailed example—engine architecture
    D) Exercise
    E) Analysis opportunities and challenges
    F) Tools
    G) Discussion—strengths and weaknesses of the approach; when, where, and why to use it
4. **Application two: *Organization Architecture DSM* for organization design**
    A) Motivation—well-integrated organizations, multi-team coordination
    B) Capturing organizational interactions
    C) Using the DSM
    D) A detailed example (General Motors)

E) Discussion—strengths and weaknesses of the approach; when, where, and why to use it
5. **Application three: *Process Architecture DSM* for program management**
    A) Problems with common process modeling methods
    B) Activity coupling, interdependency, feedback, and iteration
    C) Using the DSM
    D) A detailed example
    E) Exercise
    F) Additional examples (Boeing, Intel, Lockheed Martin, etc.)
    G) Analysis opportunities and challenges
    H) Tools
    I) Discussion—strengths and weaknesses of the approach; when, where, and why to use it
6. Integrative topics
    A) Relationships between the applications
    B) Beyond DSM: Domain Mapping Matrices (DMMs) and Multidomain Matrices (MDMs)

Dr. Tyson R. Browning is Associate Professor of Operations Management in the Neeley School of Business at Texas Christian University, where he conducts research on managing complex projects and teaches courses on project and operations management. He earned a B.S. in Engineering Physics from Abilene Christian University and two Master's degrees and a Ph.D. from MIT.

Prior to joining TCU in 2003, he worked for Lockheed Martin Aeronautics Company as the technical lead and chief integrator for enterprise processes, and for the Lean Aerospace Initiative at the Massachusetts Institute of Technology (MIT), conducting on-site research at Boeing, Chrysler, General Electric, Lockheed Martin, McDonnell Douglas, Sundstrand, and Texas Instruments. He has also worked for Honeywell Space Systems and Los Alamos National Laboratory and served as a consultant for several organizations, including BNSF Railway, General Motors, Lockheed Martin, Northrop Grumman, Seagate, Southern California Edison, and the U.S. Navy.

His internationally recognized research on managing complex projects appears in journals such as *IEEE Transactions on Engineering Management*, *International Journal of Project Management*, *Journal of Mechanical Design*, *Journal of Operations Management*, *Production & Operations Management*, *Project Management Journal*, and *Systems Engineering*. He is also the co-author of a new book on the design structure matrix (DSM).

He is a member of the Institute for Operations Research and the Management Sciences (INFORMS), the International Council on Systems Engineering (INCOSE), and the Production and Operations Management Society (POMS), and he serves on the Editorial Boards of *IEEE Transactions on Engineering Management* and *Systems Engineering*.

Location: CNM Workforce Training Center, 5600 Eagle Rock Ave., NE, Albuquerque, NM 87113, (505)-224-5200, URL: http://www.cnm.edu/campus/wtc/, near I-25 and Alameda Blvd. exit.

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Questions? Please contact Ann Hodges at alhodge@sandia.gov or Woody Weed at jwweed@sandia.gov .