

Benefits and Challenges of Multidisciplinary Project Teams: “Lessons Learned” for Researchers and Practitioners



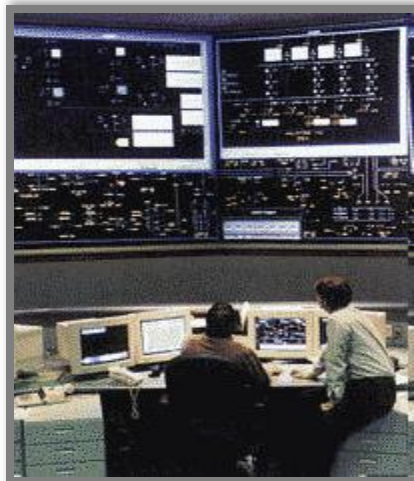
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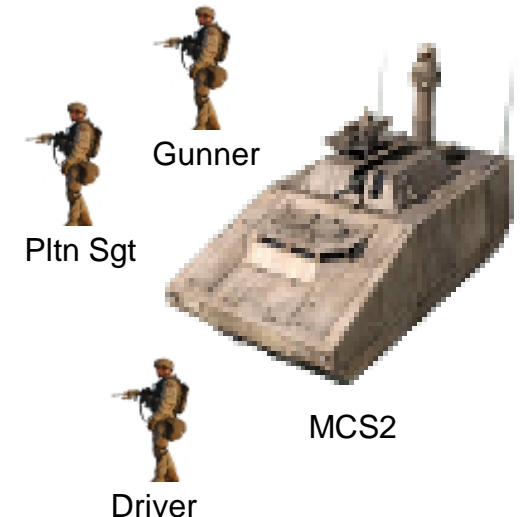
GET CONNECTED to LEARN, SHARE, AND ADVANCE.



- **Coordinated effort among several disciplines**
- **Provides complementary contributions in service of a common goal**
- **Offers multiple perspectives and broad range of expertise for generating unique and creative solutions to solve real-world problems**



- **Army-sponsored research project**
 - Conducted at Aberdeen Test Center (ATC)
- **Six SOMTE soldiers**
 - Assigned to two 3-person MCS vehicle crews
 - Crew: **Vehicle Commander, Driver, Gunner**
- **Dynamic military command and control simulation**
 - Completed eight 75-minute missions
 - Maneuvered MCS vehicles through desert and urban environments
 - Controlled unmanned ground and aerial systems



- **ACASA Researchers (industry)**
 - **Validate Automated Communications Analysis of Situation Awareness (ACASA) system**
 - Unobtrusively assesses situation awareness based on analysis of team communications
- **ARL-HRED Analysts (gov't)**
 - **Verify existing ARL-HRED task analysis and workload predictions associated with IMPRINT analysis of Future Combat System MCS**
- **ATC Researchers (gov't)**
 - **Coordinate experiment, participant recruitment, simulation, physiological and task performance data**

- **ACASA Researchers**
 - **SAGAT: Objective situation awareness measure**
 - **Digital audio recordings of team communications**
- **ARL-HRED Analysts**
 - **Instantaneous Self-Assessment of Workload (ISA)**
 - **Experimenter observations**
- **ATC Researchers**
 - **EEG recordings for physiological workload data**
 - **Simulation log files for task performance data**

- **Reflect multiple perspectives of our project team's diverse members**
 - **Drawn from both industry and government organizations**
- **Commentary also provided from project manager's perspective**
- **Aimed at providing guidance to researchers and practitioners alike**



- **Researchers must understand relation between own objectives and those of other team members**
 - Which goals are aligned?
 - How do objectives differ?
- **Created comprehensive testplan**
 - With consideration for different data collection requirements and constraints

- **Lesson Learned #1:**

- **Upfront collaborative design of an experiment allows each researcher to effectively work independently within his/her area of expertise during actual experiment data collection**
- **Begin working together early during experiment's planning and design stages**
- **Then work independently, where appropriate, during execution stage**



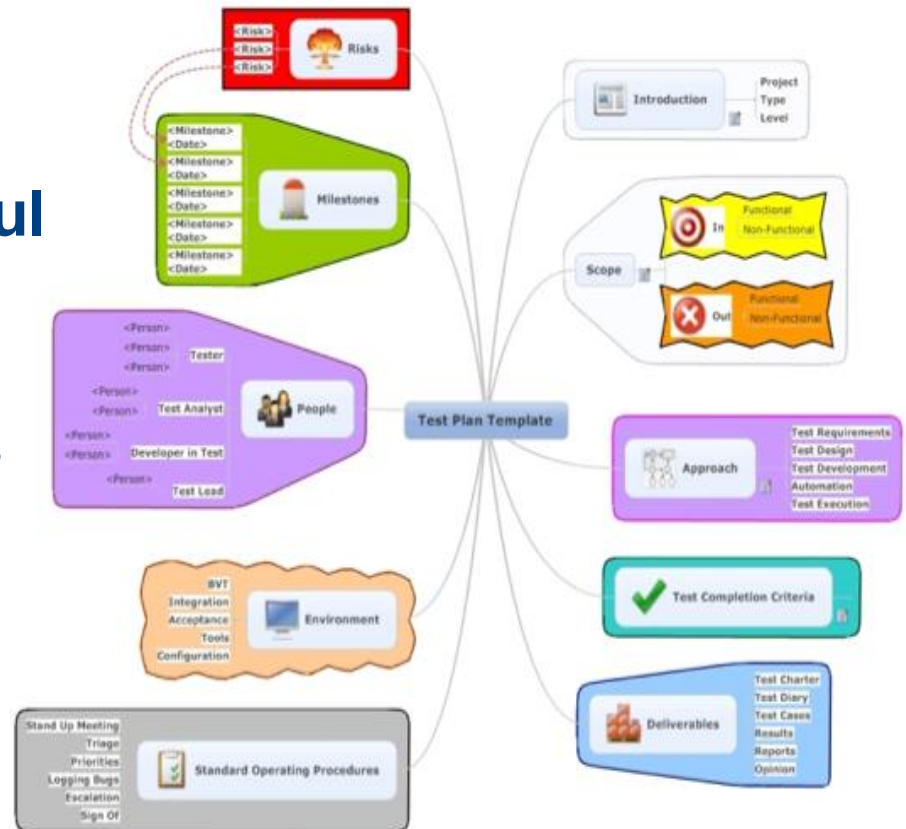
Resolving Conflicting Data Collection Requirements



- **How to efficiently incorporate project team's different measures and apparatus into overall experimental design**
 - **Continuous measures (e.g., EEG recordings) easy to coordinate during experiment**
 - **Non-continuous measures (e.g., SAGAT) had to be more carefully planned in advance**
- **SAGAT and team communication measures created challenges in collecting workload data**

Resolving Conflicting Data Collection Requirements

- **Lesson Learned #2:**
 - **Conducting multidisciplinary research requires careful consideration of conflicting data collection requirements**
 - **Goal is to minimize interference across different measures and judiciously prioritize research objectives when necessary**



- **Integrated several sources of experimental data from multiple researchers**
 - Analyzed situation awareness data with team communication data
 - Compared different types of physiological measures
 - Analyzed situation awareness data with physiological data
 - Utilized team communication data for subsequent IMPRINT analysis

- **Lesson Learned #3:**
 - **Major benefit of multidisciplinary research**
 - **Team members have access to a broader range of data at no (or only minimal) additional cost**



- **Working under numerous constraints**
 - Distributed across 4 states and 3 time zones
 - Utilized multiple technologies for collecting data
 - Those installing and configuring technology removed from those analyzing data
 - Limited resources, time pressure
- **Synchronizing simulation “clock” time with different measures proved to be a challenge**
 - Different interpretations of central clock
 - Resolved with comparison of data files, follow-up discussions, and detailed simulation clock time records kept by ARL-HRED Analysts

- **Lesson Learned #4:**
 - **Establish a priori a standardized central reference time that can be used by all researchers for tagging and analyzing data**



- **Multidisciplinary project teams have different training, backgrounds, experiences, traditions**
- **Each discipline has communal conventions for**
 - **How data is collected**
 - **What formats are preferred**
 - **How data is labeled and organized**
 - **How data is analyzed**
- **Problems may arise when researchers do not fully understand measures collected by other team members**
 - **e.g., physiological workload data**

- **Required regular meetings to design experiment, create a common testplan, and coordinate our various research activities**
 - **Creating a common testplan helped to foster a broader perspective on experiment**
- **Administrative issues included:**
 - **Training onsite contractors from remote location on how to use technology**
 - **Differences in funding mechanisms**
 - **Differences in publication approval processes**

- **Lesson Learned #6:**

- **Multidisciplinary research requires consideration of administrative capabilities and constraints of all key stakeholders, including, but, not limited to:**

- Geographic distribution
- Funding mechanisms
- Organization-specific policies and resources

- **Careful planning and regular communications among project team members can help avoid or minimize effects of many of these issues**



- **Prioritization is greatest challenge**
 - Weigh benefits of each research aim with each researcher's specific test requirements
 - Act as 'middle-man' between groups
- **Multidisciplinary teams allow researchers to**
 - Critically think through their own processes and techniques and judge them against other research techniques
 - Examine problem from every side and provide a robust answer not typically found in a stovepipe one-discipline approach



- **Meeting constraints of different stakeholders with different agendas**
 - Creates need for potential trade-offs in experiment
 - Hinders ability to meet all team members' objectives
- **Requires establishing a systematic process**
 - Objectively agree to primary goal while still permitting stakeholders to determine specific research objectives and data requirements
 - Assume existence of “hidden” requirements and subtle interdependencies
 - Upfront collaboration on planning and experimental design is crucial

- **Benefit from wider range of resources and different areas of expertise:**
 - Significantly reduces amount of time needed to plan and execute experiment
 - Pooling resources results in significant cost savings
- **Beneficial also from a theoretical perspective**
 - Leverage different perspectives to achieve greater theoretically significant outcomes arising from synergistic activities of multidisciplinary research

- **Science is about solving problems and realizing possibilities**
 - Solving today's complex problems and realizing possibilities of technological advances requires coordinated collaborative scientific endeavors that cut across multiple disciplines
 - Yields greater scientific discoveries and insights than could be accomplished by a researcher working within a single discipline
- **Multidisciplinary research allows project teams to achieve a greater return on their investment**

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