

# Tactics, Techniques, and Procedures for Quick Reaction Analysis

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*Scene 1: Large office building cubicle farm, mid-morning*

"Majors Frick and Frack, let's head down to General Harried's office; he's got something for us," called out Colonel Ontopofit. "On the way, Sir!" shouted Frick, followed closely by Frack's question, "Any idea what this is about, Sir?" "Not really," replied Colonel Ontopofit. "His XO really didn't give me a clue; he just said that it was hot and needs us there now."

*Scene 2: General Harried's office; after about a 30 minute wait in outer office*

"Here's the deal," says General Harried. "The big guys upstairs are thinking about increasing the size of Program XYZ and want to know how long it will take and what it will cost." "Sir, that shouldn't be too difficult," replied Colonel Ontopofit. "After all, it is rather similar to their question a few months ago about increasing Program ABC."

"Great. You'll have to brief me tomorrow morning at 0830 because I need to be upstairs to present our estimates to them by 0900," said General Harried. "Be prepared to go along with me if there are seats available."

*Scene 3: Walking back their office after the meeting*

"Sir, I think that meeting the timeline you promised the Boss could be a problem," offered Major Frick. "He's right, Sir," chimed in Major Frack. "The data pull and conversion alone is going to take us a few hours." "Well then, I guess it is going to be a late night, gentlemen," replied Colonel Ontopofit. "However, there should be a way that we can make use of some previous work we have done. Let's get together after we all get done working out at the LOBAC (Large Office Building Athletic Club) at, say 1300, to formulate a game plan on how to attack this problem." "Yes, Sir," replied Majors Frick and Frack in unison.

## Introduction

While the above story may seem a little contrived, similar events occur daily in various headquarters known to be populated with operations research analysts. The motivation for this article stems from a sequence of experiences by the authors in previous assignments. When reviewing the curriculum of the Army's Qualification Course for Functional Area 49 (Operations Research / Systems Analysis), one author noted that it seemed to be focused on preparing analysts for designing, conducting, and analyzing long-term studies and major models/simulations.<sup>1</sup> While this may be the environment in which many analysts at the larger analytical agencies (e.g. Center for Army Analysis, Marine Corps Combat Development Command, Air Force Studies and Analysis, etc.) find themselves working, it did not match the authors' experiences in a service headquarters and on an operational-level staff.

Analysts in these types of positions or

many others are frequently either on their own (as the only analyst in an organization) or operate as a member of a small cell of analysts. Their duties may include some routine reporting requirements or participating in long term studies, but a significant portion of their time is occupied by Quick Reaction Analysis (QRA) that differs significantly from one day to another. To help analysts who find themselves in this setting, the authors propose the following guiding principles, or tactics, techniques, and procedures (TTP), in Army parlance.

## Guidelines for QRA

The TTP presented here are divided into two broad categories. First, we suggest actions that are *preparations for QRA*, to set you up for success when the need for QRA arises. Then, we outline principles for use once you are engaged in *conducting QRA* that the authors have found to be useful. They are by no means exhaustive, but can form the basis for a framework that can be adapted to your particular situation.

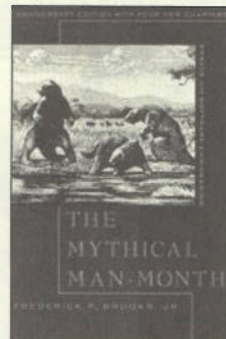
## Preparing for QRA

- **Learn systems in and around your area of responsibility.** Become the expert on information systems for which your office is responsible and develop a working knowledge of those in organizations with whom you will frequently work. If possible, take advantage of the true experts—the civilian analysts who have been there for some length of time.
- **Resolve (and Re-Solve) yours and others' problems.** Occasionally we solve a problem, only to realize that given additional time, we would solve it differently. Possibly, you see work presented by someone else and a different methodology strikes you. Problems that were worth answering once are often worth another look. Consider attacking the problem with a different methodology and explore the sensitivity of the previous analysis. Additionally, you can use another staff officers' work as a case study to learn a new technique or software package.
- **Learn the preferences of your organization's leaders.** Attend presentations to the leadership by both analysts and non-analysts to see what briefing techniques are received well and what methods don't get very far. Prior knowledge of the decision maker's level of understanding and level of technical background is critical.

- **Understand the "Mythical Man-Month."**<sup>2</sup> Some tasks take time. It does not matter how many analysts put their best efforts towards the problem, the model will take as long to optimize,

as the solver requires. Other tasks can benefit from additional hands, at varying level of analytical savvy. Learn what projects can be compressed and which will benefit from additional analysts. Good working relationships with the other analysts in your shop or in neighboring staff sections will allow you to leverage additional horsepower when the need arises.

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- **Empower non-analysts in your office with fundamental quantitative skills.** Despite the pervasiveness of spreadsheet models, many end users do not use even one-tenth of their capabilities. Conducting a short training class on importing data, cell selection techniques, formulas, range names, text selection and manipulation, logical operators, lookup functions, and pivot tables will go a long way to empowering non-analysts to tap the power of spreadsheets. Once the non-analysts in your office are armed with some of these basic skills, they will be able to conduct rudimentary analysis on their own. Some of them will not enjoy this type of work and will continue to come to you with basic queries. But, others (hopefully many) will thank you profusely for giving them the tools to look at their data in different ways and then come back to you with valuable insights and more challenging problems they would like you to help them to tackle.
- **Make everything you do easily repeatable.** Even if you think that the query is a one-time occurrence at the time, it probably will not be. Decisions are revisited at multiple levels throughout time and similar questions arise at an alarming rate. Making some tasks replicable may involve stepping outside of your comfort

zone. Instead of formatting data within Excel using point-and-click, pull-down menus, do it with Visual Basic for Applications (VBA), R functions, or SAS procedures. Once you have absorbed the fixed cost (learning and coding the data manipulation once), the payoff comes in being able to repeat the action again at essentially no cost. In the midst of a crisis, this may not be easy to do, which is the motivation behind the next rule.

- **Use available time to prepare when time is at a premium.** Had the two staff officers in the story above followed this guideline, their boss' request would have been a routine task. Instead, it may have turned into an "all-nighter" that didn't provide as much information to the decision maker as it should have. While virtually all analysts are always busy to some degree (and if they are not, either the position or person should be considered for elimination), there is likely some amount of "down time" that can be used for the self-study, formal training, and coding required to make tasks easily repeatable.

### Conducting QRA

Now the moment of truth has arrived; it is time to perform some analysis on a short timeline and present your results to a decision maker. This is when the preparations detailed above should pay off. However, there are still things you can do that may

make or break the success of the analysis and presenting it to the decision maker(s) in a useful form.

- **Take time to understand the problem, decision(s) to be made, and timelines.** When you receive a QRA task, don't immediately start working on collecting data and building models. In the vignette at the start of this article, notice that the senior analyst in charge of the effort provided the analysts with some time to reflect on the task they had just been given. This time will often be more effective than immediately reacting. The first stage (Problem Definition) of the Systems Decision Process,<sup>3</sup> used in the Department of Systems Engineering at the US Military Academy at West Point, shown in Figure 1, is colored red for *Stop! Don't Just Do Something – Stand There!* If we fail to identify and fully understand the right problem, we may end up expending a lot of time and energy creating a great solution designed to solve the wrong problem. It is critical to make sure we have a clear understanding of the problem before we jump into trying to come up with a solution.

- **Always pull more data than you think you might need.** Second only to what might be considered the First Law of Data Analysis ("garbage in = garbage out") is this one. When embarking on the data collection effort, it is almost always better to think ahead to what the decision makers' next few questions might be once you answer the current one. Also realize that they might be different sets of questions that vary depending on the outcome of the original request. The cost (in time, storage space, and spreadsheet or database efficiency) of retrieving data that ends up being unnecessary is usually small in comparison to the outlay required to go back and obtain additional data if you later realize it is required. This impact is compounded if the data comes from multiple databases on legacy systems with only text file output capability. Usually, this is due to difficulties in merging once data manipulation has begun.

- **Get an azimuth check on your proposed analysis plan.** Even though most QRA efforts will not last more than a few days (and sometimes only a few hours), once you have developed a plan on how to conduct the analysis, run it by the deci-

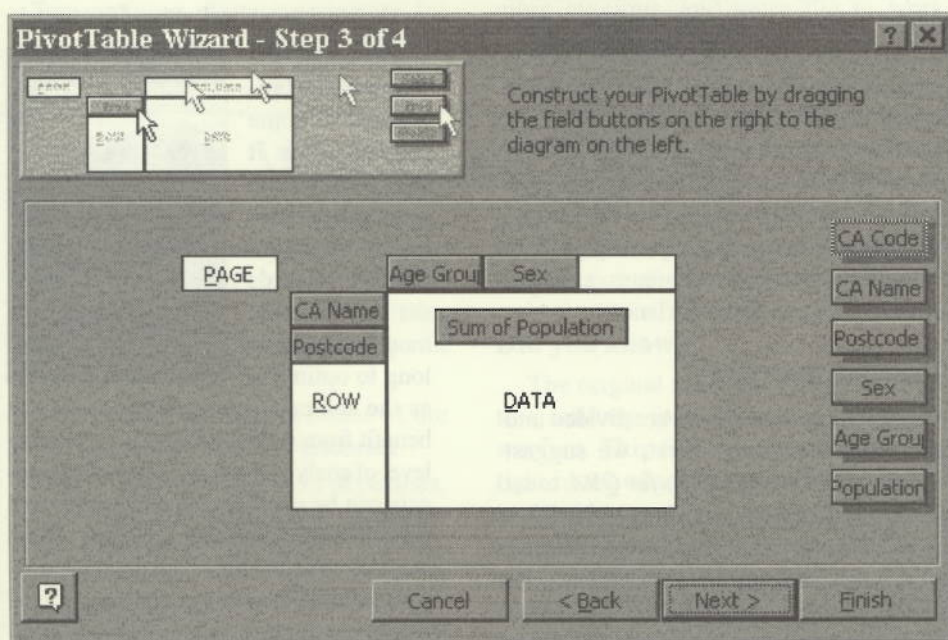
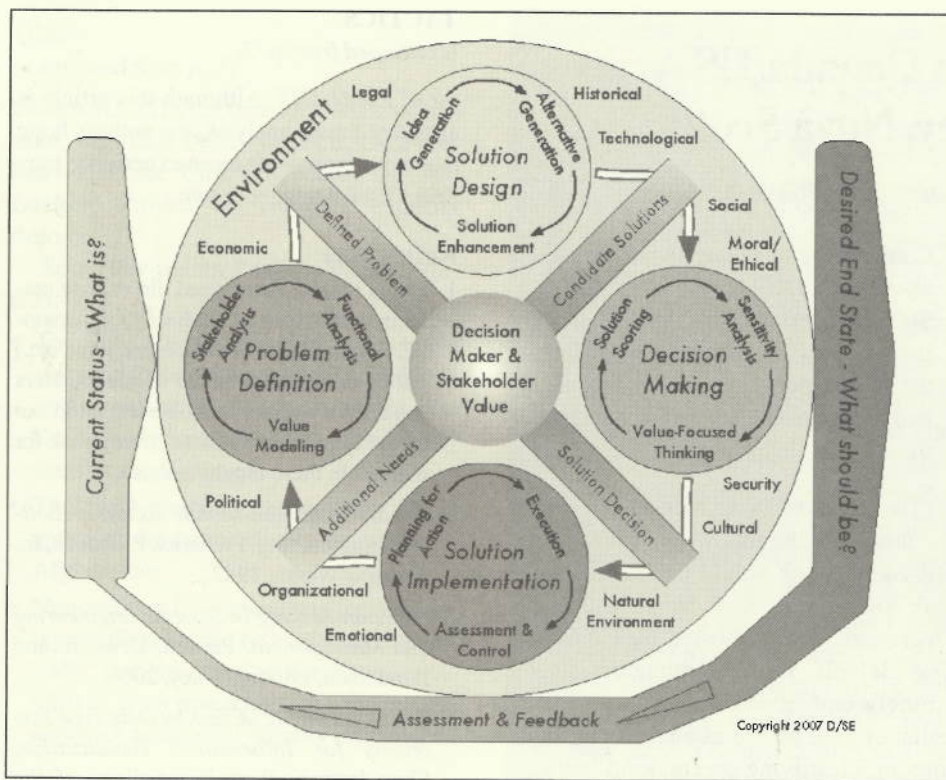
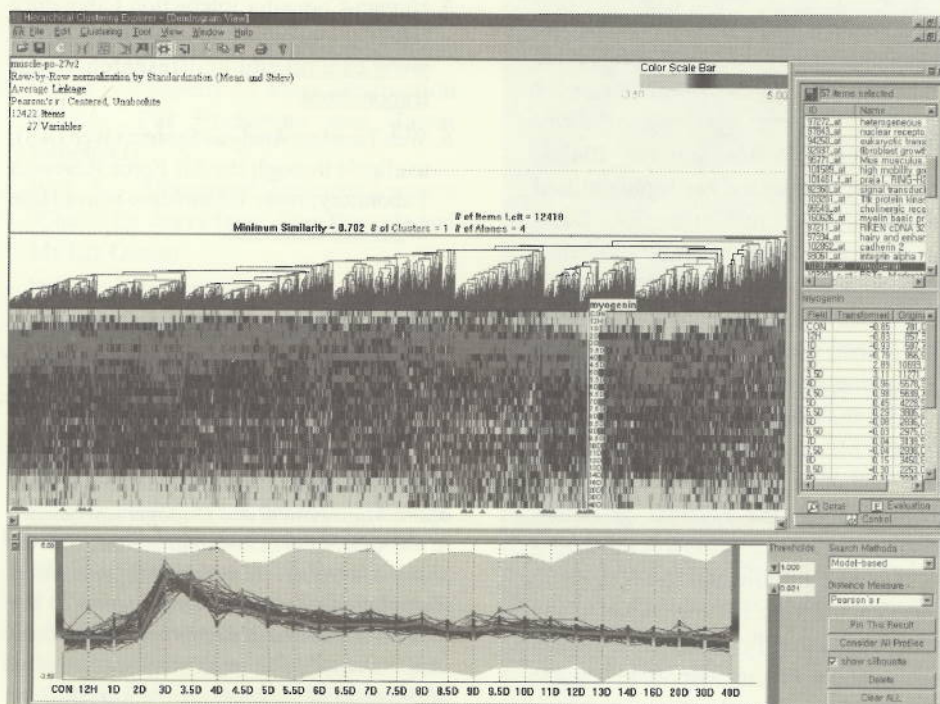


Figure 1. PivotTable is a data summarization tool found in Microsoft Excel; they can automatically sort, count, and total data, as well as create cross-tabulations.





**Figure 2. The Systems Decision Process, from the Department of Systems Engineering at West Point, encourages taking time to understand the problem before working on developing a solution.**



**Figure 3. Hierarchical Clustering Explorer is just one of dozens of useful visualization tools provided by the Human-Computer Interaction Laboratory at the University of Maryland; it allows interactive exploration of clusters shown in dendrograms.**

energy, and possibly not meeting the analysis requirement. Take the time to formally state your hypothesis and explain how the data available and proposed modeling techniques will allow you to evaluate the validity of this hypothesis. This will ensure that the completed analysis results in a usable product which provides insight to the decision maker.



- **Use information visualization techniques to your advantage.** While analysts are comfortable looking at arrays of numbers, most people are not. The field of information visualization (InfoVis) has seen some dramatic changes over the past decade, especially with regard to visual query formation and the display of results. The well-known Visual Information Seeking mantra is "Overview first, zoom and filter, then details-on-demand."<sup>4</sup> Many standalone tools and a few open-source toolkits have been developed in the academic community and are available at no cost: for example, the Human-Computer Interaction Laboratory at the University of Maryland has a wide range of visualization tools available.<sup>5</sup> Also, consider general purpose software that the government already owns, like WebTAS,<sup>6</sup> a modular software toolset that supports fusion of large amounts of disparate data sets and provides visualization, pattern analysis and activity prediction, and various presentation aids.

## Summary

Some of the tactics, techniques, and procedures outlined above could be classified as being just "good staff work." However, the use of these TTP should raise the probability of achieving success in QRA. If you have other principles that you have found useful in QRA, please share them with the rest of us, in the form of a letter to the Edi-

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sion maker if possible. If not, at least review it with someone else with experience in your organization. The purpose of

this is to make sure that you understood the leader's intent and are not heading off in the wrong direction, wasting time and



# Canada Hosts Thirteenth Canada/US Army OR Symposium in Sydney, Nova Scotia

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Sydney is a port city on Cape Breton Island at the eastern tip of Nova Scotia, one of Canada's Maritime Provinces. Canada chose this scenic seafaring site to host the Thirteenth USA-Canada Operations Research Symposium 9-11 September 2008. This event was a continuum of a regular series of annual bilateral operations research exchanges, hosted alternatively in Canada and the United States. At these Symposia, Senior Analysts and their staffs from the US and Canada share results of key studies, explore topics of mutual interest and potential areas of joint analysis, enhance old friendships, and foster new ones.

Ms. **Maria Rey**, Director General Defence R & D Canada – Center for Operational Research and Analysis (DRDC CORA) hosted the Sydney Symposium and served as Canada's Head of Delegation. Mr. **E.B. Vandiver III**, FS, Director, Center for Army Analysis (CAA), was the US Head of Delegation. In addition to analysts from CAA, the US analysis team was represented by the Training and Doctrine Command Analysis Center – White Sands Missile Range (TRAC-WSMR), Army Materiel Systems Analysis Activity (AMSAA), the United States Military Academy (USMA) and the Army Test and Evaluation Command (ATEC). The Canadian analysis team, all from DRDC CORA, represented a spectrum of disciplines within that organization.

The US and Canadian national commitments to bringing peace, stability, and progress to Afghanistan sharpened focus on our shared interests there. The result is that both countries see the value in joint analysis activities, collaborating on analytic objectives, conducting mutually supportive analysis and sharing results. This spirit of cooperation pervaded the Thirteenth OR Symposium, with shared briefings on:

- Support to current operations using deployed analysts

- Countering enemy Improvised Explosive Devices (IED)
- Stability operations in Afghanistan to include sharing concepts on polling the civilian population, data collection and analysis and support to building the Afghan National Army.

The Heads of Delegation agreed that the theme for the follow-on Fourteenth OR Symposium would be "Modeling and Analysis in Support of Current Operations," to be hosted by CAA at Fort Belvoir, VA. The attendees also strongly embraced the importance of collaboration and joint analysis in the interim, identifying several joint initiatives.

Mr. Vandiver used this Symposium to initiate an informal policy to have at least one junior analyst participate in these events. Participation means the presentation of a briefing of a project for which the analyst was the lead or a major contributor. For this Symposium the junior analyst was Ms. **Justine Blaho**, CAA, who presented her topic entitled "Analysis of Counter Insurgency Database (ACID)." Her presence and briefing were well received, setting a precedent for other junior analysts as a key step in their professional development.

Sharing analysis goals and insights was not the only focus of the three day agenda. Ms. Rey treated all participants to a visit at one of Canada's National Historic Sites, the Fortress of Louisbourg. The French came to Louisbourg in 1713 and established the fortress to protect a thriving fishing industry and trade, becoming France's most important stronghold and seaport in what is now Atlantic Canada. A guided tour brought to life the unique historic perspective of France and Britain competing for control in the New World. Dinner, served in an 18th Century-style inn with role playing waitresses in period dress, topped off the afternoon of good food and camaraderie. ★

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tor of *PHALANX*. Although this article is aimed at junior analysts, the authors hope that even those with more experience may find a useful nugget or two.

## References

1. The Q Course mentioned did expose students to the types of analysis (e.g. personnel, training, force development, joint, etc.) that could be encountered in headquarters and operational staffs; however, it did not appear to provide a general framework for analysts in these organizations.
2. *The Mythical Man-Month: Essays on Software Engineering*, Frederick P. Brooks, Jr.; Addison-Wesley 1982.
3. *Decision-Making in Systems Engineering and Management*. Parnell, Driscoll, and Henderson, Editors; Wiley, 2008.
4. *The Eyes Have It: A Task by Data Type Taxonomy for Information Visualization*. Shneiderman, Ben; Proceedings of the IEEE Symposium on Visual Languages, pp 336-343, 1996. Available at <http://citeseer.ist.psu.edu/409647.html>.
5. Human-Computer Interaction Laboratory (HCIL), University of Maryland, <http://www.cs.umd.edu/hcil/research/visualization.shtml>.
6. Web Timeline Analysis System (WebTAS), available through the Air Force Research Laboratory; more information is available at [www.webtas.com](http://www.webtas.com).

## Biographies

Lieutenant Colonel **Scott T. Nestler**, PhD is an Assistant Professor in the Department of Mathematical Sciences, and Director, Center for Data Analysis and Statistics, US Military Academy at West Point. Lieutenant Colonel **Andrew O. Hall** is a PhD candidate in Operations Management and Management Science at the R.H. Smith School of Business, University of Maryland. They are both Operations Research Analysts with experience in the Army G-1, Plans and Resources Division and as Assistant Professors in the Department of Mathematical Sciences of the US Military Academy at West Point. LTC Nestler's operational experience was with PATRIOT air defense missile units in Texas, Saudi Arabia, and South Korea. LTC Hall served in both light and mechanized infantry units in the US and South Korea, with operational deployments to Saudi Arabia and most recently to Iraq, as the Effects Analyst for Multi-National Corps-Iraq. ★