

(U) Organizational Troop-to-Task (OT3) Wargames

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Abstract

Organizational Troop-to-Task (OT3) resource-management wargames allow players to assign personnel under their command to meet the tasking of a higher headquarters throughout the narrative storyline of the wargame. We outline the rules and requirements to assemble and execute an OT3 wargame and provide a simplified “print-and-play” example. We discuss the data that can be collected, as well as what can be gleaned from that data—namely, (1) as an assessment of whether the organizational staff is “right-sized” for the given narrative storyline and its explicit or implied tasking; (2) an assessment of the gaps and seams of the organization, exploring where the organizational design may impede required information flow; and (3) a broad understanding of how an organization might respond to a given sequence of events.

This document does not assess any particular organization. It provides the framework and toolkit for future organizational assessments.

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Executive Summary

An Organizational Troop-to-Task (OT3) analytic wargame is used to examine the relationship between an organization's staff size and its expected tasking throughout a likely narrative of events. Players in this style of wargame will experience the challenges of staff limitations, clarity and interpretation of commander's intent, and information availability (particularly for geographically distributed commands). Analysis of the data collected at an OT3 wargame allows sponsoring organizations to explore

- whether the organization staff is **right-sized** and **right-staffed** for the assigned mission;
- the locations of the organization's **gaps and seams** relative to assignment of forces for a given task; and
- the organization's **capability to respond** to expected and unexpected events within a continuing operational narrative.

OT3 wargames use an organization's current or proposed manning document and ask players representing staff directorates to assign those personnel to a task for the length of time that the personnel would need to complete it. A player representing the organization's commanding officer assigns tasks to the directorate players based on a narrative of events delivered by the wargame controllers. The commanding officer player determines the commander's intent for the events and presents them to the directorate players, who must then decide which personnel to allocate to the task and for how long. Once the personnel are assigned, they are unavailable to the players until they have completed their tasking. The next stage of the narrative of events is then presented to the players and the process repeats.

Throughout this process, CNA data analysts are collecting data on

- the commander's intent as derived from the narrative of events;
- the directorate players' responses to the commander's intent and the level to which it can be achieved;
- which billets from the manning document are assigned to which task and for how long;
- when and where directorate players are unable to meet commander's intent due to a lack of personnel or structure; and
- the overall commitment and expected activity of the organization in response to the narrative of events.

Using this data, CNA analysts can assess a variety of organizational traits and the associated manning document. Relative to the given narrative of events, this assessment can include:

- clarity in roles and responsibilities across and external to the organization;
- the amount of overall capacity and set of billets not utilized;
- the distribution of work across tasked billets;
- the set of billets that were required but unavailable;
- when, where, and for how long augmentation was needed; and
- any correlation between employment of billets within and between directorates that may suggest organizational changes and/or additional coordination mechanisms.

CNA has executed OT3 wargames for US Africa Command and OPNAV N4. A description of those wargames, as well as the full data analysis, is available by request (inquiries@cna.org) on SIPRNET for US-only persons in the Department of Defense (DOD) and DOD contractors.

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Introduction

There is no algorithm for designing organizations and, once designed, no proof before implementation that the design will satisfy the organization's requirements. However, an analytic approach can help bound the design, and senior leaders must justify any resourcing requests that result from a reorganization or creation of a new organization. Particular design choices that must be made in reorganizing or standing up a new organization include its (1) missions, functions, and tasks; (2) the organization's structure (its wiring diagram); (3) key processes; and (4) personnel needs in terms of skill and total manpower. Particular organizations may also need to plan for agility to transition from peacetime to crisis states, or otherwise flex in response to dynamic tasking. The Operational Troop-to-Task (OT3) wargame is designed to provide information to support these choices, helping senior leaders adjust and justify them for organizational design.

This document is meant for wargame facilitators. It will discuss the benefits and data available by executing an OT3 wargame, as well as an analysis methodology for using that data to improve an organizational design. It will also give all the rules and instructions necessary to design and execute an OT3 wargame. The facilitators will need to use their own organization manning document and develop an appropriate scenario, but this document discusses how to use that information to create the necessary pieces of an OT3 wargame.

The sections that follow give a brief overview of the utility of wargaming and then a general description of an OT3 wargame.

What is wargaming?

Wargaming is notoriously hard to define, particularly when the concepts being explored may not involve warfare. Expanding on the definition offered by Dr. Peter Perla, we consider a wargame to be *a simulation that does involve the operations of actual assets in which the flow of events shapes, and is shaped by, decisions made by a human player or players.*¹

At CNA, we use wargaming as one of many analytic tools to understand, explore, and evaluate a scenario, situation, or problem. Just like all other tools, there are tasks for which wargaming is well suited and tasks for which it is not. Wargaming is best used when optimized decision-

¹ John Curry, ed. 2011. *Peter Perla's The Art of Wargaming: A Guide for Professionals and Hobbyists*. Annapolis, MD: US Naval Institute Press. (This is the updated edition of Dr. Perla's book, published in 1990 by USNI Press.)

making is not possible—when decisions fall to humans who must use the information available, their experience, and their intuition to determine how to proceed. The human player must have a vital role, and the choices they make must impact the flow of events.

Analytic wargames² offer insight into the implications of human decision-making. They are not a psychological or sociological study of human decision-making, but instead explore what occurs in a scenario **as a consequence** of human decision making. The human players are seen as a component of the simulation, not as a test group or a target audience. This means that any analysis resulting from a wargame will be necessarily dependent on the players. The greater the number of players or the number of repetitions with different players, the more robust the conclusions of the wargame will be.

As mentioned above, wargaming need not be about war. The name extends from its roots in the analysis of war plans—the rigid *kriegsspiel* of the Prussian army in the 19th century.³ However, the methods of wargaming and the concepts that can be explored have evolved substantially. The wargame moniker is often used to denote any kind of serious game played for analytical or educational purposes, regardless of the audience or subject matter. The design of wargames can be about organizations, businesses, commerce, diplomacy, or any other topic.

The cycle of research

It is important to understand that wargames will not in and of themselves provide the answers to most problems. Wargames are an essential part of reaching desired outcomes, but by themselves they will present an incomplete picture of the problem. As described in *The Art of Wargaming*, the cycle of research (Figure 1) presents CNA's philosophy on wargaming: wargaming, analysis, and experiments form the three key pillars that lead to the desired outcomes.

Wargames help shape decisions, analysis presents data, and exercises perfect actions. Wargames inform analysis and suggest things to exercise. Exercises explore what can be accomplished by real people with real equipment and can uncover tactics to wargame and requirements to analyze. Analysis determines the limits of the physically possible and feeds data into wargames, identifying capabilities to test in exercises. Exercises add realism to

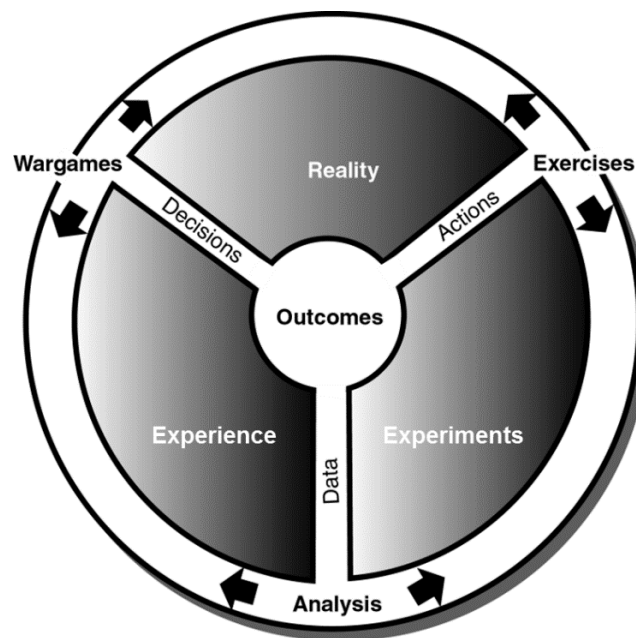
² Wargames are often grouped into two broad categories: *analytical* and *educational*. Analytical wargames are used to discover and explore new information using the players as a resource. Educational wargames are used to convey information to the players. While all wargames will naturally do a bit of both, CNA's operations research and analysis focus often leads us to weight the analytic component more heavily.

³ Curry, ed., *Peter Perla's The Art of Wargaming*.

wargames. Experience in wargames helps determine what needs to be analyzed. Experiments help bring the theoretical exploration of analysts into actionable exercises.

This virtuous cycle should be repeated as often as possible, ensuring that the information from any one pillar flows freely into the others. Singular wargames are as valuable as singular analyses or singular exercises: useful as a test case, but increasingly useful with repetition.

Figure 1. The “cycle of research”



Source: Curry, ed., *Peter Perla's The Art of Wargaming*.

Organizational Troop-to-Task (OT3) Wargame

CNA created the OT3 wargame to explore whether a new or redesigned organization—not yet implemented—was the “right size” and had the “right mix” of capabilities to execute its mission during a high-intensity period of operations. This is particularly important for a few reasons. First, unlike a piece of equipment, you cannot test and evaluate an organization in advance of its standup. You may have expectations of how it will behave based on similarly established organizations, but no two organizations have exactly the same people, processes, and inputs/outputs, so those expectations cannot be fully validated. Second, determining how big a staff should be in advance of its standup is difficult. There is no algorithm to determine how many people will be necessary—even the private section has not been able to identify one, again pointing to the uniqueness of every organization. There is also no workload analysis that

can be conducted on a staff that does not yet exist. Finally, getting the design as “right” as possible in the beginning can have consequences. Habitual processes and relationships developed early on can be hard to break, and our experience suggests that no matter how big an organization is, there will always be work available to fill everyone’s time. In other words, even if an organization is “oversized” at its inception, the additional capacity will quickly be consumed by “nice-to-have” tasks.⁴

The wargame sponsors were interested in learning whether individual persons assigned to an organization were under- or overtasked, whether any persons or groups of people were not utilized at all, and whether there were any gaps that should be filled in the manning document. In other words, the goal was to explore person-by-person whether the organization as envisioned could function as intended, whether there were efficiencies to be realized (through elimination of billets), and whether more people would be needed (via requirements that could not be met).

To answer these questions, we developed a wargame that drew on many classic resource-management board games, but was simplified to players controlling a resource (personnel) that must be allocated to meet requirements arising through a scenario.

Working with the sponsor, we built a scenario of events that reflected a high intensity of operations for the target organization. Using their manning document, we created physical cards that represented each individual on the manning document. Under the assumption that each individual can work on up to four projects at a time, we created four cards per individual, each representing 25 percent of that individual’s time.

During the wargame, we revealed the events in the scenario at a given in-game frequency (e.g., three days of events per turn). Players representing higher headquarters then translated the events in the scenario (e.g., a soldier is involved in a car accident off base) into commander’s intent for the target organization (e.g., provide medical and legal assistance as required). Players representing the target organization then decided which of their personnel cards to allocate at what fraction of their time to each event, and for how long (e.g., 25 percent of a medical professional for three days and 50 percent of two lawyers for two weeks). Once players allocated each of their personnel, the next set of events was revealed. When individuals finished certain tasks associated with an event (e.g., a medical professional was assigned for three days and the three days have passed), they were returned to the resource pool and can be used again. If an event arose for which players did not have sufficient personnel to meet the commander’s intent, they were able to request augmentation from their higher headquarters for the required period of time.

⁴ The Kano model from the consumer goods sector suggests that “nice-to-have” tasks commonly become *essential* tasks over time.

By recording which personnel, at what fraction, and for what duration are allocated to each event, we were able to track the utilization of each individual in the target organization. Some individuals (e.g., dedicated watch officers) were excluded from the calculation under the assumption that, regardless of the events occurring, they will be occupied 100 percent of the time executing a specific task (e.g., manning the watch floor). This data allows a detailed quantitative analysis of the organization based on the choices players made in response to the events. While no one wargame should be used to definitively state how events will transpire, the data can be used to suggest the areas that may be over- or undertasked, which of the personnel tend to work together, and if there are any gaps in resources.

In what follows, we present the rules and execution methods for an OT3 wargame. We then discuss the analysis methodology for how the data can be used.

Rules and Execution

This section describes the detailed rules for executing an OT3 wargame. It includes details important to wargame facilitators regarding the preparation of materials prior to the wargame, the execution of the wargame itself, and the data collection that should occur during game play. A thorough understanding of this section is not required for most players.

Wargame preparation

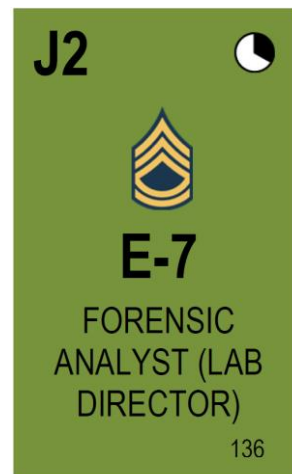
We recommend starting wargame preparation at least three months prior to the execution date. The creation of the physical personnel cards and the development of the scenario can take a substantial amount of time.

Personnel cards

Personnel cards are the constrained resource in an OT3 wargame. They represent the individuals assigned to the organization that can be tasked in response to events. Each individual is represented by a number of physical cards (cut from standard card stock) showing how many different activities the individual can execute simultaneously. At least one card must be created for each individual in the organization's manning document. We generally impose a limit of four cards per individual, representing the idea that a person doing more than four simultaneous, independent tasks will become increasingly unproductive. Put another way, each card represents a certain fraction of that person's time, attention, or capacity. If each individual is represented by four personnel cards, then each card represents 25 percent of that individual's time.

Each card should show sufficient identifying information so that players not intimately familiar with the organization's manning document can understand the role, specialty, and position of the individual represented. Figure 2 shows an example personnel card used in a recent OT3 wargame. The upper left ("J2") indicates the directorate the individual is assigned to. The upper right indicates the fraction of the individual's time that this specific card represents. In this case, the

Figure 2. Example personnel card



Source: CNA

card is one of three, and thus the symbol shows one-third of a shaded circle (i.e., one-third of the person's notional 12-hour day). The symbol and text at the center identifies the rank (E-7). The text below the rank shows the individual's billet title and, in parentheses, specialty. The number at the lower right is a billet number assigned to the individual; it is a unique identifier for the purposes of data collection. The green background identifies this individual as a member of the US Army.

There must be one set of cards for each individual in the manning document that is to be wargamed. Each set should include a number of identical cards based on the agreed-upon maximum number of tasks a single individual can perform. We recommend placing each set of cards in a clear plastic card sleeve (such as those used for collectible card games or to protect board game cards). Each sleeve would then represent 100-percent of an individual's time.

We recommend using a spreadsheet and a mail merge template to create the cards, particularly if the manning document is large. However, mail merge files can cause issues with changing graphics from card to card, and we have recently created a Python script to create personnel cards from a manning document. Creation of such a script should be attempted only by wargame facilitators with advanced programming knowledge. Figure 3 shows an example page created from a mail merge document with a maximum of three tasks per individual, ready to be cut into individual cards.

These personnel cards will then be provided to the players to "spend" toward the resolution of events. They should be placed on the wargame play matrix (see "Play area" below) to indicate the events to which they are allocated and for how long.

Figure 3. An example sheet of personnel cards for the OT3 wargame



Source: CNA.

Scenario and event cards

An OT3 wargame scenario represents the regional narrative over the course of the desired timeframe in the area of responsibility (or regard) of the target organization. The scenario is broken up into discrete pieces called “events” that are revealed to the players on each turn. The timing and pacing of the events in the scenario is critical to getting actionable data from an OT3 wargame. If the events happen more rapidly than they might in reality, the wargame analysis would show an increased demand for personnel and resources. If the events happen much slower than they would in reality, the wargame analysis would show a reduced demand for personnel and resources. This is why it is imperative to (a) vet the scenario and pacing with regional subject matter experts to ensure that it is a reasonably paced scenario; (b) understand where the pacing sits on the spectrum of the possible realities (i.e., Is it a high-intensity or a

low-intensity version of what might be?); and (c) as discussed above, avoid making programmatic decisions based solely on data that arises from a single wargame, as a combination of players and scenarios always has the potential to create a highly unlikely outcome.

Building the scenario

The scenario should be constructed with regional subject matter experts (SMEs). Whenever possible, we recommend modifying actual historical events to develop a narrative that's similar in pacing, style, and action to what has happened in the past. However, the scenario should be modified by the SMEs' inclusion of known or expected future trends (e.g., an increase in terrorist activity or incidents stemming from global adversarial competition).

The scenario itself should assume that at each step of the way the target organization successfully executes everything in its power/authority/capability. While the scenario can be modified by the activities and choices of the players, it is not necessary in an OT3 wargame. The players are not being opposed by the scenario, they are being opposed by the choices that they made in previous turns. The "adversary" in this wargame is the players themselves, the resources constraints of the manning document, and the establishing directive that identified what the target organization is required to do. Again, the adversary in the OT3 wargame is NOT the scenario. Thus choices the players make need not influence future events in the scenario to generate useable analytic results. The results arise from the player's own self-regulation of responses to the scenario events based on their resource limitations.

Thus the scenario is a complete story of events that should be written in total prior to the start of the OT3 wargame. If the organization has the ability within its establishing directive to choose how to act in some instances, it is recommended that the facilitators build into the scenario a directive from higher headquarters on which to choose. Trying to construct a branching storyline for all possible choices has the potential to get very complicated very quickly. The structure of the OT3 wargame will support such branching stories, but facilitators are encouraged to consider whether the learning that arises from those choices is worth the added effort in creating the wargame.

The complete scenario should stretch the full timeframe of the planned OT3 wargame. When the scenario starts, the wargame starts; when the scenario ends, the wargame ends. The scenario should explain details of what is happening in the region at a level required for players representing the commanding officer to determine their commander's intent based on the establishing directive of the organization. Whenever players have questions about the details behind an event, the facilitators should be able to look to the full scenario for those details. The scenario itself is the background narrative from which the events are drawn.

To construct the scenario, we recommend that players begin with an actual history of the region of interest and examine how often the organization did (or would, if it does not yet exist)

interact with that history. Then facilitators can extract the pieces of that history that are relevant to the organization—the only pieces of the scenario that matter to this wargame are those that would be of interest to the target organization. It is best to sample various historical periods in the region of interest to see how the intensity of events changes. If the wargame is going to explore a period of six months, examining periods of recent history would be ideal. The wargame scenario can be developed by modifying actual historical events, changing their order, and swapping or adding events from one period of history to another. Then new events can be created by SMEs that pertain to what might happen in the future. These new events can add to the historical sample (if trying to increase the intensity) or replace other events (if trying to maintain intensity).

The timeframe that the scenario (and thus the wargame) should cover will depend on a number of factors:

- If the organization is large, it will take players a longer amount of time to determine which personnel cards to allocate to which events. Larger target organizations will thus take longer to complete each turn. This can be mitigated by lengthening the out-of-game time spent on the OT3 wargame, increasing the in-game time per turn, or decreasing the total time of the scenario.
- The fidelity of the collected data is limited by the turn length. If the turn length is one week, the data will show personnel allocations for each week. It will be impossible to determine whether a given task is one that would take hours or days. If higher resolution on personnel allocation is required by the analysis goals of the wargame, the turn length should be reduced. This will require a shorter scenario or a longer total time for the wargame.
- Some organizations act faster than others. If the target organization responds quickly and completes quickly, then explores resources constraints due to possible overlapping scenario events, the turn length should be short. We would recommend that the turn length be no longer than about half the average time it takes an organization to complete its response to an event—meaning that a player's allocation of personnel cards would stay on the board for at least one turn following their original allocation. This maintains some resource pressure on the players. Short turns are recommended where possible.

Building the events

Events are discrete chunks of the scenario, broken out into segments with an interval equal to the turn length. Once the scenario is written, it needs to be presented to the players in batches during each turn. Each batch should contain the things that happened in the scenario during that time period. Depending on the intensity of the scenario, nothing may happen, one thing may happen, or multiple things may happen. Each independent thing that happens that may

cause the organization to allocate personnel to a task should be encapsulated as a separate event.

For example, over the course of a week-long turn, the scenario may state that a soldier is involved in a liberty incident, a new ship pulls into port and requires maintenance, and the commanding officer decides to execute a senior leader engagement with local officials. Each of these parts of the scenario may cause some aspect of a target organization to allocate personnel to tasks associated with them, but there are few to no overlapping tasks in each piece of the scenario. Thus each piece should be encapsulated as a separate event. If, perhaps, the senior leader engagement arose *because* of the liberty incident, then those pieces would be linked and can be combined into a single event.

As described in the rules below, the events for a given turn are revealed to the players at the start of the turn. Most of the players do not need the full details of the event—they need to know only what their tasking is in response to that event. However, the player(s) representing the commanding officer may need additional detail to determine what they feel should be the commander’s intent for the target organization. Thus we recommend that those players be briefed on the full scenario (and allowed to request additional detail, if available) before deciding the commander’s intent. Other players should need little information beyond that.

The full scenario of events does not need to be resolved over the course of a single turn. It is possible that as the scenario progresses, things happen that amplify, nullify, or otherwise modify events for which players have allocated personnel cards. For example, if maintenance is still occurring two turns after the above ship maintenance event, and evidence of intentional sabotage to the damaged parts is discovered, the players may wish to modify their allocation of personnel cards to that event. In other words, this is a new event that is a continuation of the previous event. When this happens, players should be allowed to reallocate personnel already allocated to the previous event, as it is likely the commander’s intent has changed.

Play area

The final required wargame preparation is the play area. This is the “game board” where players will allocate their personnel cards to meet the requirements of events. There should be two pieces: (1) the “Duty Standers/Watch Standers Matrix” (sometimes also called the “Steady State Matrix”), and (2) the “Play Matrix.”

Duty Standers/Watch Standers

The Duty Standers/Watch Standers Matrix (Figure 4) shows an example of the play area that we used during one instance of an OT3 wargame. Each row shows a place where each directorate can place personnel cards whose primary activity does not change throughout the course of any scenario. Which personnel cards should be added to this play area, when, and

how will be covered in the “Initial setup” section. This matrix should be placed near the play area, but will not require regular access. Players should not be adding or removing personnel cards to this matrix throughout the wargame. They will be placed here only once, at the initial setup. We added a “location” option at the top of this matrix since, in this instance, there were personnel in a single organization spread among multiple physical locations. The rows are tall enough to fit a single personnel card, and players placed large stacks of personnel cards from their organization onto each row.

Play Matrix

The Play Matrix (Figure 5) is the primary wargame board where players place the personnel cards they have allocated to each event. Each row of the Play Matrix is for an individual event. As they are revealed during the scenario, a marker for each event (a card, a hand-written statement, etc.) can be placed in the first column. As players allocate personnel cards to the tasks associated with the event, they place them in the appropriate row on the column when they will *finish* their task. For example, if an event on row 4 started on turn 4 (D+9 to D+11), and the player for the N2 directorate felt that his personnel will need nine days to complete their tasking, the player would place their personnel cards on turn 6 (D+15 to D+17). Those personnel cards would be available at the end of turn 6.

Each box in the Play Matrix should be sized to fit the personnel cards. For space considerations, we recommend making them slightly larger than the size of a single personnel card and asking players to stack the cards neatly in a pile. Otherwise, the Play Matrix can grow to an unmanageable size, particularly in a long scenario.

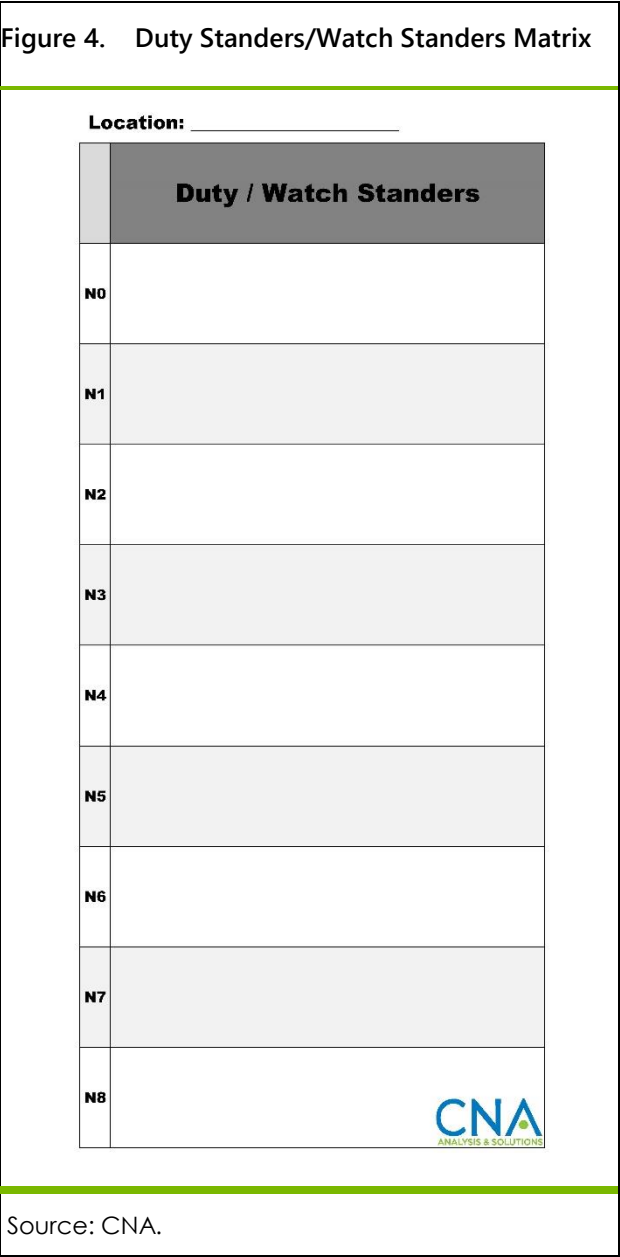


Figure 5. Play Matrix

Events	D+0 to D+2	D+3 to D+5	D+6 to D+8	D+9 to D+11	D+12 to D+14	D+15 to D+17	D+18 to D+20	D+21 to D+23	D+24 to D+26	D+27 to D+29	D+30 to D+32	D+33 to D+35	D+36 to D+38	D+39 to D+41	D+42 to D+44	D+45 to D+47	D+48 to D+50	D+51 to D+53
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Source: CNA.

Wargame execution

Once the Play Matrix is set up, the wargame execution can begin with a full scenario separated into discrete events and a stack of personnel cards representing the entire target organization in hand.

Initial setup

The first step in an OT3 wargame is to let the players familiarize themselves with the personnel cards available to them in their organization's directorates. The number of players can vary greatly in an OT3 wargame, and there is no required number. The larger the target organization, the more players should be expected. At a minimum, there should be enough players such that at least one player is familiar with the roles and function of each directorate, division, and/or group that are in the organization. If the organization is broken out into the

standard codes, we recommend two players per code (to allow diversity of opinion and knowledge), plus an additional player to portray the commanding officer.

The personnel cards for each directorate should be distributed to the player(s) responsible for that directorate, and the players should be given time to familiarize themselves with the personnel available.

Next, players need to allocate steady-state personnel to the “Duty Standers/Watch Standers Matrix.” Historically, this has been the part of the OT3 wargame that is most difficult to accurately convey to the players. At this stage of the wargame, players should set aside any personnel (or fraction of a personnel card) whose tasking does not substantively change regardless of events happening in the region. For example, if a billet is a “Duty Stander, Night Shift”, the implication is that that billet will be operating the duty desk regardless of any emergency, conflict, or lull in the region. They will be continually receiving and passing information, building briefs, and maintaining situational awareness. While the subject matter of those briefs or communications may change, the day-to-day tasking of that billet does not substantively change. Alternatively, billets whose tasking shifts from day to day based on the events in theater should not be placed on the Duty Standers/Watch Standers Matrix. (An example here would be the chaplain, who may assist grieving armed forces members, then join a senior leader engagement, and finally conduct weekly services.)

Step 1: Prep the commanding officer

At the start of each turn, prior to the players getting an update on the scenario, the player(s) representing the commanding officer should review the events for the turn, as well as any detailed scenario information that they need to determine their commander’s intent. This can easily take place while other players are placing their personnel cards on the Play Matrix or in a break between turns. Doing this prior to presenting the events and allowing the commanding officer player(s) to prepare the commander’s intent will help keep the wargame moving quickly.

SMEs on the scenario should be available at this stage to answer any additional questions that the commanding officer player(s) may have that are not covered in the detailed scenario.

Step 2: Present events and assign commander’s intent

Any events for the time period of this turn (each already present to the commanding officer player(s)) are presented to the players along with the commander’s intent. Players should not need to be briefed on the full scenario for this time period, but the information should not be withheld from the players if needed. The commander’s intent should be clear and concise, follow the establishing directive for the organization, and allow the players freedom to determine how they will meet that objective with the personnel available to them. For example,

a commander's intent that states the target organization must "provide security to the medical camps established as a result of the viral outbreak" gives players the option to determine the level of oversight, the number of personnel required for security, and any medical support necessary to ensure the safety of the assigned personnel. Players should feel comfortable expanding on the commander's intent during the planning step (next) if they feel additional actions are necessary.

Continuing events

As discussed above in "Building the events," there may be times when an event presented in this stage builds upon an event already in play with allocated personnel. When that occurs, players should review the personnel already allocated to the event that is being modified. During the following stages, players may reallocate those personnel to other events revealed in this turn during the allocate personnel step. For planning purposes, players should consider those personnel available for tasking.

Step 3: Planning

When given the commander's intent, the players should determine how the organization responds and which directorates receive which tasking. This can be done any number of ways. We recommend that the organization chose a planning process that closely aligns with the planning processes they use in a real-world basis. Some possible planning methods include the following:

- A collective discussion where all players gather and discuss the best way forward for each directorate.
- Each directorate discusses internally and determines its best course of action.
- A small group (perhaps the current and future operations planners) meet to determine specific tasking for each directorate.

At the end of the planning stage, players in each directorate should understand the limits of the capabilities that they can offer to each event for the turn. They should not, at this stage, assign individual personnel cards for a given directorate. Instead, they should temper their plans based on the personnel that they have available and be ready to apply individuals to the events.

If a directorate cannot meet the commander's intent based on the currently available personnel—because they do not exist in the manning document or because they have been used in previous events—the players can request augmentation. See Step 5 below for details. Because of this, planning need not be limited only to the personnel cards immediately available.

Step 4: Commander's Update Brief

Players brief their plan to the player(s) representing the commanding officer to ensure that their commander's intent was met. Players should not present a person-by-person brief of the plan. Instead, they should discuss the activities that are being done to meet the commander's intent. Commanding officers likely are not interested in whether it takes "three intel analysts 50 percent of their time for two weeks." Instead, they likely are more interested in knowing that "intel analysts will maintain surveillance of the area of interest and produce daily intel products."

The player(s) representing the commanding officer should feel free to adjust, redirect, or provide inputs as necessary. If the players present multiple possible courses of action, the commanding officer should choose one for the players to act on.

Step 5: Personnel assignment

Once the players have received any feedback on their plans from the commanding officer, they must then determine the number and quantity of personnel cards they need to allocate to meet that requirement, as well as how long it will take each of the personnel to accomplish their task.

At this step, players should physically place personnel cards on the Play Matrix in accordance with the plan. If an event occurs on D+11 and a given billet will take 100 percent of its effort six days to complete the tasking, then 100 percent of the personnel cards for that billet should be placed on the row for that event in the D+17 column (D+11 plus six days = D+17).

Not all billets need to be assigned for the same duration, and each billet need not have all of its capacity allocated for the same amount of time. For individual personnel cards, it is possible for a single billet to be assigned to multiple time periods. For example, an event revealed in turn 1 requires significant attention from the deputy chief of staff (DCOS) for the first week, and less attention the following week. A player might allocate 25 percent of the DCOS to turn 2 (assuming one-week turns) and another 25 percent to turn 3. This means that 50 percent of the DCOS is allocated to that event for the first week (since 50 percent of the cards were removed from the directorate's available personnel). After the first week, 25 percent of the DCOS will be returned to the players, but the remaining 25 percent, still on the table until turn 3, is still unavailable. Thus 50 percent of the DCOS time is allocated to that event for the first week, and 25 percent is allocated for the second week.

Continuing events

As discussed above and in "Building the events," if an event presented in this stage builds upon an event already in play with allocated personnel, players may remove or reallocate those personnel to events that were revealed in the current turn. Players cannot reallocate those personnel to events revealed in previous turns.

Request for Augmentation

There may be times when players are required to execute an action for which they do not have sufficient forces. This may be because the forces do not exist in the manning document or because the forces do exist but are already committed to other tasking. When this occurs, the players should first see if there is a way to accomplish the task in a different way: is it possible to achieve the same result with different personnel assigned? If so, players should execute the task in that way. If not, then players can submit a Request for Augmentation (RFA) to the wargame facilitators and the player(s) representing the commanding officer. RFAs are recorded by the data collectors to determine whether a functional area does not exist in the manning document or is overtasked (i.e., does not have sufficient capacity).

An RFA should be given in writing to the OT3 facilitators and the players representing the commanding officer. Both should review and approve the request before wargame facilitators provide the temporary capability to the players. The request should include the specific kind of augmentation, which should include the requested augmentation's

- rank and service (if relevant);
- specialization;
- specific event tasking that the directorate cannot fill; and
- time needed in that role to meet the tasking.

Recording each of the above pieces of information will allow both the commanding officer and the facilitators to assess whether this is a required augmentation, whether there are other ways of meeting the tasking within the command, whether the commander's intent was interpreted correctly, whether the RFA is sufficient to meet the tasking, and the likelihood of availability of augmentation of that kind. Within the context of this wargame, we do not recommend RFAs be rejected due to unavailability; the wargame assumes that the events are tasked at levels that allow them to be complete. Thus players should be given the personnel required to meet the task at the requested level. RFAs should be rejected if they are not absolutely required to meet the tasking as directed by the commanding officer player(s).

Step 6: Advance time and collect personnel

After all players have placed their personnel on the Play Matrix, facilitators must record all the personnel allocations (see "Wargame data collection" below). Once that is complete, the facilitators can then advance the time to the next turn. When this happens, any personnel who have completed their tasking by the start of that turn should be collected and returned to the directorate that allocated them. They are then available for tasking for new events. Any

collected personnel cannot be retasked for previously resolved events. Remember, it is assumed that these events will be completed at the level described in Step 4 with the personnel allocated in Step 5. Personnel recovered during this step should be given to the directorate players for allocation to new events that arise this turn. Any forces provided via an RFA are returned to their parent command, not the directorate that requested them. If the same forces are needed in subsequent turns, another RFA will need to be submitted.

Wargame data collection

As stated above, this is an analytic wargame focused on using players as surrogates for the execution of real world events. The human players are simulating the activity of multiple people in an accelerated and sterile environment at a pace that could not be replicated in the real world. This allows us to collect simulated data that would not be available even if funding were allocated to a long-term study of an organization. Since the data is such a critical piece of this wargame, and good analysis depends on quality data, collecting data completely and accurately is imperative for an OT3 wargame.

Different kinds of data should be collected at each stage. Next, we will walk through each stage with a distinct data collection step and discuss what needs to be recorded.

Initial setup: data collection

Once all players have allocated their personnel to the “Duty Standers/Watch Standers Matrix,” facilitators should record which personnel cards (or fractions of a personnel card) from each directorate are allocated. This list should not change throughout the course of the wargame and needs to be recorded only once.

The data here are important to analyze what fraction of the organization is required simply to sustain and maintain the functioning of the organization.

Step 1: Prep the commanding officer: data collection

There is no data collection directly associated with Step 1.

Step 2: Present events and assign commander’s intent: data collection

The development of the commander’s intent is a key data point for an OT3 wargame. This piece can be very subjective and highlights one of the key reasons why a wargame such as this provides insights that modeling or simulation cannot: the “human in the loop” needs to

interpret the events through the eyes of the organization's establishing directive within the context of the regional requirements and global priorities.

The data at this step are twofold: (1) the commander's intent for each event, and (2) the commander's interpretation of the establishing directive in the context of each event.

For (1), it is important to record the stated commander's intent at this stage. That intent may change in Stage 4 in response to the player's ability to respond, requests for augmentation, and input. The shift in intent can provide useful insight into how closely the manning document aligns with the commander's interpretation of the establishing directive. This can help organization designers determine whether the manning document needs to be adjusted or the establishing directive needs to be changed.

For (2), facilitators should record as best they can with the available information why the player(s) representing the commanding officer decided on the commander's intent that they did. What are the important and actionable parts of the event? Are there places where the establishing directive forced their hand? Are there places where they took action that the establishing directive did not require, yet felt it was important for other reasons? Was the establishing directive clear enough to develop a concrete commander's intent? This qualitative data can be vital to the organization designers and the writers of the establishing directive: they will be able to determine if their directives were clear and are being interpreted correctly. This qualitative data collection will also elucidate any second- and third-order impacts on the organization that the designers may not have identified.

Step 3: Planning: data collection

Step 3 offers an opportunity to collect data on the player's interpretation of the commander's intent. Just as the player representing the commanding officer interpreted the event through the establishing directive, the directorate players must interpret the commander's intent through the lens of the personnel cards available to them at the moment. Facilitators should collect qualitative data regarding how the players decide on the tasks that should be done, what the implications of those tasks are, and if there are any linked events that must occur for certain tasking. Qualitative data collected here will help to interpret the quantitative results discussed below in the "Analysis Methodology" section.

Step 4: Commander's Update Brief: data collection

At this stage, players present their interpretation of the commander's intent and discuss with the commander the response that the organization can have. The qualitative data collected here can illuminate the limitations imposed by the manning document, misinterpretations between the directorate players and the commanding officer, alternative courses of action

(COAs) presented by the players and made available by the manning document, and the COA selected by the commanding officer.

Step 5: Personnel assignment: data collection

This is the largest data collection step and is arguably the most important. For useful and accurate quantitative analyses, it is imperative that this step be done completely and accurately. After all personnel cards have been assigned to the Play Matrix, facilitators should record the event and time to which each personnel card is assigned. If there are multiple personnel cards per personnel (i.e., representing fraction of a person-day as described in “Wargame preparation”), the number of cards that are assigned should be recorded as well. Numbering the personnel cards speeds the data recording at this step. Data entry at this stage can look like:

“2 copies of Card # 136 assigned to event 7 at D+21”

Every card assigned to each new event must be recorded. For large organizations, this data collection step can be daunting, but the analytical results are invaluable (see the “Analysis Methodology” section).

Additionally, if players submit any requests for augmentation, they will need to be recorded as well. Facilitators should record why the augmentation was requested and if it was approved. If approved, they should record the duration that will be needed (i.e., on what turn they are returned to their parent command) and the event to which they are assigned.

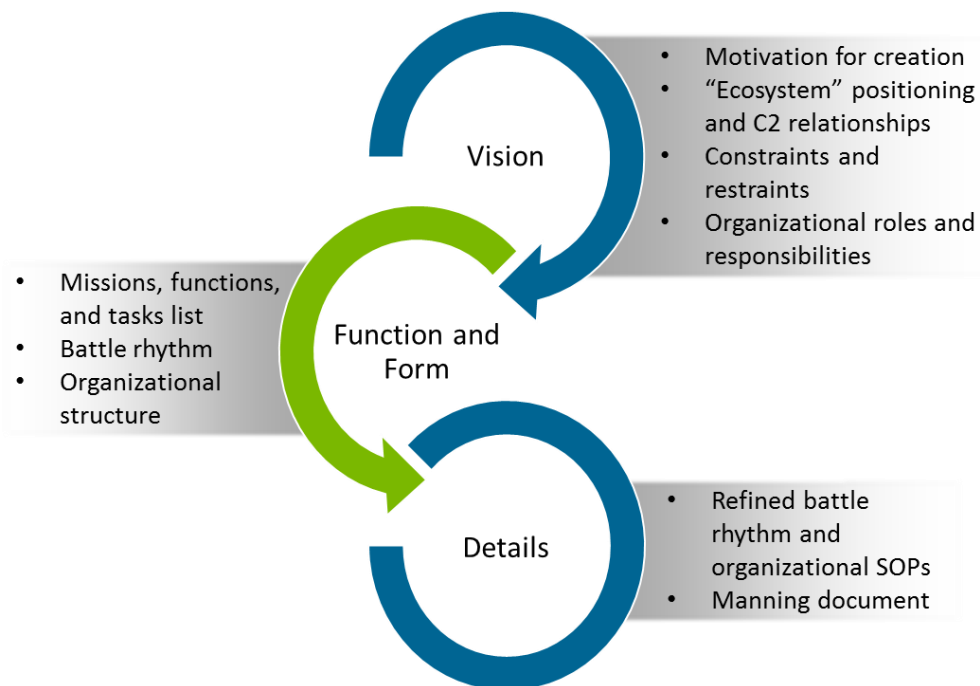
Step 6: Advance time and collect personnel: data collection

There is no data collection directly associated with Step 6.

Analysis Methodology

CNA describes three stages of organizational development, as depicted in Figure 6 below. In general, we expect an OT3 wargame to be most effective at providing insights for the second and final development stages—the form and function and the details. However, depending on how deliberately the organization or reorganization has been approached up to this point, there may be findings that lead to a reassessment of the organization’s “vision.”

Figure 6. Organizational design life cycle



Source: CNA.

Two types of analysis can be conducted with the wargame data, both of which can shed light on function and form and details:

- Qualitative data analyses involve exploration of the discussions that took place during the wargame and the tasking that was provided
- Quantitative data analyses involve exploration of the billet employment data.

Qualitative data analyses

For qualitative analyses, observers' notes—and any notes taken by participants—are crucial. These notes form the data on what was discussed and debated, how decisions were made, and how events were translated into tasking across the organization (steps 2, 3 and 4, principally, but can be found anywhere during the wargame). We have found three kinds of qualitative analyses to be useful in OT3 wargames: (1) RFA characterization; (2) qualitative alignment of tasking; and (3) coding for themes, which are listed in terms of least to most time-intensive.

RFA characterization flows directly from the RFA cards submitted during wargame play. The identity and organizational location of these RFAs can help recommend refinement to an organization's manning document, highlighting important skill sets that might not have been anticipated for the organization to meet its responsibilities. *Recommendations resulting from RFA characterization can inform manning document changes.*

Qualitative alignment of tasking involves associating tasking given in the wargame with the directorates to which it was given, and then comparing that to the functions and tasks described in the missions, functions, and tasks (MFT) document.

Assessing the alignment of tasking can yield a few different insights. For instance, tasking that was given to one part of an organization in the wargame but is assigned to a different part of the organization in the MFT document may signal confusion over roles and responsibilities (and thus warrant more clarity in the documentation) or the need to realign that task. Tasking provided in the wargame that does not appear in the MFT document may demonstrate the need for additional tasks to be defined in the MFT document. Finally, tasking to coordinate with other parts of the organization, or external organizations, can provide signals regarding how closely two parts of the organization must work together (which could suggest coordinating meetings within the battle rhythm) or where liaison officers might be best positioned for external interactions. *Recommendations resulting from qualitative alignment of tasking can inform changes to the MFT document and establishing directive, inclusion of specific meetings for the organization's battle rhythm, and liaison officer alignment to the organizational structure.*

Finally, analysts can code observers' notes to identify themes. Coding for themes involves identifying certain words or phrases in a transcript, notes, images, and so forth that are assessed as being associated with a theme as defined in a theme glossary. For instance, a note that "N3 staff and N4 staff disagreed over who should have the lead for planning the operation" might be coded as "confusion over roles and responsibilities." Commonly, analysts will start with a small set of anticipated themes (a glossary) and iteratively add or subtract themes as they code qualitative material. It is important to note that if themes are added after the start of coding, the materials that were coded prior to the addition need to be reanalyzed for new codes.

To assist with coding and the analysis of themes, we recommend the use of computer-assisted qualitative data analysis software (CAQDAS) such as NVivo. CAQDAS allows the validation of coding through interrater reliability assessment, which is important because coding can be a somewhat subjective endeavor, even when themes are well defined. CAQDAS also allows themes to be both quantified for frequency and easily associated with a host of variables such as different parts of the organization or different wargame events. For instance, we might find that the “confusion over roles and responsibilities” theme occurred only on the first day of the wargame, suggesting that the confusion was rectified by either (1) participants better familiarizing themselves with the MFT document, or (2) participants working to better define roles and responsibilities between day 1 and day 2.

Thus coding for themes in observers’ notes can help illuminate points of tension or confusion that occur during the wargame. Our experience has shown that these can include debate over who is responsible for what, particular operational concerns for particular contexts, or ambiguity in how to respond to an event. *Highlighting these points for the wargame sponsor can inform changes to the MFT document and areas for further development within the command—such as developing preplanned responses or establishing an SOP for the standup of a Joint Task Force.*

Quantitative analysis

Complementing our qualitative analysis—and somewhat unique in organizational analyses—is the quantitative analysis we can perform on billet employment. We have found here that two types of such analysis are useful in OT3 wargames: billet-level employment summaries and social network analyses.

Billet-level employment summaries

Billet-level employment summaries can provide information on how and to what extent individual billets are used over the course of a wargame. Data collected in spreadsheets during the wargame can be manipulated with pivot tables and calculations formulas to understand how staff across the organization contribute to tasking. Analysts can calculate the total available capacity (commonly described in man-hours, man-days, or man-weeks, depending on the turn length in the wargame) for each billet and sum them up across all billets—representing total capacity of the manning document. The relationship between capacity employed (the total man-hours/days/weeks assigned to tasking) and total available capacity can yield insights into the following:

- Whether any billets were completely unused. This may suggest billets that are not truly needed.

- How much available capacity was employed, and how it was distributed across the staff. This may suggest whether adjustments are needed to staff sizing, and whether there is sufficient or excess capacity to address less tangible staff activities (non-steady state tasks that do not rise to the level of event tasking).
- How capacity was distributed across steady-state and event-driven tasking. This reveals insights into the agility of the staff to respond to real-world events and may suggest whether the scope of steady-state activities should be reduced.

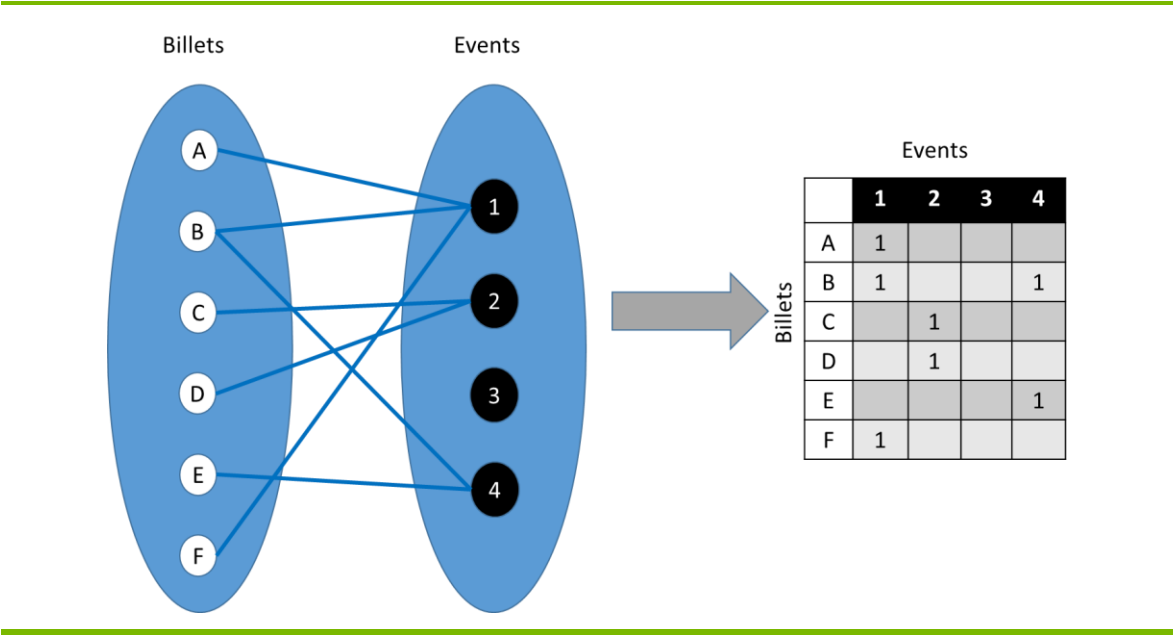
Billet-level data can also reveal the “versatility” of different positions; that is, the number and variety of tasks to which individual billets respond. Those billets that are tasked to only one or two events in the wargame—particularly those that are employed in those events below their full capacity—may be candidates for acquiring support external to the manning document. That is, depending on whether the tasking requires physical presence and on the lead time available, billets supporting “niche” tasking might be more appropriate as reachback capability or on-call augmentation.

Recommendations from billet-level employment can include support for eliminating or re-thinking individual billets and overall manning increases or decreases to right-size the staff.

Social network analysis

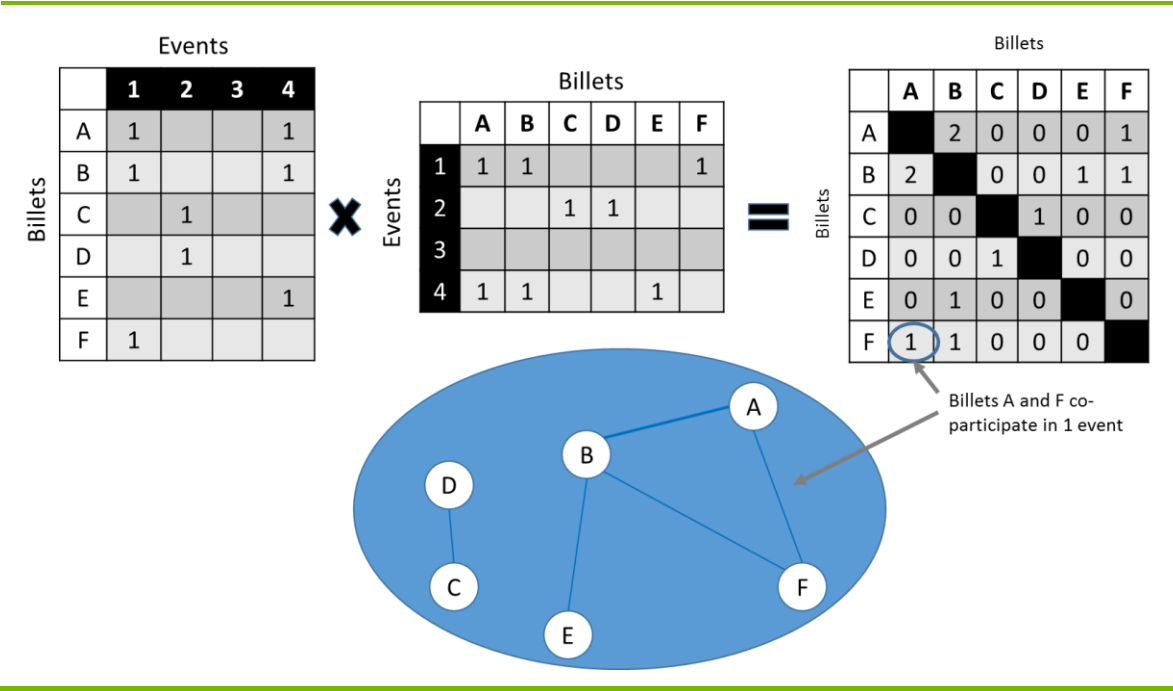
For OT3 wargames, we construct from the data a bipartite network that shows how billets co-participate in events. An example of a bipartite network is shown in Figure 7. We then convert the bipartite network into a co-participation network by multiplying the bipartite network matrix by its transpose, as shown in Figure 8, creating a network graph where the edges (connections) between nodes (billets) are weighted by the number of events where billets co-participate (also shown in Figure 8). The co-participation network quantifies the number of times any two billets participate in the same event.

Figure 7. A bipartite network (graph on left and matrix on right)



Source: CNA.

Figure 8. Creating a co-participation network from a bipartite network



Source: CNA.

Creating the co-participation network is important because our network analysis is based on the premise that billets typically responding to similar tasking have established relationships and are likely to require access to similar information. From this constructed network, we can examine a number of network measures. In our experience, organizational networks describing a staff are particularly dense and connected—requiring bounding the network to some minimum number of co-participation events. Network measures can include individual billet and overall network characteristics.

Individual billets that have high power centrality⁵ are particularly important to the organizational network. In Figure 8 above, billet B has the highest power centrality. These personnel are critical to maintain on the manning document and are worth considering to centrally position physically in the organization. Individual billets' membership in network-defined communities can also suggest changes to or decisions about billet assignment within the organization.

Network-level analysis can include measures such as assortative mixing and community make-up. The extent to which the network aligns with organizational structure—demonstrated by a high assortative mixing score (closer to 1 than 0)—suggests that the proposed organizational structure is appropriate for the way the staff behaves; interpretation of the converse will also depend on the makeup of communities.⁶ Communities created by event co-participation can also suggest organizational changes. Communities with a strongly heterogeneous makeup (having numerous directorates involved) are cross-functional; the events most closely tied to such communities are good candidates for the topic areas of standing boards, bureaus, cells, centers, and working groups (B2C2WG). Similarly, communities comprising just two directorates may indicate areas where more fidelity is required on directorate roles and responsibilities, particularly with supporting data from qualitative theme coding.

Recommendations from social network analysis may include individual billet assignment within an organization, possible structural changes, appropriate standing B2C2WG, and clarifications in the MFT document.

⁵ Power centrality, also called eigenvalue centrality, is a measure of an individual node's "influence," measured by the connectedness of each of the nodes to which it is itself connected.

⁶ Notably, we would not expect a functionally aligned staff to have an assortative mixing score of 1.0, since few tasks can be completed wholly within a single functional directorate.

Summary

Both qualitative and quantitative analyses of OT3 results can support recommendations for several elements of organizational design. Table 1 summarizes the alignment of analyses to design elements for easy reference. If time and resources are tight, this table can help focus analysis on those areas of most interest to the wargame sponsor.

Table 1. Analytic support to recommendations for different elements of organizational design

Orig. design element	RFA characterization	Alignment of tasking	Coding for themes	Billet-level employment	Social network analysis
MFT document		Changes based on discrepancies between wargame and MFT document	Debates or confusion over responsibility		Community-related tasking and directorate overlap
Battle rhythm/SOP		Indications of important coordination meetings	Areas requiring further development (e.g., PPRs, SOPs)		Heterogeneous communities suggest B2C2WGs
Structure		LNO alignment based on external coordination tasking			-Network alignment with directorate structure -Core personnel to centrally locate
Manning document	Additional billets to consider including			-Billets to consider eliminating or switching to reachback/augmentation -Tweaks to staff right-sizing	-Core personnel to ensure on document -Informed placement of unplaced personnel

Source: CNA.

We note that the analyses in this table are by no means exhaustive. As we continue to conduct OT3 wargames, we are continually adding to and refining what we can do with the data they produce.

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Abbreviations

B2C2WG	Boards, bureaus, cells, centers, and working groups
CAQDAS	Computer-assisted qualitative data analysis software
COA	Course of action
DCOS	Deputy chief of staff
LNO	Liaison officer
MFT	Missions, functions, and tasks
OT3	Organizational Troop-to-Task
PPR	Preplanned response
RFA	Request for Augmentation
SME	Subject matter expert
SOP	Standard operating procedure

This report was written by CNA's Operational Warfighting Division (OPS).

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