(Photo by Bob Harrison, FORSCOM PAO)

Spc. Federico Arce passes along his input as he and his fellow soldiers provide key information during a practical planning exercise 10 April 2012 at Fort Bragg, North Carolina. Arce and his fellow soldiers, all assigned to the Fort Bragg Warrior Transition Battalion, completed training for Lean Six Sigma Green Belt certification.

Operational Art by the Numbers

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Conventional warfighting is grounded in tactics and techniques; it is part science and part art. Most soldiers and many civilians can intuitively interpret the graphic associated with a conventional brigade attack. Friendly and enemy units, axes, objectives, and tactical mission tasks combine to show the flow of a fight in a single picture. However, ask the same soldiers and civilians how to create a similar graphic for a stability operation, showing the flow of the brigade operation over time with nested tasks leading to objectives, and they will hesitate or even stop cold and ask what you mean.

The science of moving men and machines along routes toward ground objectives is intuitive. It is a logical flow of actions over time and space. Stability operations seem to defy that level of visualization and the corresponding ability to display the operation sequentially and graphically. Yet, we have a method for displaying stability operations in a sequential, graphic manner; we do this through an operational approach,

usually focused on lines of effort. Operational art and its associated elements can be elusive because they focus much more on art than science. The process of performing operational art is not defined and codified with the same prescriptive techniques and procedures that inform the tactics of conventional warfighting. However, by clarifying the terms and concepts in our doctrine and applying some prescriptive techniques to focus that doctrine, we can simplify the process of operational art into a paint-by-numbers project.

Operational art spans a planning continuum that runs from comprehensive strategic actions down to concrete tactical actions.[1] Both joint and Army elements use operational art, which is defined as the use of creative thinking to design strategies, campaigns, and major operations.[2] Operational art allows commanders and staffs to think through the challenges of understanding their environment and the problem, and then develop a concept that frames and guides detailed planning.[3] The elements of operational art are intellectual tools that help commanders and staffs visualize and describe their approach for conducting an operation. These tools include end state and conditions, centers of gravity, lines of effort, phases and transitions, and several other elements that allow commanders to assess and plan long-term operations.

Joint and Army doctrine provides descriptions and basic examples of centers of gravity, problem statements, operational approach, and lines of effort. This doctrine also describes a general sequence of actions that leads from operational art to detailed planning. Joint Publication (JP) 5-0, *Joint Operation Planning*, describes the overall methodology for developing an operational approach with lines of effort consisting of understanding the strategic direction and goals, understanding the operational environment, and defining the problem.[4] This doctrine is not prescriptive; it does not provide specific techniques for developing planning products or an exact sequence for these efforts.

Applying Operational Art

The process of conducting operational art can be simplified through the use of plain language to describe key terms and concepts as well as a clearly prescribed sequence of actions. To clarify this process, we will employ a simple example familiar to many military members—the permanent change of station (PCS) move. A PCS move is a complex event that takes place over an extended period of time and lends itself well to planning using operational art and an operational approach. In this example we will use the following scenario:

It is January 2015. Maj. Smith is stationed at Fort Leavenworth, Kansas, attending the Command and General Staff Officer Course. Maj. and Mrs. Smith, their two children, and their dog reside in a rental house in Lansing, Kansas. They own two cars. The Smith children attend elementary school in Lansing. There are no special circumstances within the Smith family, such as exceptional family member, joint domicile, etc. Maj. Smith has been notified by Human Resources Command that he will receive PCS orders for an accompanied tour to Hohenfels, Germany, with a report date of July 2015. The unit he will be assigned to is not slated to deploy anywhere for the next eighteen months.

The simplified process of operational art we will employ will follow these four steps:

1. Determine key actors and their desired end states.
2. Develop a problem statement.
3. Determine friendly and enemy centers of gravity and associated requirements.
4. Develop an operational approach with lines of effort.

Step 1: Determine Key Actors and Their Desired End States

In both joint and Army doctrine, it is necessary to understand the operational environment and all of the actors within it. The overall goal of understanding the environment is to "produce a holistic view of the relevant enemy, neutral, and friendly systems as a complex whole within a larger system."[5] This consists of answering several questions. What is going on? Why is it going on? Who is involved? What do they want? In the end, we need to identify the key actors and their desired end states, including the end state of friendly forces. Knowing the end states of all relevant actors will help us determine centers of gravity.

In the PCS scenario, the Smith family represents the friendly forces with an overall end state of smoothly moving all personnel and property from Kansas to Germany. The enemy is a little more difficult to discern in this scenario. The enemy does not always have to be a thinking, hostile force. Sometimes the enemy is environmental, as in the case of Hurricane Katrina. In this scenario, the enemy is the environment that threatens the move.

The environment's end state is not driven by a personal objective or desire but rather the need to maintain a state of equilibrium or inactivity; its end state is to conserve energy by maintaining the status quo through inertia. These two end states are in conflict; one seeks to make change, and the other seeks to remain as static as possible. This conflict represents the problem.

Step 2: Develop a Problem Statement

The problem statement describes the obstacles between our current state and the desired end state—what we must overcome to get from where we are to where we want to be. Developing a problem statement is the key outcome of framing the problem, which consists of understanding and isolating the root causes of conflict. By questioning the difference between the current state and the desired end state, and determining what is preventing you from reaching the desired end state, you frame the problem. In its purest form, the problem statement is a concise statement of the issue or issues requiring resolution.[6] However, by adding a short narrative to the problem statement that also explains how to bridge the gap between current and desired end state, you have a more complete product that begins to inform your operational approach. This is similar to the thesis in an essay, since it guides all other materials in the work. You now have described the obstacles facing you and a broad way of addressing them.

Looking at the PCS situation, we want to develop a problem statement that will describe what the Smith family must overcome to get from where they are to where they want to be. By brainstorming the many obstacles in their path and then focusing on the desired end state, we might come up with this problem statement:

Given PCS orders, limited time, a weight restriction on household goods, and a single vehicle shipping restriction, as well as post out-processing and in-processing support, how do you move a family of four with a pet out of the United States from Kansas to Germany and smoothly settle into a new job, new home, new school, and new community with all property intact?

Friendly Center of Gravity

Smith family goal: To smoothly move all Smith family personnel and property from Kansas to Germany

Critical Capability: Coordinate all move events with appropriate agencies	**Center of Gravity (COG)** Maj. Smith
Critical Requirements Orders Out processing time Transportation Access to communications	**Critical Vulnerabilities:** Inadequate lead time

Figure 1. Center of Gravity Worksheet

Step 3: Determine Friendly and Enemy Centers of Gravity and Associated Requirements

After analyzing the environment, determining what we want it to look like, and identifying the obstacles standing in the way of our vision, we need to determine the most important elements to both protect and attack as we develop a plan. These become the friendly and enemy centers of gravity (COGs). The term *center of gravity* is derived from the writings of Clausewitz, who described a center of gravity as, "the hub of all power and movement, on which everything depends … the point at which all our energies should be directed."[7] The military definition of the center of gravity as defined in doctrine is "a source of power that provides moral or physical strength, freedom of action, or will to act."[8] There is no set process for determining a COG. Based upon their understanding of the actors in the operational environment, analysts are supposed to develop candidate COGs—how to do this is not specified—and test them against twelve characteristics of centers of gravity found in JP 5-0.[9] Centers of gravity are further analyzed within the framework of three critical factors—capabilities, requirements, and vulnerabilities. In joint

doctrine, a critical capability is a crucial enabler for a COG to function and is essential to the accomplishment of the adversary's assumed objective. A critical requirement is a condition, resource, or means that enables a critical capability to become fully operational. A critical vulnerability is an aspect or component of a critical requirement that is vulnerable to direct or indirect attack in a manner achieving significant results.[10] Thus, a COG is characterized by critical capabilities that enable it to function. These capabilities are further enabled by critical requirements, some of which are vulnerable to attack. By identifying these and understanding their relationships, we can describe our adversary as a system susceptible to attack at vulnerable points. The problem with this is that we have to divine the COG in the first place before being able to further describe it using the critical factors. We need a straightforward formula for determining COGs.

A more systematic approach to COG development is proposed by retired Army Col. Dale Eikmeier, who posits that the COG is best discovered by first determining the critical capability.[11] This critical capability is directly aligned with the most important resource, or means of action, in the system—the center of gravity. Eikmeier's stepped approach looks first at the goal or objective of the friendly or enemy force. After identifying this goal, the next requirement is to determine ways or methods that this goal can be accomplished. These ways are critical capabilities. The next requirement is to select the critical capability that reflects the most likely way to achieve the overall objective. This becomes the primary way and the most important critical capability. Now

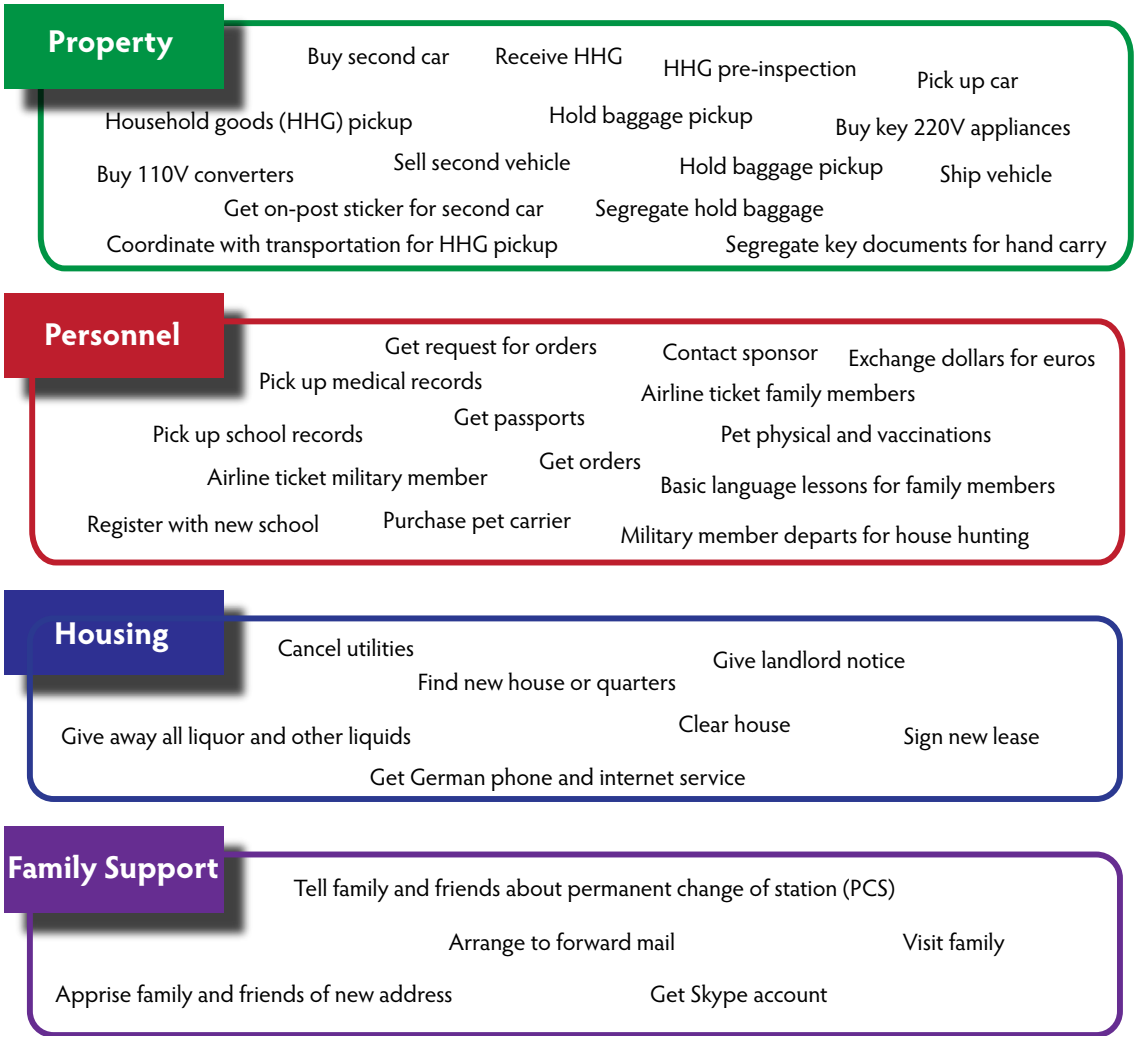

Figure 2. Logically Group Actions, Tasks, and Objectives

determine the resources or means that are available to perform this most important critical capability. The resource that most directly performs this critical capability is the COG. Thus, the critical capability is a verb describing the way to accomplish the overarching goal, while the COG is a noun and the thing that performs the critical capability. The resources or requirements that the COG requires in order to perform the critical capability are the critical requirements. Critical vulnerabilities are those critical requirements that are susceptible to attack. This method can be used to determine both a friendly and enemy COG.

Let us look back at the Smith family PCS example and determine the COGs of both the Smith family and the environment. First, we look at the best way (critical capability) that each can accomplish its end state, and then we determine which resource within their respective systems is the source of this action. The source of action that most directly performs the critical capability is the COG.

There are several ways that the Smith family can accomplish its goal of moving the family members and property from Kansas to Germany. A friend with a power of attorney could arrange all aspects of the move. Or, the Smith family could simply hope that agency representatives take the initiative to coordinate the actions of the move. However, the most likely way to accomplish this move is for the Smith family to personally coordinate all move events. Coordinating all move events is the critical capability. If this is the most likely way to do this, which element of the Smith family will perform this critical capability of coordinating the move events? Considering Maj. Smith, Mrs. Smith, the children, and the dog are the resources within the Smith family, Maj. Smith is the resource that will most directly perform the critical capability of coordinating the move. Thus, Maj. Smith is the friendly center of gravity. Now we look at the resources Maj. Smith requires in order to coordinate the move. Some of these might be PCS orders, out-processing time, personal transportation, and access to communications. These are critical requirements. Any of these that are vulnerable to attack could be critical vulnerabilities. Perhaps inadequate lead time is a key factor and thus a critical vulnerability.

When looking at the opposing actor, the environment, we must look at ways that the environment will attempt to accomplish its goal of maintaining the status quo. A rogue actor may target the Smith family and disrupt all of their coordination. Fierce competition for move resources may cancel all actions related to the Smith move. Constant friction by multiple sources involved in the move may slow and disrupt the move. Finally, a catastrophic weather or environmental event may defeat the move. The most likely way of maintaining a state of inertia comes from applying constant friction to the move. Thus, applying friction to the move is the critical capability. Looking at the possible sources of this constant friction, we might consider weather, distressed family members, or apathetic agency workers. While all of these may apply, the resource that most directly performs the critical capability of

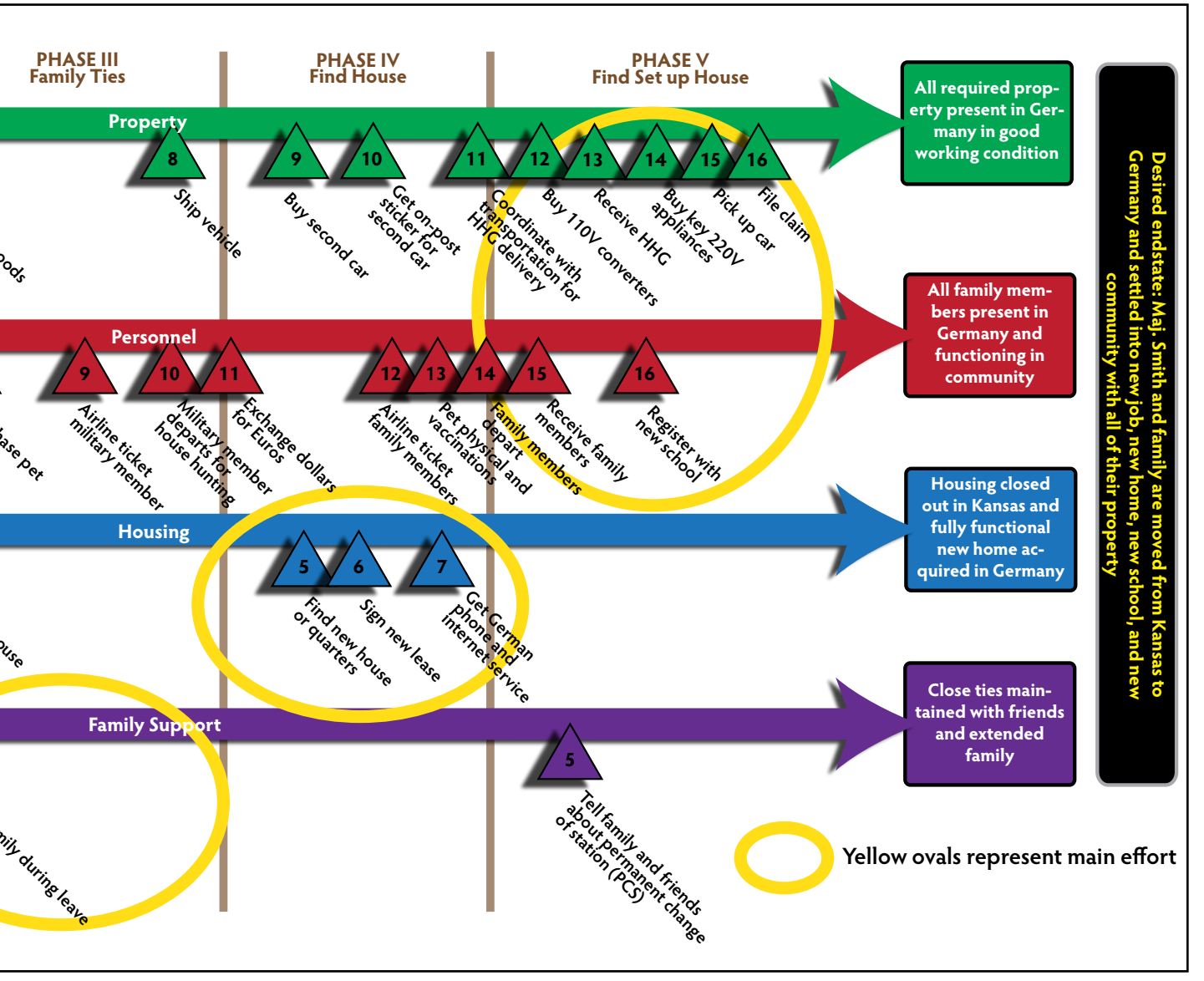

Figure 3. Operational Approach to PCS Move

creating constant friction is the collection of apathetic agency workers. This makes them the environment's COG. Some of the resources they employ to accomplish this constant friction are bureaucratic regulations, access control, and perceived legitimacy with superiors. The resource most vulnerable to exploitation might actually be the use of regulations since it not only slows the Smiths but also places requirements on the agency workers themselves. Systems with COGs can be expressed graphically for quick reference as depicted in figure 1. At this point, we have set a foundation that describes where we are, where we want to go, the obstacles in between, the most important elements available to both the friendly and adversarial forces, as well as some of the vulnerabilities of those elements. We are ready to move from the realm of why to the realm of how; we are ready to develop an operational approach.

Step 4: Develop an Operational Approach with Lines of Effort

The operational approach describes the broad general actions required to solve the problem. The operational approach serves as the main idea that informs detailed planning and guides the force through preparation and execution.[12] JP 5-0 provides basic guidelines

(Photo by Mark Brown, Hawaii Army Weekly)

The process a family goes through in the planning and execution of a permanent change of station move can be comparable to the use of operational art to plan and conduct extended military operations. Both are complex, and both require synchronization of multiple tasks to achieve a successful outcome.

on developing an operational approach. These include considering both direct and indirect approaches as well as arrangement of actions along *lines of effort*.[13] Army doctrine defines a line of effort as "a line that links multiple tasks using the logic of purpose rather than geographical reference to focus efforts toward establishing operational and strategic conditions."[14] Since the tasks or actions along a line of effort are related by purpose, the line provides an overall theme or topic describing the tasks. Actions along these lines of effort may use defeat or stability mechanisms, or both, to create conditions that lead to the desired end state.

Developing the lines of effort and actions along them is a combination of brainstorming and organizing. Start with the desired end state. Write down all of the major actions or tasks that must occur to get you from where you are currently to where you want to go. Attempt to group these actions or tasks by similar topics or themes, and give each grouping or theme a logical name or title. These themes will form the basis of your lines of effort.

Let us use the Smith family PCS again to illustrate this. The desired end state for the Smith family is to smoothly move all personnel and property from Kansas to Germany. Now we brainstorm to determine all of the tasks that must be accomplished in order to meet this end state. This includes official military actions, family actions, and any other event associated with the move. In no particular order write down every action, task, and objective that comes to mind.

Next we want to organize these seemingly random tasks into categories. Tasks that are linked to one another as part of a topic or purpose should be grouped together. Thus, we rearrange the tasks into logical groups and label these groups with intuitive names. Figure 2 provides an example of how to organize these tasks.

Now arrange these groups of tasks in a linear, sequential fashion. You can work on one line at a time, but understand that eventually you will have to synchronize the lines with one another. These groups become lines linking multiple tasks using the logic of purpose; they are lines of effort. Establish an end state for each of these lines of effort. Once you have sequentially ordered the tasks on each line, you will want to display the product in a manner in which you can see all of the lines together. Thus, you have developed an operational approach. It is a graphical representation of actions that you must accomplish over time to go from your current conditions to your

desired end state. It is a picture of your operation or campaign. Figure 3 provides an example of such a graphic representation.

Even though we have each line of effort arranged in sequence, they now need to be aligned in time with each other. Your lines should run horizontally, displaying actions sequentially from left to right. The element of time will run vertically and can be displayed in days, months, or years, depending upon your planning horizon. Once you have a common time schema overlaid on your lines of effort, you can slide your actions and tasks along the lines to the appropriate point in time when they should take place. In most cases this should be when you initiate an action or task.

Once you have all actions and tasks on your lines of effort arranged according to when they should occur, you can begin to see how certain tasks and actions cluster over time. There are themes that exist across all of these lines that characterize the nature of the actions taking place at that time. You can also see logical break points where the overall nature of the actions changes. Draw vertical lines between these clustered events along the break points that separate them from one another and organize your operation into logical time zones. These are the phases of your operation that extend across all lines of effort. Give them a title that succinctly describes them. The vertical lines in figure 3 demonstrate the timing for tasks associated with the Smith family PCS.

At this point, you may identify and add in more actions and tasks that need to take place to shape conditions. Look at each phase and determine where the most critical actions are in that phase. In most cases these will be on a single line of effort. Circle these actions as demonstrated in figure 3. This designates your main effort in that phase. Identifying this main effort helps prioritize certain tasks and objectives and directs resources toward these points of concentration.

Conclusion

Analyzing an operational environment, determining centers of gravity, and developing an operational approach are complex tasks requiring intellectual rigor. These tasks can seem even more complex without a systematic approach for accomplishing them. Providing structure to this process through discrete steps and simple techniques allows even novice operational artists to press forward and develop the design products that provide the bedrock for detailed planning. ■

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Notes

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2. Joint Publication (JP) 3-0, *Joint Operations,* (Washington, DC: U.S. GPO, 11 August 2011), II-3.
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5. Ibid., III-10.
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