

XVII. C4 ARCHITECTURE

A. INTRODUCTION

This chapter is based on a small Command, Control, Communications, and Computers study conducted by students in a section of CC3900 Special Topics in Command, Control, Communication, Computers, and Intelligence Systems course focusing on ExWar. The study was limited in scope and did not attempt to address the C4 problem as a whole, but rather focused on the parts amenable to study within the timeframe available. For example, the complex relationship between the Commander, Amphibious Task Force (CATF) and the Commander, Landing Force (CLF) is a key issue that has not been completely addressed and remains an issue for further study. A second issue is how a Joint Task Force (JTF) commander would control what has historically been a Naval force mission with its own traditions, operational procedures, and doctrine. The Integrated Battle Organization (IBO) proposed below only partly addresses this issue. The results of the study should be viewed as a jumping off point for further research vice a complete examination of the C4 mission set. The primary value of this study is the functional decompositions of C4 functions for use in future research.

The introduction of STOM as an operational concept has increased the role of C4 systems in ExWar. STOM is an element of OMFTS. OMFTS is characterized by the use of surprise, speed, focus, lethality, flexibility, and audacity in order to control the tempo of operations and overwhelm the adversary (USMC, 1996, 2). By projecting combined arms maneuver from beyond the horizon, STOM dilutes the enemy by enlarging their battle space and has the ability to control vital areas by operating outside them in order to create and exploit reaction from the enemy. The command and control requirements for executing maneuvers across these large areas from beyond the horizon will require new systems and C2 organizations to successfully execute STOM. A brief description of certain portions of this new C4 architecture is the subject of this chapter. STOM operations also emphasize ISR, and assets to perform these functions as part of a three-tiered ISR system of systems. ISR capabilities are discussed in more detail in Chapters XVI and XVIII.

In the past, for example, the expeditionary elements of logistics, fires, and C2 went ashore. STOM, however, calls for rapid projection of combined arms teams ashore, but emphasizes Sea Based command and control, logistics, and fire support. Logistics, maneuver, fires, and ISR, then, must be addressed in any C4 system designed to support STOM. This chapter will propose four individual C4 architectures for each of these areas.

B. ASSUMPTIONS

Prior to developing the four different architectures, the following assumptions were made.

1. The Expeditionary Operation will be a MEU-Sized STOM Operation

The Commander has the choice of executing a traditional expeditionary operation employing the build-up of an Iron Mountain and the associated operational pause or he can execute an operation employing the principles of STOM. The expeditionary operation referred to in this chapter will employ a MEU-sized force. Although the Integrated ExWar Project is based on a MEB, the C4 architectures identified in this chapter can be scaled upward to provide for the needs of the larger force.



Figure XVII-1: Fully Supported STOM Operation (Source: Sweeney, et. al., 2002)

2. A Joint Task Force (JTF) Commander Will Be Appointed to Command the Expeditionary Operation

The establishment of a JTF will coordinate the efforts of the military forces of all component services involved in the operation.

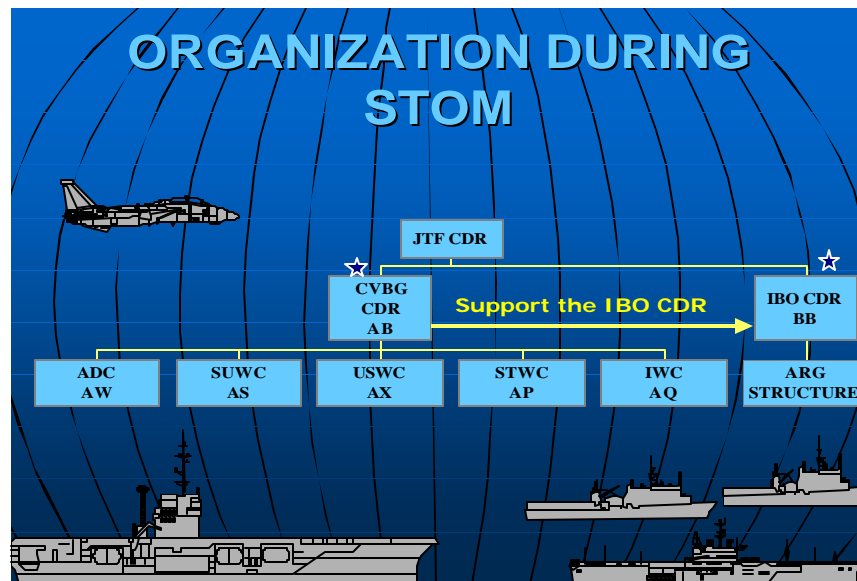


Figure XVII-2: An Organizational Chart for a JTF STOM Expeditionary Operation (Source: Sweeney, et. al., 2002)

3. The Integrated Battle Organization (IBO) Commander is the Expeditionary Maneuver Warfare Commander in Reference to the Combined Warfare Commander Concept

The current CATF/CLF organization is replaced with an Integrated Battle Organization capable of controlling the Naval, Marine, and Joint elements of the expeditionary operation. The C2 function is currently performed by a pair of O-6s, one Navy and one Marine, whose command relationship and operational procedures vary from battle group to battle group and operation to operation. The placement of an IBO commander over the entire operation simplifies the command relationships and eliminates many of the conflicts encountered in the current expeditionary command structure.

The IBO commander, a one star position which could be filled by either a Naval or Marine officer, and their staff would be placed in overall command of the expeditionary task force, and be designated the supported commander. The one star commanding the Carrier Strike Group (CSG) would be designated the supporting commander in order to ensure the efficient provision of the air support required to conduct the overall operation.

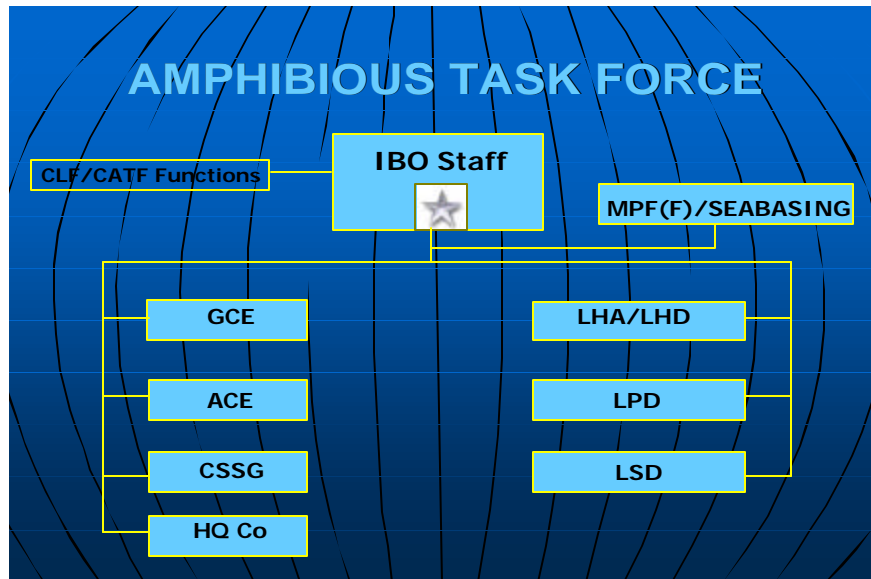


Figure XVII-3: The IBO Chain of Command (Source: Sweeney, et al., 2002)

4. C2 for the IBO is centrally located on the LHD/LHA

The C2 element remains Sea Based, vice being sent ashore. The idea is to reduce the footprint ashore.

5. The CSG plays a supporting role for the IBO

This CVBG is essential in terms of providing additional close-air support and the ability to provide a deep strike capability of fixed targets. The Marines on the ground will need the additional air cover since heavy equipment like M1A1 might not be available at an objective located 200 NM inland from the beach.

C. METHODOLOGY

The four major groups in C4 were analyzed by creating functional flow block diagrams using IDEF conventions as previously described. The diagrams represent architectures that can be used to identify drivers for all C4 functional flows.

D. LOGISTICS MODEL

1. Introduction

Logistics is the biggest part of any expeditionary operation. There can be no success in any expeditionary operation without taking logistics as a factor. The C4 analysis group derived a logistics model that covers all aspects required to successfully perform STOM. In this model, the C4 group decomposed the requirements to the lowest common denominator. Using the system engineering approach of the IDEF functional flow, the group modeled all the control and resources for all the functions. The figure below is the top-level IDEF of logistics.

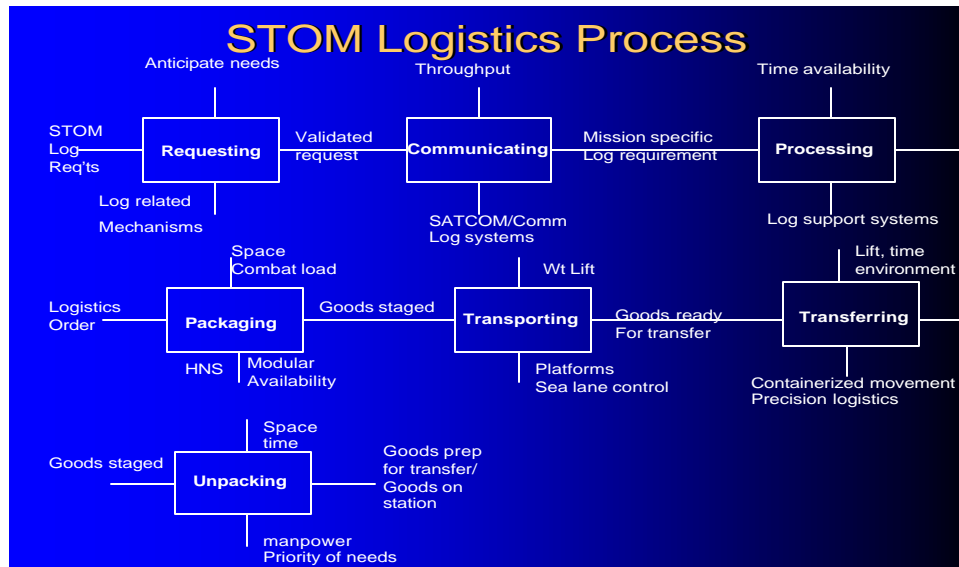


Figure XVII-4: Top Level View of the STOM Logistics Process (Source: Sweeney, et al., 2002)

2. Logistics Process

Logistic processes take place at multiple levels in a STOM environment. The level dictates process details. The IBO facilitates the process, but most of the responsible parties are outside the realm of the IBO staff. This makes the job of supporting an indefinite sustainment operation more difficult. Below is a general description of the major functions in the model:

a. Requesting

Requesting logistics support starts prior to the troops landing on the beach. The idea is to have all the required supplies on the ships and available to the IBO when needed. The goal is to control the amount of supplies with some margin to minimize the footprint and still fully support the troops.

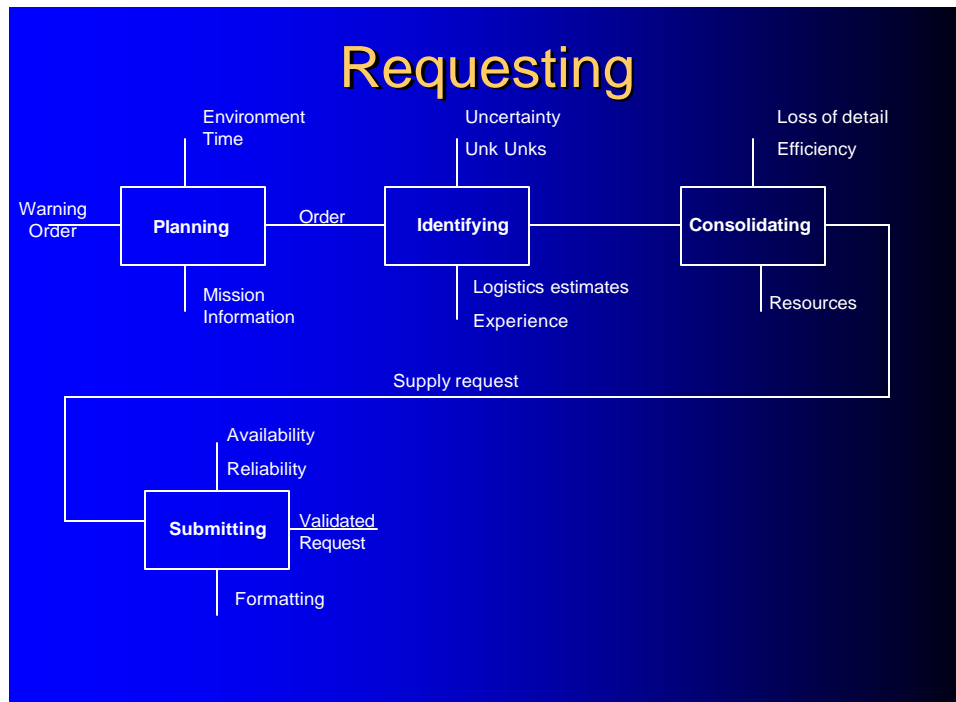


Figure XVII-5: Logistics Request Process (Source: Sweeney, et al., 2002)

b. Communicating

Communicating is the process through which logistics support requests are updated or amplified based on new information and changing requirements.

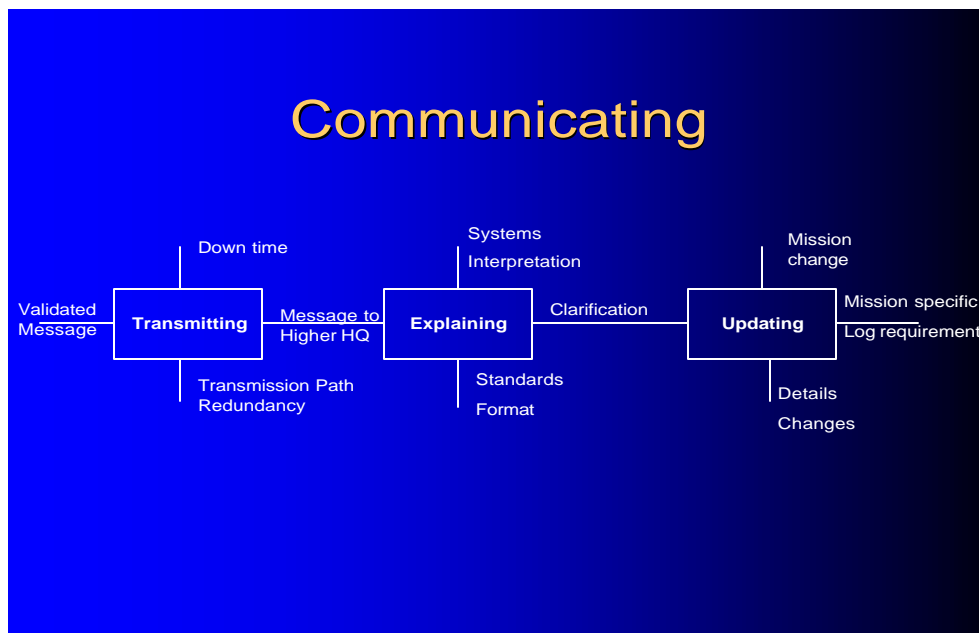


Figure XVII-6: Logistics Request Communication Process (Source: Sweeney, et al., 2002)

c. Processing

Processing is how the supplies are shipped. In commercial shipping, the supplies are typically loaded for efficiency of space utilization vice loaded for combat effectiveness. Prepositioned shipping is also packed this way. STOM will require that loaded equipment be packaged based upon the commander's intent for the operation.

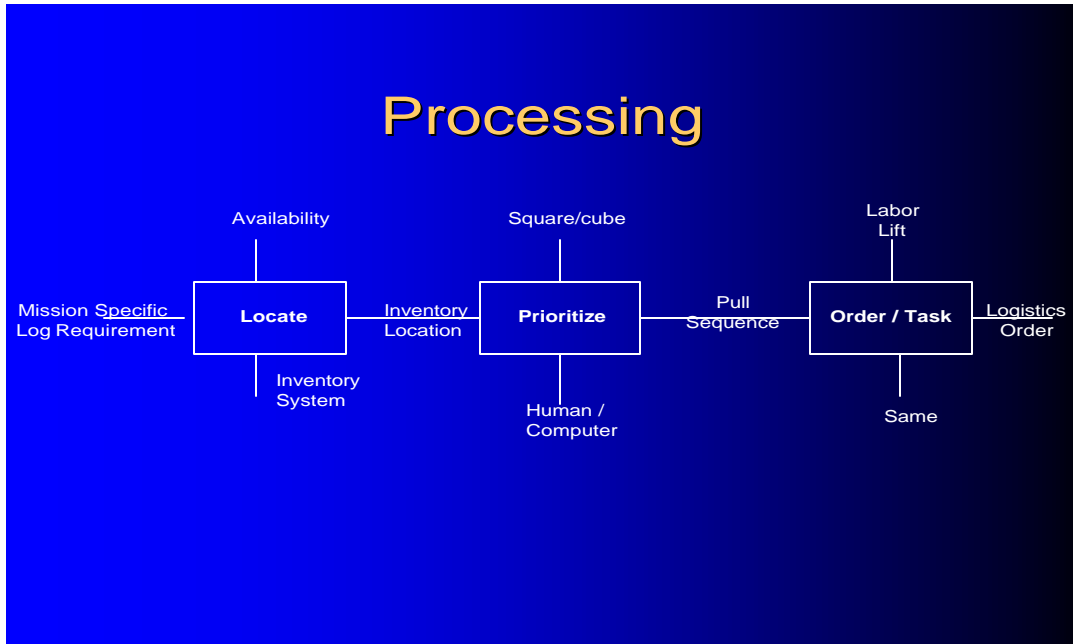


Figure XVII-7: Logistics Request Processing Flow (Source: Sweeney, et al., 2002)

d. Packaging

Packaging is a manpower intensive process. Since goods are shipped in containers, each container needs to be packaged with what it needs to carry.

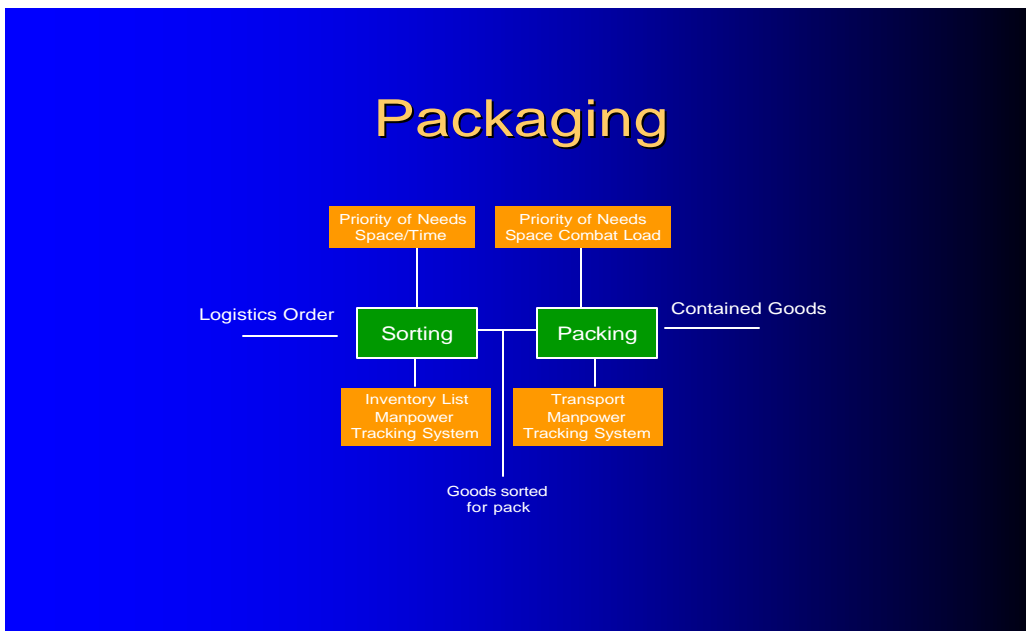


Figure XVII-8: Logistics Packaging Process (Source: Sweeney, et al., 2002)

e. *Transporting--comes into two stages*

Port to Sea. In port-to-sea transportation, the port has to have the capability of handling the specific containers used by the military. There will be an automated determination of the path to ship goods based on shipment capacity, the speed of the transporter, and the urgency of the request. The port also needs the flexibility for rapid shipment of critical supplies. New technologies need to be developed for better ship-to-ship transfers.

Ship to force. There is a conflict between using lift assets to move troops and equipment and using lift assets to provide logistics support especially during the initial phases of an operation. The determination of troop needs at the objective regarding sustainment is what will drive the process.

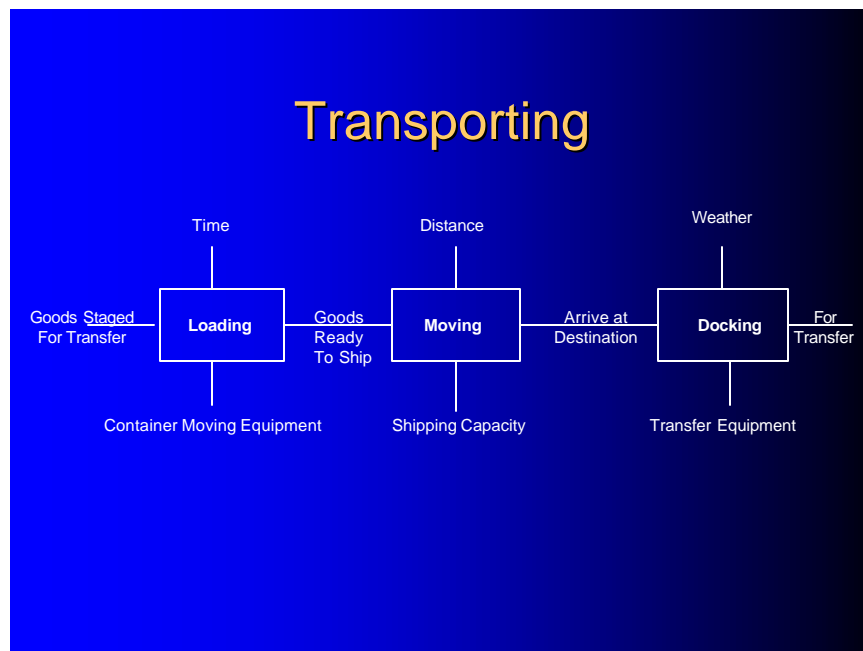


Figure XVII-9: Logistics Transport Process (Source: Sweeney, et al., 2002)

f. Transferring

Transferring includes the ability to monitor the movement of all supply assets. Using the Unified Planning System model of continuous tracking, the marine in the field will be able to locate his supplies and the logistics controller will receive feedback and updates on whether the supplies have been received at the objective. This control loop will prevent loss of supplies base shipped to wrong location.

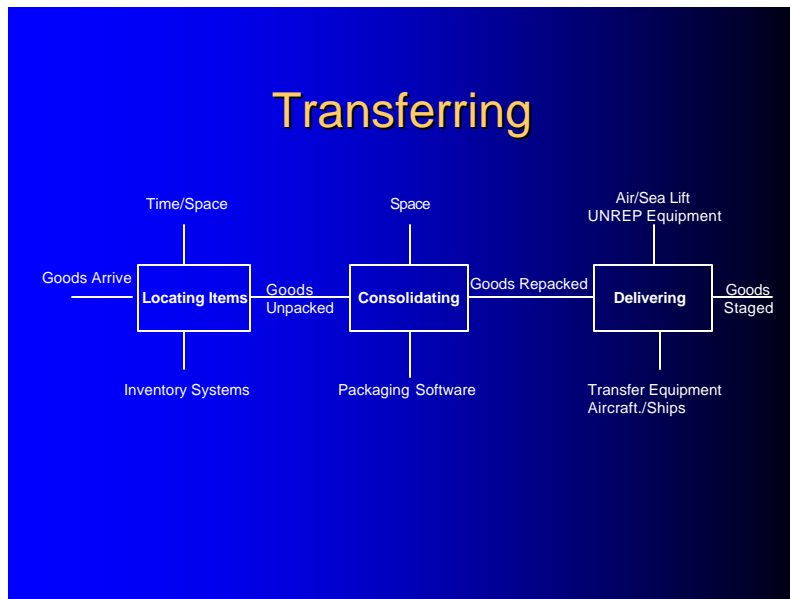


Figure XVII-10: Logistics Transfer Process (Source: Sweeney, et al., 2002)

g. Unpacking

Unpacking is based on who the goods are packed for and at what point the sorting will take place. Sorting can take place either at the beach or at the Sea Base.

The full model break down is presented below. Each major function is brought down to the lowest common denominator.

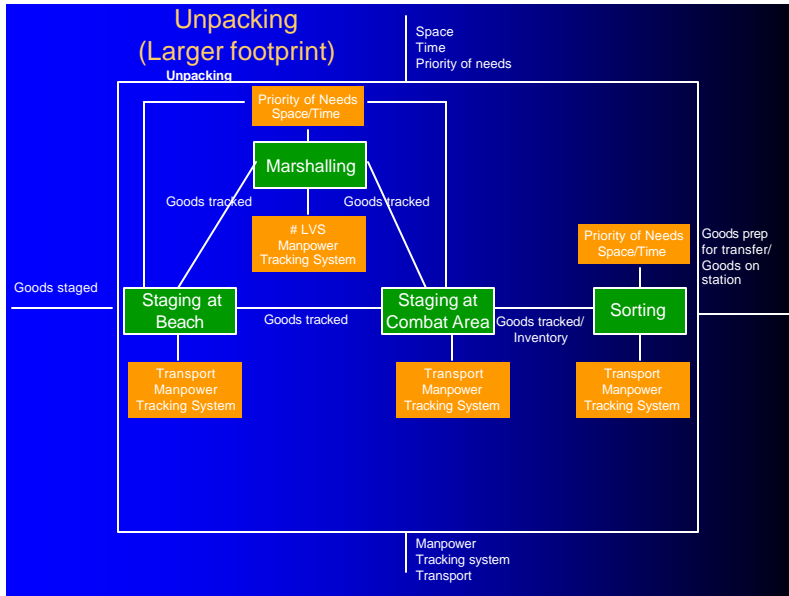


Figure XVII-11: Unpacking Ashore (Source: Sweeney, et al., 2002)

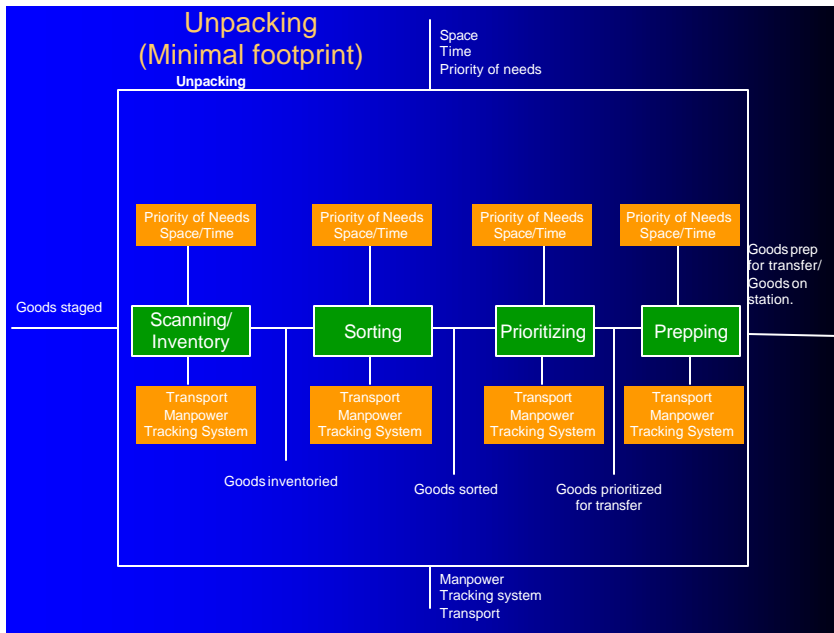


Figure XVII-12: Unpacking at the Sea Base (Source: Sweeney, et al., 2002)

3. Logistic Cell

A logistics cell will be utilized to organize and coordinate all the effort for the IBO. The cell will liaise with outside organizations. The goal is to focus the effort based on the commander's intent. This will ensure that the correct logistic flow can be established based on the correct combat elements ashore.

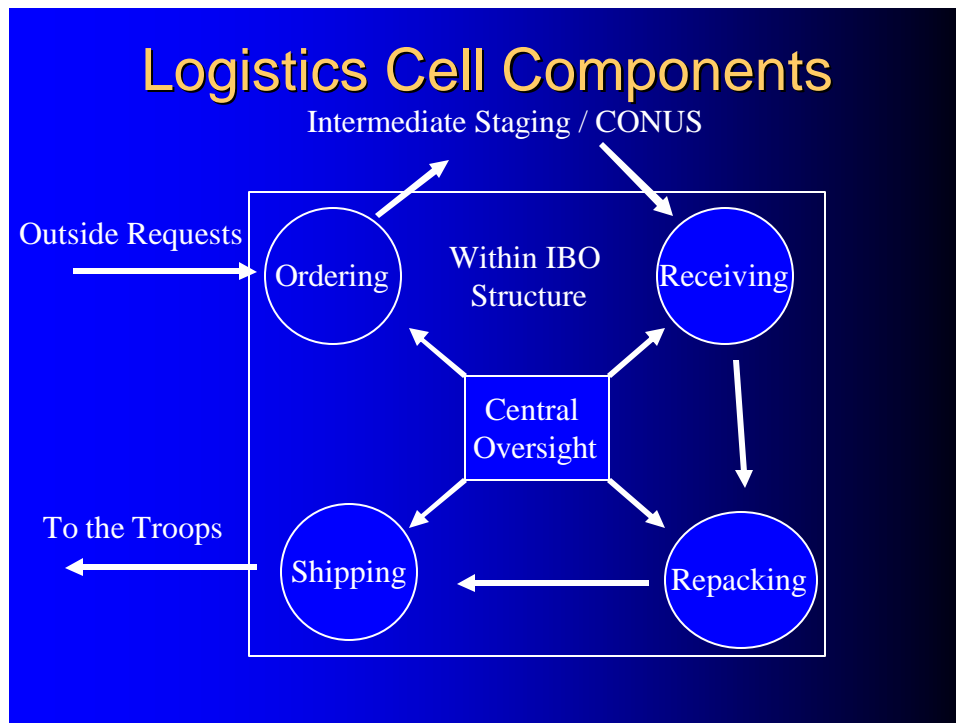


Figure XVII-14: Logistics C4 Cell For STOM (Source: Sweeney, et al., 2002)

The logistics cell will handle the coordination between the troops, ports and other organizations will go through the IBO logistics cell. The coordination effort will prevent the loss of supplies or duplication of ordering which wastes time, money, and manpower.

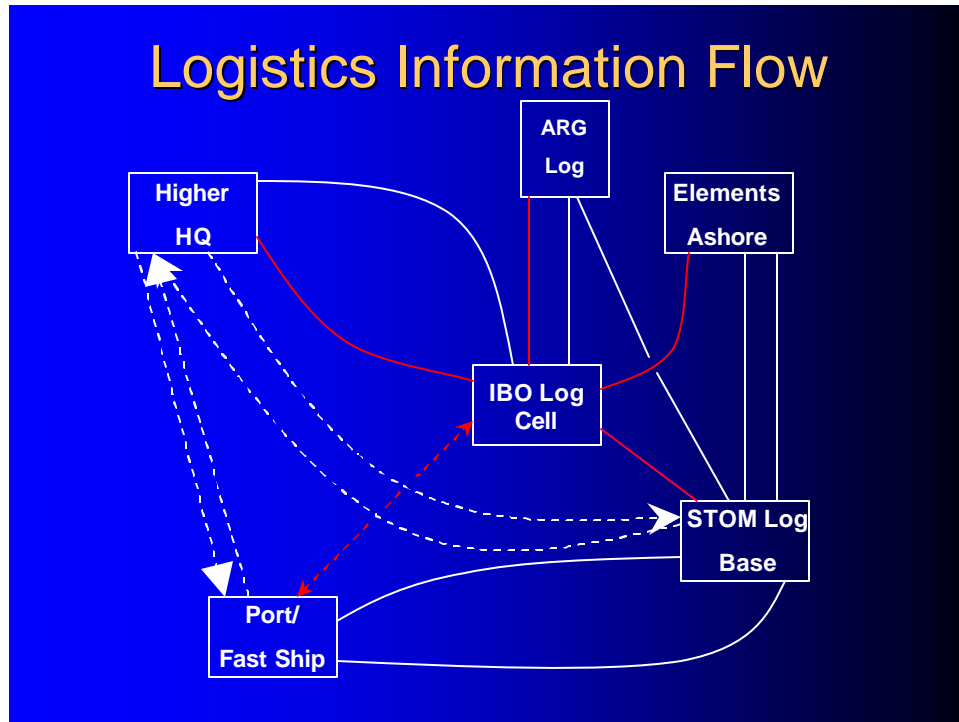


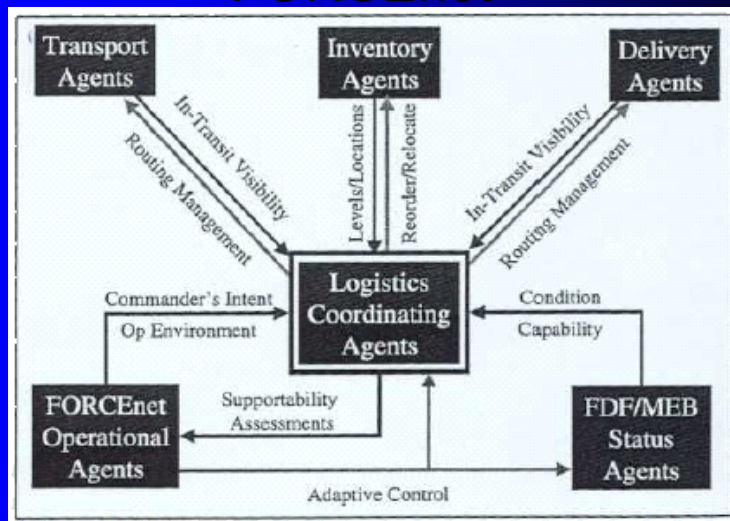
Figure XVII-15: Logistics Information Flow (Source: Sweeney, et al., 2002)

The information flow is based upon task organization. The IBO logistics cell based upon a MEU size force will be staffed with one O-5 as the OIC, an O-3 or O-4 as a deputy, one Chief, one deputy chief and 8 clerks. The IBO Logistics cell is scalable. The larger the size of the force, the more the cell will need to be augmented with personnel.

4. Navy's FORCEnet Program

The Navy is attempting to improve its logistic flow using FORCEnet. FORCEnet is part of the Navy transformation program attempting to make Network Centric Warfare a reality. Below is an example of how FORCEnet will be used to provide sustainment functions.

Sustainment Functions of FORCEnet



XVII-16: FORCEnet's Sustainment Function (Source: Sweeney, et al., 2002)

5. Conclusion

Logistics is the major part of any expeditionary operation. This conceptual paper model is a good basis for further development. This model should be tested in a real world situation in order to be validated. Once tested, the links and processes can be analyzed to find out where the best investment in resources should be utilized to give the maximum return for logistic capability.

E. MANEUVERING MODEL

1. Introduction

In this section, the broad operational capabilities necessary for STOM operations against littoral defenses are identified. Technical and functional capabilities should be developed from these overall operational requirements. The planning and execution

cycle depicted in the center is a modified version of the Amphibious Planning Process for STOM.



Figure XVII-18: C2 Integration (Source: Sweeney, et al., 2002)

a. Command and Control

The C2 system must be able to integrate all aspects of power projection operation and create a common battlefield perception for all levels. The system will present information appropriate for the level of command or function.

b. Lift

This capability (amphibious ships and supporting transports) is necessary to move sufficient forces to the objective area and to maneuver those forces in theater.

c. MCM

This capability enables the amphibious projection of ground forces without loss of tempo and initiative to minefield delays and/or loss.

d. Surface Maneuver

Surface maneuver forces must be capable of conducting opposed mechanized penetration and exploitation operations across the land-sea interface.

e. Vertical Maneuver

This capability is necessary to insert ground forces at critical points from over the horizon at sea, using indirect and variable routes.

f. Landing Force Maneuver

Landing forces must be able to maneuver to take advantage of gaps located or created in vulnerable spots at sea and ashore in the enemy defense. Amphibious battlefield mobility is required to allow non-linear maneuver between ship and shore, unbroken continuance across the land-sea interface, and high tempo operations.

g. Combined Arms

The combined arms forces must have sufficient capability to overwhelm the defensive forces at the time and place of our choosing. This includes the ability to suppress the covering defensive fires and maneuver forces threatening the assault forces as well as the ships at sea.

h. Logistics

Logistics support must be capable of providing sufficient combat support services to rapidly maneuvering elements ashore directly from a Sea Base.

2. Steps in the Amphibious Planning Process

The amphibious planning process establishes procedures for analyzing a mission, developing and war gaming Courses of Action (COA) against the threat, comparing friendly COA against the commander's criteria and each other, selecting a COA, preparing an order for execution, and transmitting the Optional Plan (OPLAN), Operational Order (OPORD), and/or Operational Task (OPTASK) to those tasked with its execution.

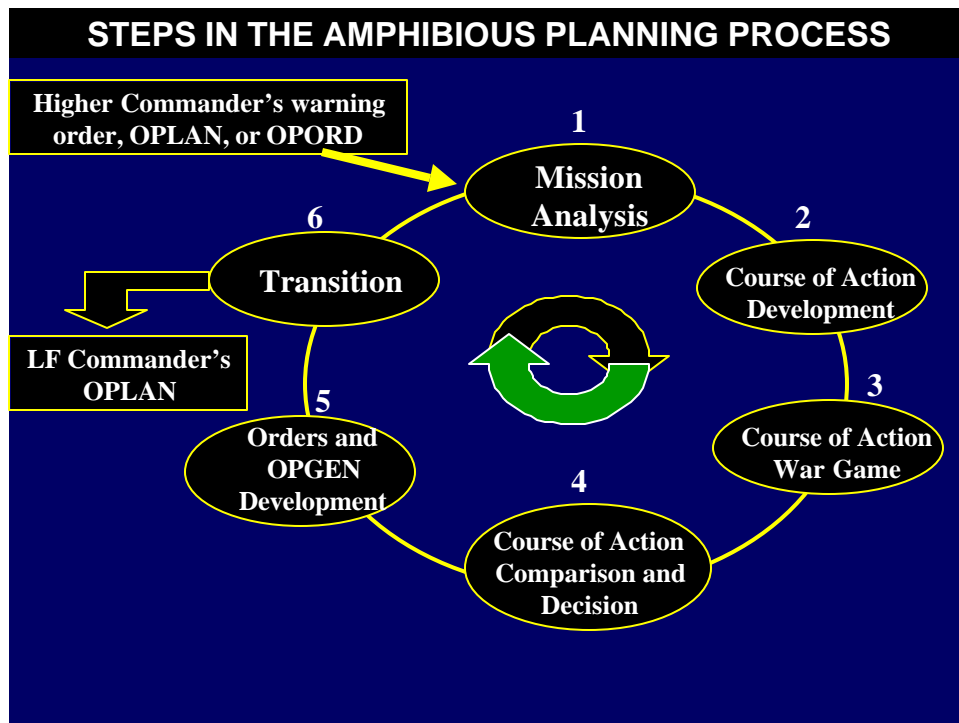


Figure XVII-19: Amphibious Planning Process (Source: Sweeney, et al., 2002)

The details at the various stages are shown in the following figures:

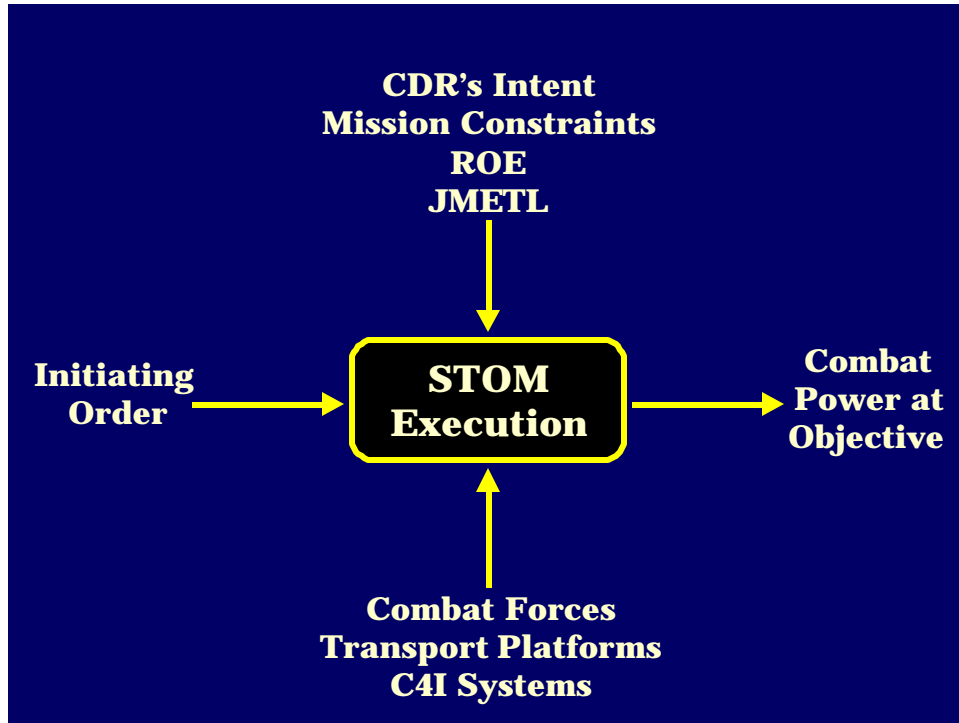


Figure XVII-20: STOM Maneuver Execution Process (Source: Sweeney, et al., 2002)

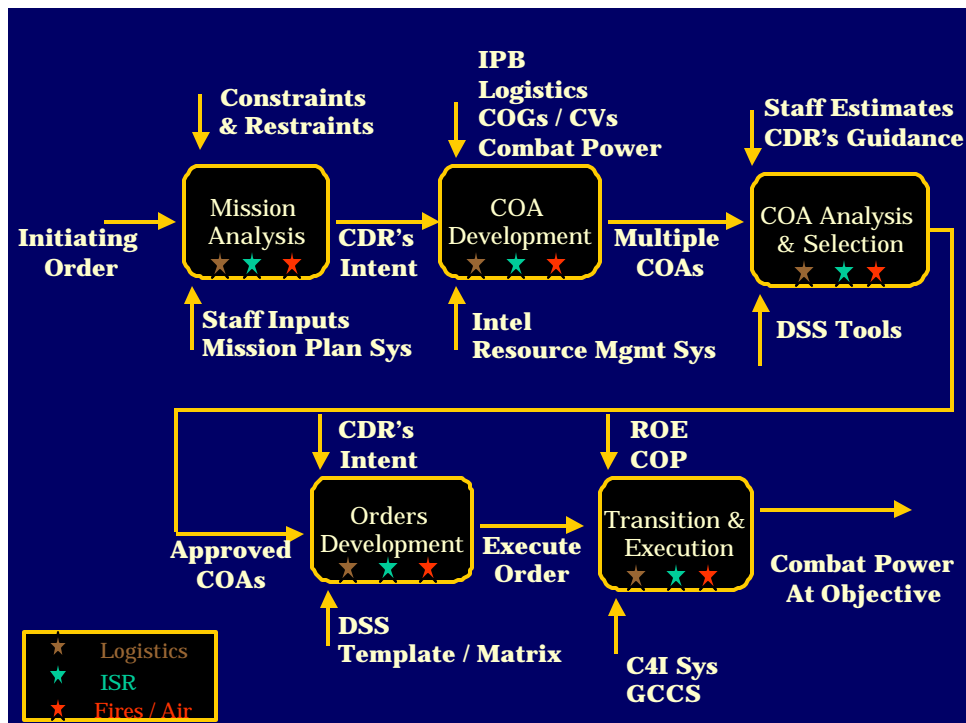


Figure XVII-21: Details of STOM Maneuver Execution Process (Source: Sweeney, et al., 2002)

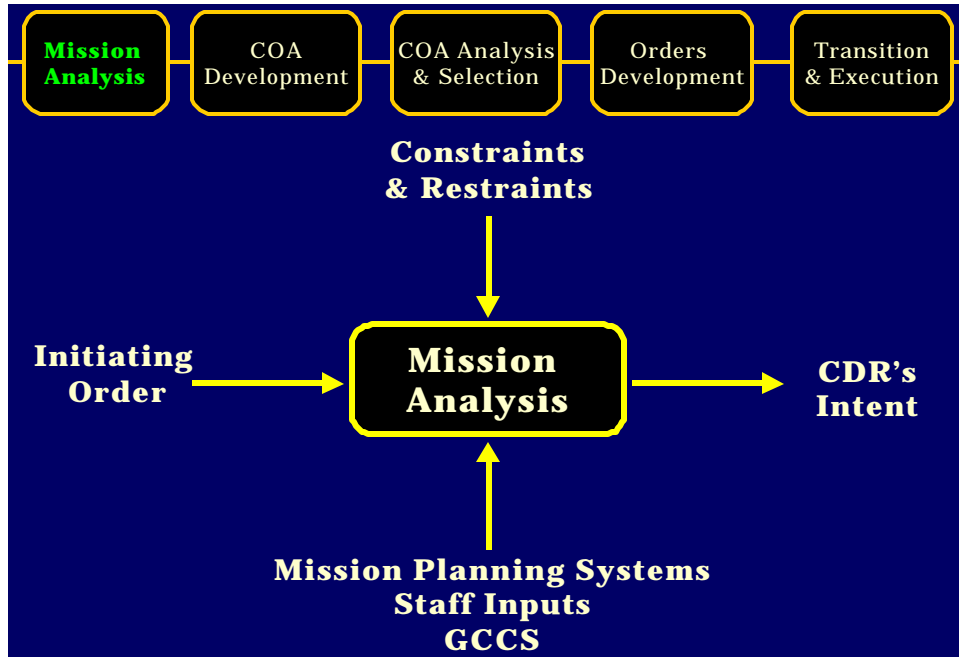


Figure XVII-22: STOM Maneuver Mission Analysis (Source: Sweeney, et al., 2002)

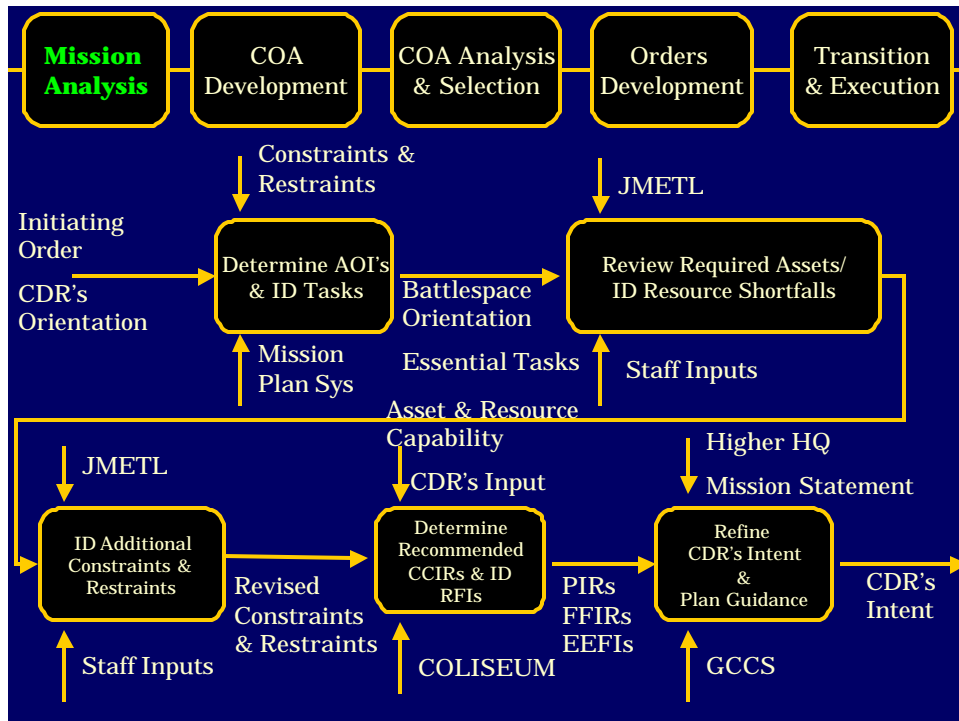


Figure XVII-23: Details of Mission Analysis Process (Source: Sweeney, et al., 2002)

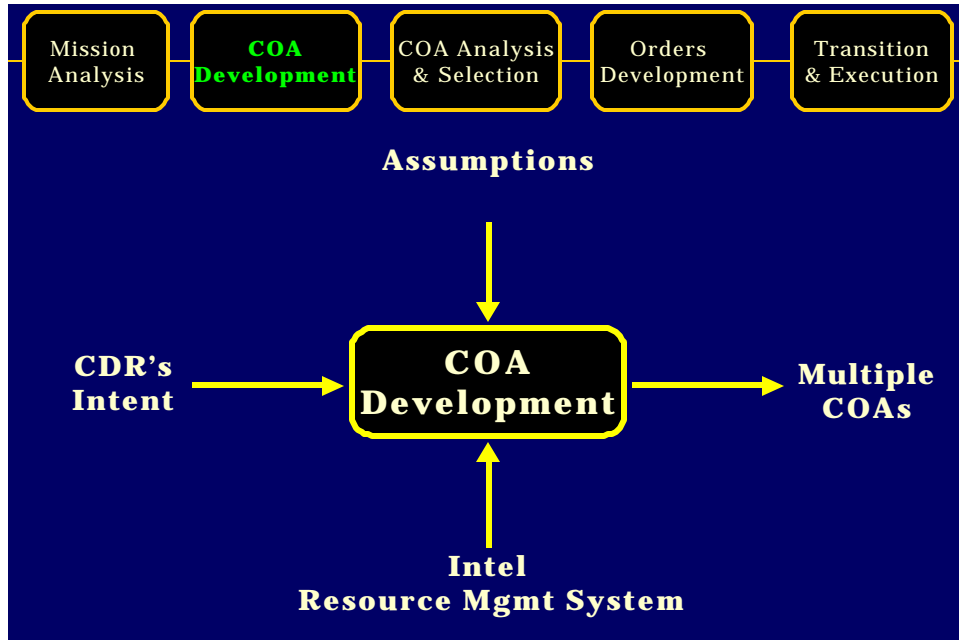


Figure XVII-24: COA Development (Source: Sweeney, et al., 2002)

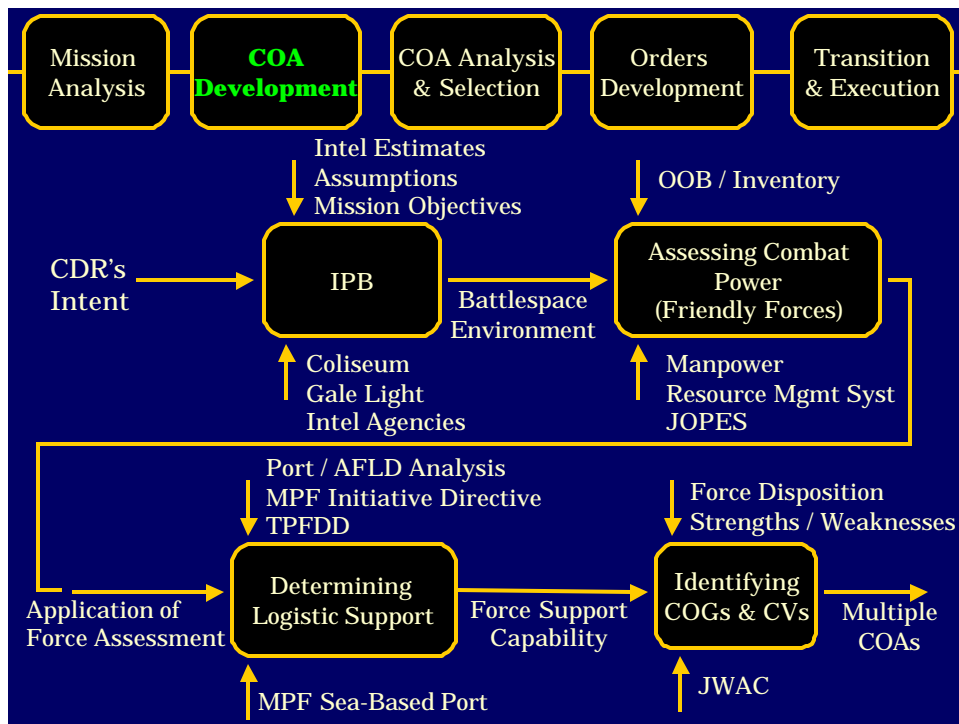


Figure XVII-25: Details of COA Development (Source: Sweeney, et al., 2002)

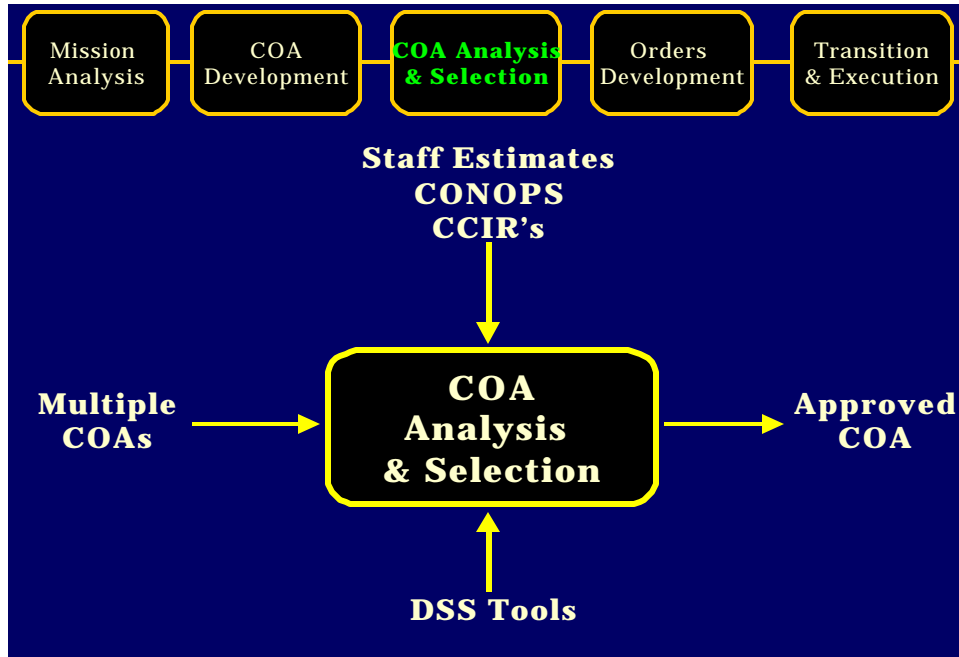


Figure XVII-26: COA Analysis and Selection (Source: Sweeney, et al., 2002)

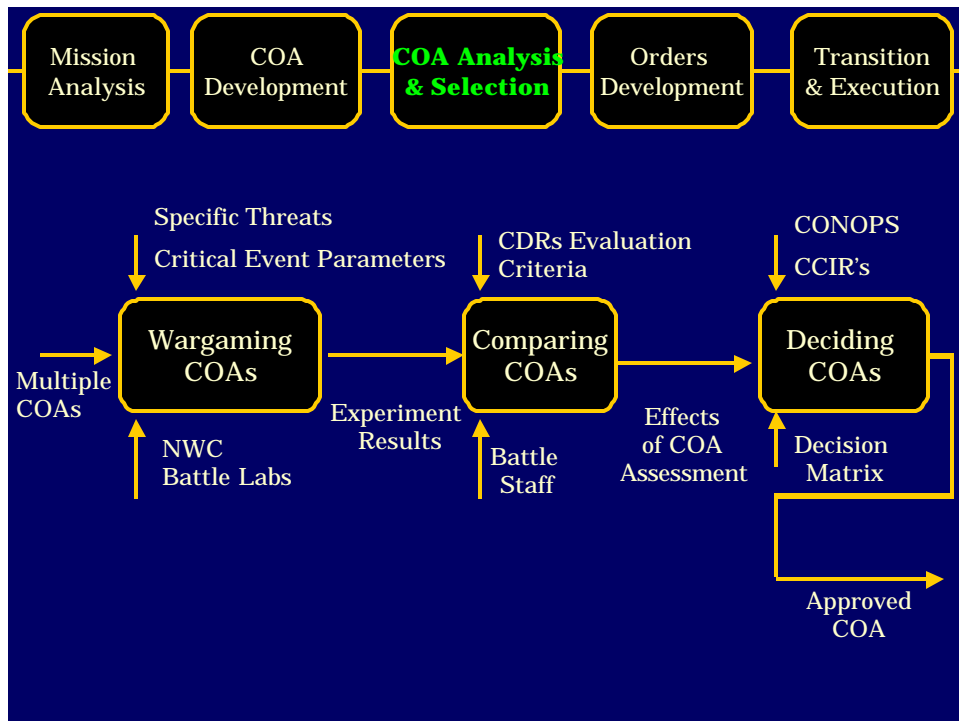


Figure XVII-27: Details of COA Analysis and Selection (Source: Sweeney, et al., 2002)

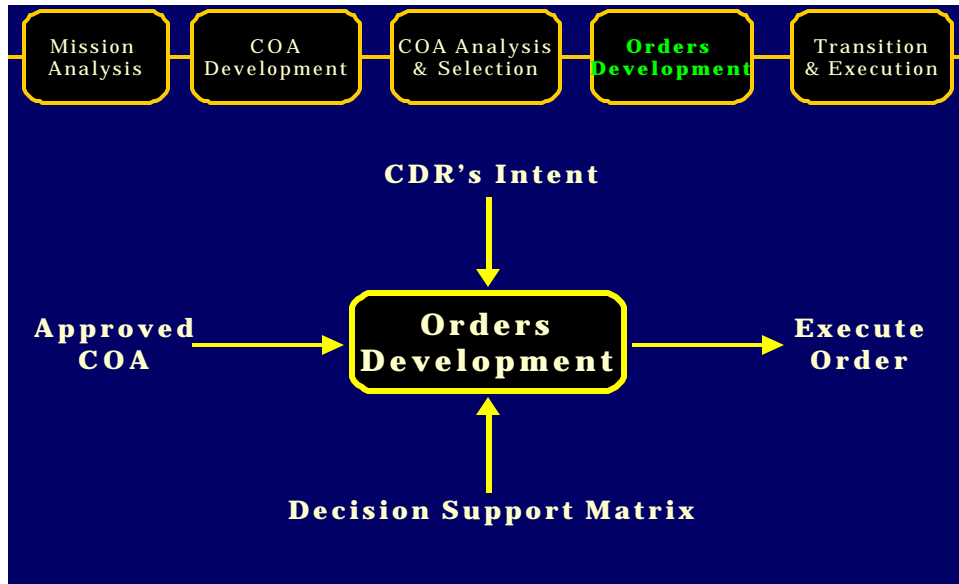


Figure XVII-28: Maneuver Orders Development (Source: Sweeney, et al., 2002)

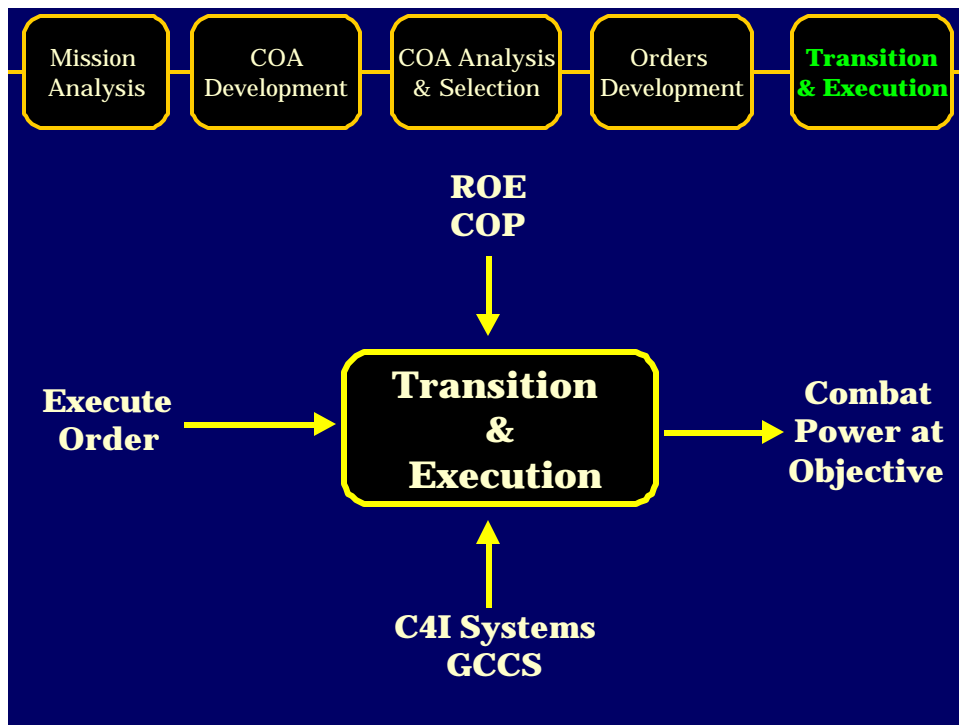


Figure XVII-29: Transition and Execution Process (Source: Sweeney, et al., 2002)

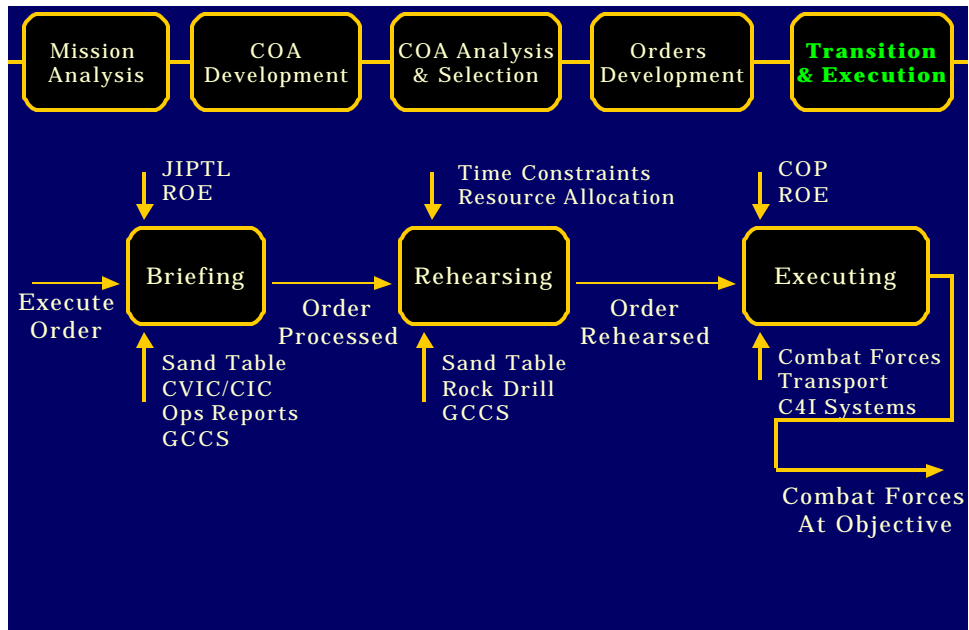


Figure XVII-30: Transition and Execution Details (Source: Sweeney, et al., 2002)

3. The C2 Cell

The C2 cell must coordinate with the other cells in order to ameliorate the time constraints between logistics and maneuvering. We believe that fluidity must exist between these two functions if STOM is to successfully exploit an adversary's littoral region. In addition, the reporting structure for the chain-of-command for this cell will go directly to the IBO Commander. Above the IBO Commander will exist either a numbered fleet or JTF commander. The important aspect to note is that the C2 Cell has a direct line to the IBO Commander who will oversee STOM operations. **Error!**

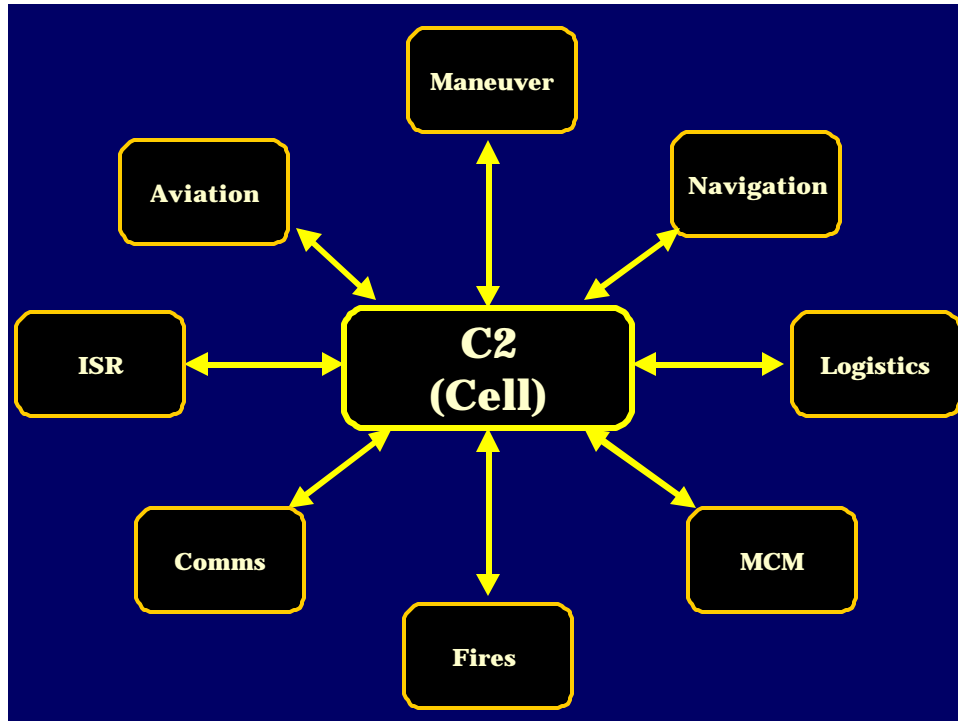


Figure XVII-31: Functions of C2 Cell (Source: Sweeney, et al., 2002)

4. Requirements

The current day requirements for STOM are listed as follows:

- a. Increased lift capability
 1. Speed for rapid maneuver
 2. Air transportable
 3. Surface transportable
 3. Logistical transportable
 5. Maneuver force transportable

- b. C4I Architecture for STOM Integration
 1. Joint / Combined C2 Coordination
 2. Communication Links (i.e., range and reliability)
 3. Intelligence

5. CONCLUSION

Maneuver is the medium by which STOM takes place. Maneuver involves a fusion of ISR, logistics, and fires/air. CAPT Scott Jasper, USN has said, “Fires and maneuver are continuously and seamlessly integrated across the battlespace in a synergistic manner.”

F. FIRES MODEL

1. Introduction

Fires are the effects of lethal or non-lethal weapons. Implicit in the employment of fires is a rational process to select appropriate targets to gain control of an area of operation in order to allow components to execute the commander’s guidance and objectives.

The overarching process for fires is summarized in the figure below.

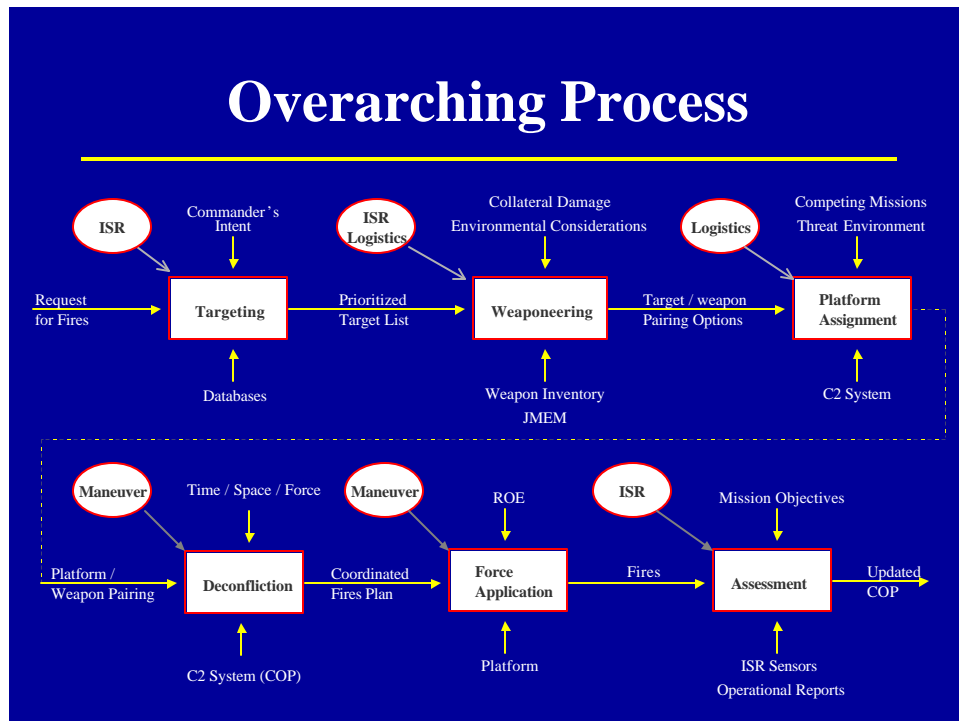


Figure XVII-32: Overarching Fires Process (Source: Sweeney, et. al., 2002)

2. Staffing

The staffing in the fire cell should be optimized for mission requirements. The fire cells are staffed by Fires Officers (Marine - Ground Military Operational Specialty). Fires subject matter experts are needed in the following areas:

- a. Naval Aviation (CVW)*
- b. Marine Corps Aviation (ACE)*
- c. Air Force*
- d. Surface Cruise Missile & Gun Fire Support*
- e. UAV Specialist*
- f. Intelligence*
- g. Special Operations*
- h. Non-Lethal Weapons*

A minimum of 10 individuals are needed to man the cell: six officers and four enlisted. They are responsible for the rotation of Fire Plans and current fires. The requirements to conduct Information Operations were not considered in this portion of the study.

3. Scalability

The scalability of the fires cell was determined by the type of operation and the mission objectives. It is also determined by the composition of forces, their size, capabilities, and interoperability. The complexity of the operation and the selected

COA(s) are another factor. Finally, scalability is determined by the anticipated duration of operation and manning and space limitations.

4. Organization

The fire cell is organized into three tightly integrated teams. First, there is the Targeting team responsible for targeting, weaponeering, and assessment. The Fires Plan team is in charge of platform assignment and deconfliction, while force application is the task of the 24-hour watch Current Fires team.

5. Integration and Location

The key to effective integration of joint fires is a thorough and continuous planning process. There is integrated current operations watch of fires, ISR, logistics and maneuver similar to the Tactical Flag Command Center. Networking may even enable some degree of virtual presence of cell members.

6. Chain of Command

The chain of command in the fire cell is shown in the figure below:

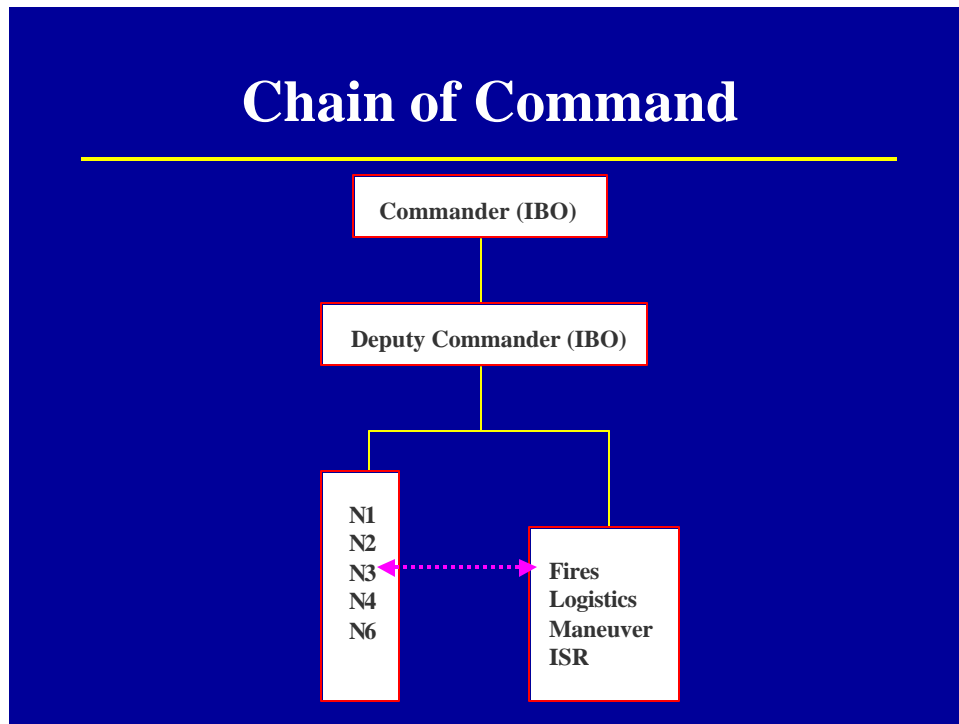


Figure XVII-33: Fires Chain of Command (Source: Sweeney, et. al., 2002)

7. C4I SYSTEMS

The C4I systems in the fire cell consist of the following:

a. Shipboard Integrated Systems & Support

Staff (system operators)

Ship's Company (system administrators)

b. Joint Command and Control System Integration – Global Command and Control System-Maritime (GCCS-M), Theater Battle Management Core Systems (TBMCS) (Contingency Theater Automated Planning System) (CTAPS), etc.

- c. *Fires Tracking (tactical picture) - Tactical broadcasts (near-real time)*
- d. *Targeting Tools – Joint Service Imagery Processing System-Navy (JSIPS-N) suite, Joint Mission Planning System (JMPS), Joint Tactical Terminal (JTT), etc.*

8. CONCLUSIONS

Fires are the effects of lethal or non-lethal weapons. Fires consist of six major sub-processes. They are targeting, weaponeering, platform assignment, deconfliction, force allocation and assessment. There is also overlap with other processes that requires an integrated current operations watch. Due to the complexity of the operation, the presence of subject matter experts is essential for the effective execution and success of the mission. Thorough and continuous planning and an effective C4I system hold the key to successful mission accomplishment.

G. INTELLIGENCE, SURVEILLANCE, AND RECONNAISSANCE (ISR) MODEL

1. Introduction

ISR is the eyes and ears of the JTF commander. Collection of this crucial data begins even before the JTF is stood up. Under a STOM operation, it is imperative that the IBO has the ability to gain rapid understanding of the battle space and critical decisions depend on the accuracy and timeliness of ISR data.

With increases in technology, ISR systems have grown more complex. As a result, without proper knowledge of the new systems, this new technology can actual hinder decision making. For example, new concepts such as Network Centric Warfare will increase the nodal activity, potentially creating decision making delays. This architecture provides the process through which ISR data is received and swiftly and effectively disseminated at all levels of the IBO. Once this architecture is understood,

delays can be minimized by focusing funds and manpower on improving those functions with the largest contribution to these delays.

2. The Model

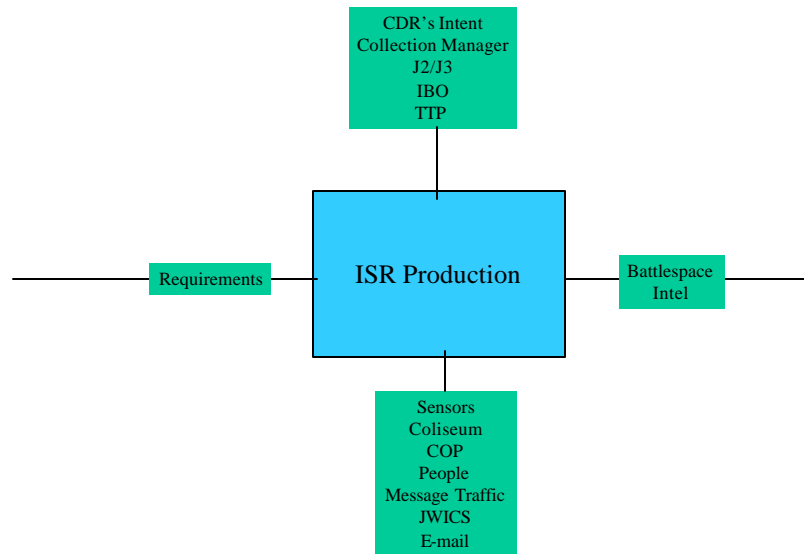


Figure XVII-34: Top Level ISR Process (Source: Sweeney, et. al., 2002)

ISR starts with the commander's intent. The intent identifies the resources needed to gather information and data. The commander has organic assets at his disposal for ISR. The priority of the mission will dictate the need for additional, external resources. These additional assets can be obtained from national collection (CIA, satellite imagery, and other organizations), or theater collection (Special Forces not assigned to his command).

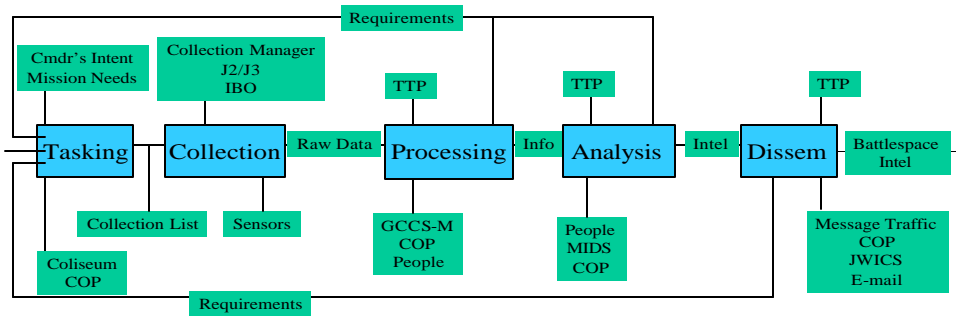


Figure XVII-35: ISR Process (Source: Sweeney, et. al., 2002)

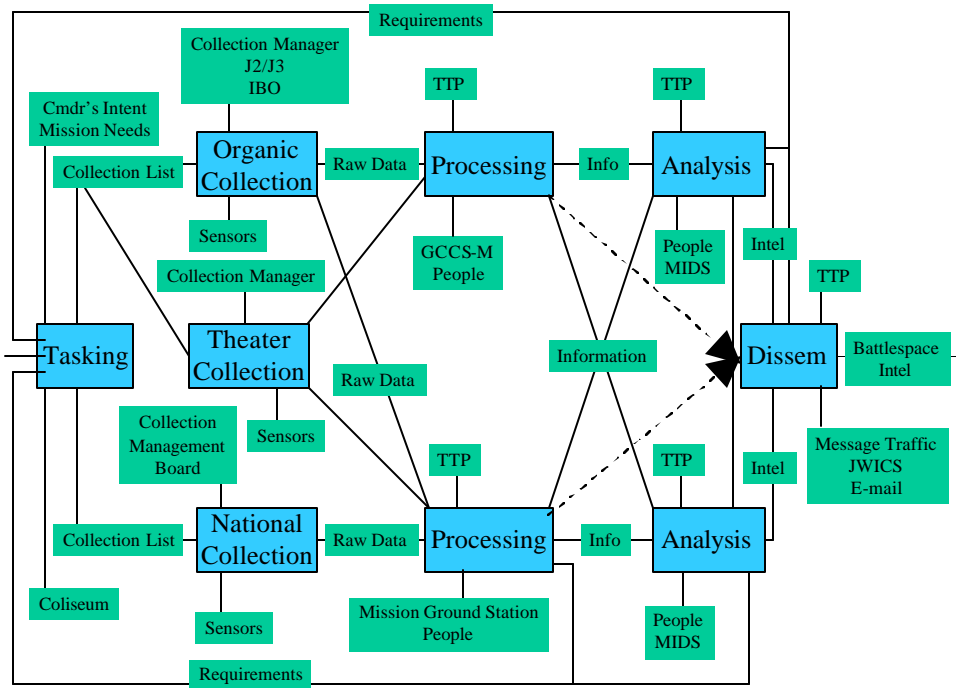


Figure XVII-36: ISR Process Based On Multiple Collection Sources (Source: Sweeney, et. al., 2002)

ISR becomes very complicated when many different groups are involved. Each of the collection agencies can be further broken down into smaller organizations

responsible for collecting the data. Integration of this data, and interfaces with different equipment, becomes the largest frustration with ISR. The IBO staff can make ISR more coherent and relevant for the commander by putting ISR resources in the right places. These decisions need to be made in support of the maneuver and fires models. Model conflicts must be mitigated by the IBO staff based on mission priorities.

3. Requirements for ISR

There should be two types of ISR cells:

a. First Cell

The first cell will be located in operations department and will have at least one watch stander. This watch stander should be an ISR professional who has experience working with the “second cell.” The responsibilities of this watch stander will be to provide ISR support and insight to current operations. The first cell will be staffed by with one officer and up to two enlisted personnel. At least one of the enlisted personnel should be an E-5 or above with a thorough understanding of Navy and Marine forces.

b. Second Cell

The second cell will look at longer-range plans and issues concerning ISR. The IBO N/G-2 staff will have one O-5, one or two O-4s (of these two positions one should be Navy and the other Marine) and at least one senior enlisted. The MEU intelligence personnel will provide the needed personnel to fulfill the requirements of the expeditionary operation regarding ISR.

4. Conclusions

ISR becomes more complicated as more systems come on line. This complication needs to be resolved or delays can occur which can detract from the commander’s ability to make correct decisions.

H. CONCLUSIONS

The four models are a good base line to start from in accounting for the complexity of command and control. Logistics, maneuver, fires, and ISR all play an integrated part of any STOM expeditionary operation. All four models provide insight for C2. Work still needs to be done to integrate the four models into one complete operating model for C2. A complete C4 model that is tested and verified can be a powerful tool for achieving a synergistic, Network-Centric combat capability.

The number of personnel required to provide C2 for these mission areas in a MEU-sized STOM operation is provided in Table XVII-1 below.

Mission Area	C2 Cell Size	Officers	Enlisted
Maneuver	TBD	O-7 IBO CDR	TBD
Logistics	12	O-5, O-3 or O-4 deputy	Chief and Deputy Chief, 8 clerks
Fires	10	6	4
ISR “Cell One”	2-3	1	1-2 (1 E-5 or above)
ISR “Cell Two”	3-4	1 O-5, 1-2 O-4	1 Senior Enlisted

Table XVII-1: C2 Cell Size for a MEU size STOM Operation (Source: Sweeney, et al, 2002)

Finally, the designation of an IBO CDR and supporting C2 structure could resolve many of the CATF/CLF relations problems the fleet has experienced in the past and make the projection of power ashore faster and more efficient.