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ACQUISITION RESEARCH SPONSORED REPORT SERIES

Development of a Rapidly Deployable Special Operations Component Command (SOCC) Core Concept for the North Atlantic Treaty Organization (NATO) Special Operations Headquarters (NSHQ)

11 January 2012

by

LCDR John Krott, USN,

Lt. Frank Morales, USN, and

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ABSTRACT

The North Atlantic Treaty Organization (NATO) Special Operations Headquarters (NSHQ) is the primary point of development, direction, and coordination for all NATO Special Operations-related activities. NSHQ could enhance the effectiveness of NATO Special Operations Forces (SOF) and increase the probability of mission accomplishment when NATO SOF assets are collectively employed in a combined manner by adding an operational command and control capability. This would be in the form of a Special Operations Component Command (SOCC) Core. The SOCC Core is an advanced party of 70–150 personnel who provide an organic, rapidly deployable headquarters (HQ) capability for NSHQ. NSHQ does not currently have the ability to provide NATO with a rapidly deployable asset package, which would include a full suite of operational command, control, communication, computers, and intelligence (C4I) capabilities equipped with organic SOF and their enablers.

The purpose of this thesis is to examine equipment and deployment configurations that will fulfill the mission requirements of the SOCC Core. An analysis of alternatives is conducted to determine which equipment types and configurations achieved the desired robust mission capability at the lowest possible cost. The focus is on the make-up of the four sub-components of the SOCC Core. These sub-components are the Operations Center (OPCEN), All-Source Center (ASC), Support Center (SUPCEN), and the Signals Center (SIGCEN). Possessing a rapidly deployable SOCC Core would be a sound step toward establishing and ensuring interoperability among allied SOF units and commands and would enhance the employment of NATO SOFs.

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Public Policy in pursuit of a Master's of Business Administration. Upon graduation from the Master's of Business Administration in the financial management program at the Naval Postgraduate School in June of 2012, LT Livingston will report to a Naval Special Warfare Command.

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LIST OF ACRONYMS AND ABBREVIATIONS

ACO	Allied Command Operations
ADVON	Advanced Liaison
AFS	ACO Force Standards
AKSS	Alaska Small Shelter System
AOR	Area of Operation
ASC	All-Source Center
ATC	Aberdeen Test Center
BATS	Biometric Analysis Tracking System
BBM	Baseband Module
BICES	Battlefield Information Collection and Exploitation System
BOS	Balance of Systems
C2	Command and Control
C4I	Command, Control, Communications, Computers, and Intelligence
CIS	Communication and Information Systems
CEN	Center
CHS	Combat Support Hospital
CIDNE	Combined Information Data Network Exchange
CJFSOCC	Combined Joint Force Special Operations Component Command
CMM	Call Manager Module
COCOM	Combatant Command
COTS	Commercial Off-the-Shelf
CS	Combat Support
CSS	Combat Service Support
DA	Direct Action
DCU	Digital Control Unit
DJTF	Deployable Joint Task Force
DoD	Department of Defense
DSOO	Directorate of Special Operations Office
ECU	Environmental Control Unit
EMED	Expeditionary Medical Facility
EoIP	Ethernet Over IP
FCSA	Future Comsatcom Services Acquisition
FMV	Full-Motion Video
FOC	Full Operational Capacity
FST	Forward Surgical Team
GBS	Global Broadcast Service
GCCSI3	Global Command and Control System—Integrated Imagery

	and Intelligence
HQ	Headquarters
HUMINT	Human Intelligence
IOC	Initial Operating Capability
IOC	Initial Operational Capability
IP	Internet Protocol
IPL	Imagery Product Library
ISAF	International Security Assistance Force
ISR	Intelligence, Surveillance, and Reconnaissance
ITAR	International Traffic in Arms Regulations
IVDS	Interactive Video Display System
JOA	Joint Operations Area
JRT	Joint Response Team
JTF	Joint Task Force
JSOTF	Joint Special Operations Task Force
LEM	Local Expansion Module
LOGCEN	Logistics Center
LSD	Large Screen Display
MA	Military Assistance
MCT	Mobile Communications Team
MECC	Mobile Expandable Container Configuration
MEF	Marine Expeditionary Force
MOU	Memorandum of Understanding
MTC	Modular Tentage System
NA5CRO	Non-Article 5 Crisis Response Operations
NAC	North Atlantic Council
NATC	Nevada Automotive Testing Center
NATO	North Atlantic Treaty Organization
NAVSOC	Navy Special Operations Command
NAVSPECWARCOM	Naval Special Warfare Command
NCS	NATO Command Structure
NDF	NATO Deployable Forces
NFS	NATO Force Structure
NMA	NATO Military Authorities
NRF	NATO Response Force
NSCC	NATO SOF Coordination Center
NSHQ	North Atlantic Treaty Organization Special Operations Headquarters
NSTEP	NATO SOF Training and Education Program
NSTI	NATO SOF Transformation Initiative
NSWC	Naval Special Warfare Center
NSWG	Naval Special Warfare Group

OEF	Operation Enduring Freedom
OIF	Operation Iraqi Freedom
OPCEN	Operations Center
OPCOM	Operational Command
OPCON	Operational Control
PE	Peacetime Establishment
PIR	Priority Intelligence Requirements
PoP-VTC	Post Office Protocol Video Teleconferencing
RBM	Receive Broadcast Manager
RLS	Real Life Support
ROC	Rated Operating Capacity
RT	Receive Terminal
RTOC	Rapid Tactical Operation Center
SACEUR	Supreme Allied Commander Europe
SATCOM	Satellite Communications
SBS	Satellite Broadcast Service
SCAMPI/DRSN	Secure Conferencing Access With Multicast Protocols for the Internet/Defense Red Switch Network
SCI	Sensitive Compartmented Information
SDN-H	SOF Deployable Node-Heavy
SDN-L	SOF Deployable Node-Lite
SDN-M	SOF Deployable Node-Medium
SHAPE	Supreme Headquarters Allied Powers Europe
SHARC	Specialized Helicopter and Aircraft Re-deployable Container
SICPS	Standard Integrated Command Post System
SIGCEN	Signals Center
SOATG	Special Operations Air Task Group
SOCC	Special Operations Component Command
SOCOM	Special Operations Command
SOF	Special Operations Forces
SOF FN	Special Operations Forces Fusion Node
SOI	Spec Ops, Inc.
SOIB	Special Operations Intelligence Branch
SOTG	Special Operations Task Group
SOTU	Special Operations Task Unit
SR	Special Reconnaissance
SSOO	SHAPE Special Operations Office
SUPACT	Support Activity
SUPCEN	Support Center
TACLAN	Tactical Local Area Network
TBM	Tactical Ballistic Missile
TIP	Target Intelligence Package

TOC	Tactical Operations Center
TMSS	Trailer Mounted Support System
TRECC	Tactical Re-deployable Expanding Container Capability
UPS	Uninterruptible Power Supply
UST	Utility Support Transport
USSOCOM	United States Special Operations Command
VDS	Video Display System
VDU	Video Distribution Unit
VGA	Video Graphics Array
VOIP	Voice Over Internet Protocol
WMD	Weapons of Mass Destruction

I. INTRODUCTION

This project was conducted at the request of the North Atlantic Treaty Organization (NATO) Special Operations Headquarters (NSHQ) to develop materiel options that would contribute to the creation of a rapidly deployable headquarter (HQ). The focus of this study is on the four Centers (CENs): Logistics Center (LOGCEN), Support Center (SUPCEN), Operations Center (OPCEN), All-Source Center (ASC), and Signal Center (SIGCEN).

NSHQ desired to have the rapidly deployable HQ solution come within $12 million. In this study we investigate options for all four CENs and make recommendations to the leadership of NSHQ based on requirement, capability, value, and durability. Leading up to our recommendations, we discuss the origin of NSHQ and how it has evolved into an operational command. This will help the reader understand the rationale and imperative for the desired rapidly deployable HQ. Additionally, we provide the background of NSHQ’s formation, structure, and doctrine to gain a better understanding of how NSHQ operates.

We also review what has been written about developing a rapidly deployable HQ before laying out the problem that NSHQ is seeking to solve. The core of this project revolves around the four CENs and, moreover, the requirements, the capabilities available, and the best equipment for each CEN to fulfill the mission. At the conclusion of this project, we make recommendations based on extensive research to effectively develop a rapidly deployable HQ.

A. ORIGIN OF THE NSHQ

The NSHQ is a concept that emerged from the NATO Special Operations Forces (SOF) Transformation Initiative (NSTI) approved by the North Atlantic Council (NAC) on November 22, 2006. There are currently 28 NATO member nations, and 26 of those possess SOF. The NSHQ initiative was intended to effectively orchestrate collective SOF employment by NATO member nations. Figure 1 displays the national flags and country names of all the nations that contribute to NSHQ.

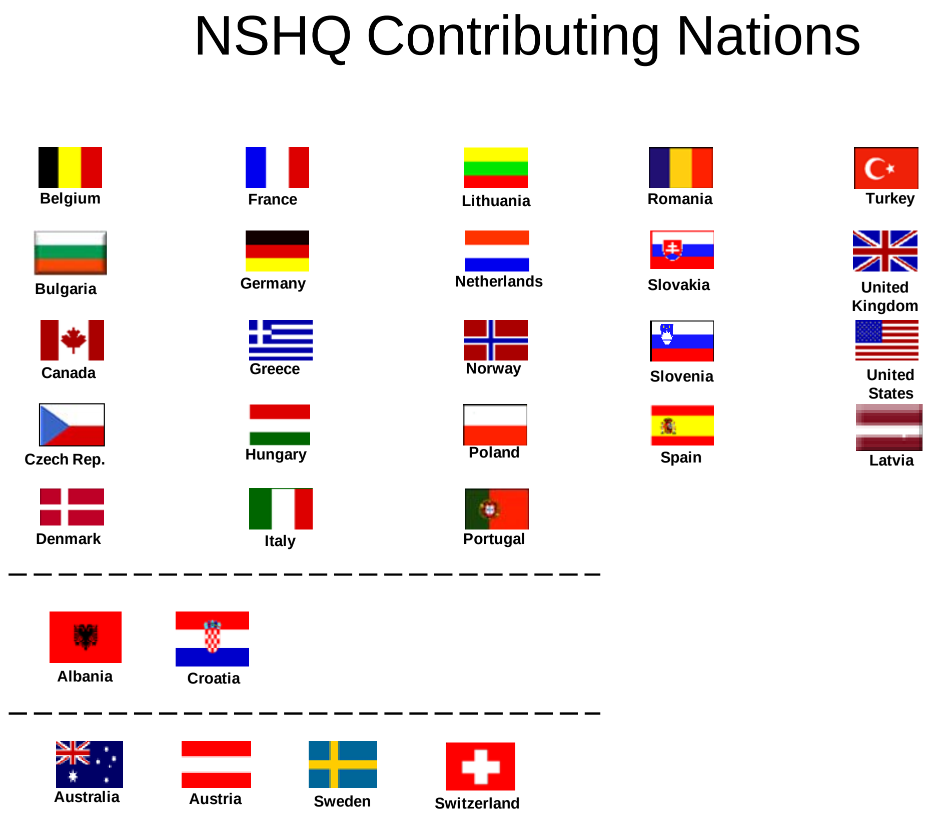

Figure 1. NSHQ Contributing Nations
(NSHQ Unpublished Brief, 2011)

Note. The dotted lines are nations newly joining NSHQ or expressing their intent to increase or reallocate personnel from ongoing NATO reorganization.

Historically, NATO SOF groups have been employed individually by each member nation. Operations in the Balkans, security during the 2004 Olympic Games in Athens, and the initial offensive in Afghanistan are all examples of NATO SOF employment. Although allied SOF have maintained contact with one another and have conducted training exercises together over the years, these interactions have been intermittent and on an ad hoc basis.

B. RATIONALE AND IMPERATIVE FOR THE DEPLOYABLE HQ

Launched in 2006, NSTI was the first move toward rectifying historical deficiencies associated with the employment of NATO SOF in multinational efforts. The NSHQ's *Biennial Review* (NSHQ, 2011, p. 6) has a timeline that describes the steps and stages that culminated with the formation of NSHQ. NATO held the Riga Summit on November 28–29, 2006. Attendees of this summit focused on the transformation of NATO. An article on the Riga NATO Summit website (NATO, 2006) quoted President Bush as stating that NATO was in transition from a static force to an expeditionary force and that NATO's SOF initiative was one of the key things on the table at the summit. At the Riga Summit, heads of state and governments endorsed NSTI (NSHQ, 2010b, p. 6).

Today, SOF fill a far more significant role than they did in the environment for which the original NATO military structure was designed. NATO's current SOF staff structure, despite having made important contributions, is inadequately located, resourced, and connected in order to accomplish the necessary strategic groundwork that today's environment demands. The challenge today is to coordinate strategic SOF solutions based on standardized and validated capabilities.

NATO addressed this challenge with three recommendations:

1. Reposition the Directorate of Special Operations Office (DSOO) on the special staff of the Supreme Allied Commander Europe (SACEUR). The intention of NATO was to position SOF to deliver special operations-related advice and assistance directly into the strategic level at the Allied Command Operations (ACO).
2. Create the NATO SOF Coordination Centre (NSCC). Later, on September 25, 2009, the NAC directed the NSCC to reorganize into NSHQ.
3. Develop a NATO SOF Training and Education Program (NSTEP). This effort is focused on NATO SOF-specific training and education intended to enhance commonality in doctrine, procedures, and (in some cases) equipment among allied SOF. (NSHQ, 2010)

C. THE MISSION AND VISION OF NATO SPECIAL OPERATIONS HEADQUARTERS

The mission of NSHQ is to serve as "the primary point of development, direction and coordination for all NATO Special Operations related activities to optimize the employment of SOF, to include providing an operational command capability when directed by the Supreme Allied Commander Europe (SACEUR)" (NSHQ, 2009). The objective is for NSHQ to enhance the probability of collaborative success when allied SOF assets operate in a combined manner. Adding an "operational command capability" in the mission includes an operational command and control role through provision of the "core" for an organic, rapidly deployable SOCC when directed by the SACEUR.

According to its NATO International Military Body status, NSHQ can be tasked to support different elements of NATO and other national entities by deploying tailored planning and liaison teams. The vision of NSHQ is to be the alliance SOF proponent for NATO SOF policy, standards, doctrine, training, education, and assessments. In this position, NSHQ maintains and develops a robust operational command, control, communications, computers, and intelligence (C4I) capability, equipped with organic SOF enablers to ensure interoperability and to enhance employment of NATO Special Operations (NSHQ, 2010).

D. LEADERSHIP AND STRUCTURE OF NSHQ

As a member of SACEUR special staff, the NSHQ director provides advice on special operations. In this essential function, NSHQ enables and supports NATO SOF throughout the alliance and provides the focal point for NATO Special Operations expertise to SACEUR and ACO. (NSHQ, 2010a)

NSHQ is a NATO organization that receives personnel from NATO member nations through a memorandum of understanding (MOU). Member nations apply for and offer personnel based on the size and maturity of their SOF. An NSHQ SOC CORE Concept Brief (NSHQ unpublished brief, 2010) detailed the current manning of 149 positions, which indicated it is at its initial operating capability (IOC). NATO's goal is to have growth in three phases. Phase one is the IOC. Phase two includes a deployable HQ element of approximately 70 personnel, a slated personnel level of 188, and a 2012 implementation date. Phase three includes multiple deployable HQ elements, a desired personnel level of 214, and a 2013 implementation date.

Figure 2 is a diagram of the current NSHQ command structure. This flat organization not only emphasizes but also requires decentralized decision-making of subordinate departments under a centralized command and control (C2) element. This structure will be duplicated with the deployable HQ element NSHQ and will supply to future contingency operations.

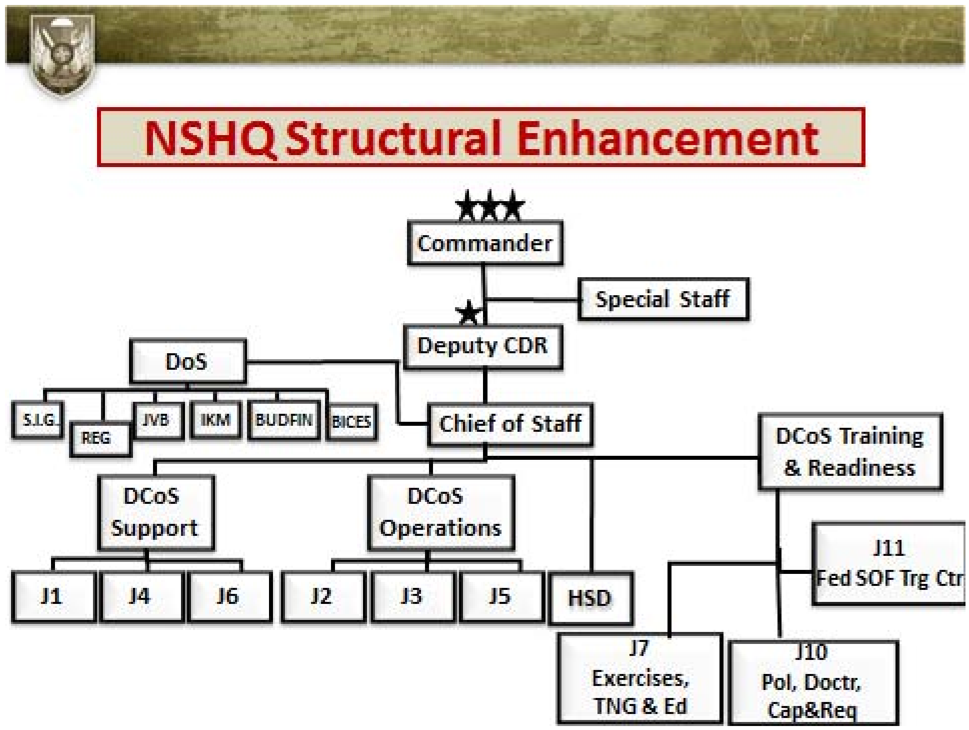

Figure 2. NSHQ Organizational Chart
(NSHQ Unpublished Brief, 2011)

1. NATO and NSHQ Supporting Documents

In the document *Final Decision on MC 324/2: The NATO Military Command Structure* (NATO, 2010b), NATO lists critical success factors for the alliance. One of the most important to our study is how NATO military operations rely on communication and information system infrastructure for effective command and control (NATO, 2010b). NATO alliance nations must be committed to resource the HQs, and host nations with available capacity must assist NATO while it is operating in their territory.

NSHQ is a new and evolving organization, which was instructed to develop a rapidly deployable HQ. NSHQ receives its authority from the document *Draft MC Policy for Allied Forces and Their Use for Operations* (NATO, 2011). In this document, NATO Military Authorities (NMA) agreed to the NATO Deployable Forces (NDF) concepts.

In the Background section of the *Draft MC Policy* (NATO, 2011), NATO states,

> This policy is a single overarching concept, eliminating redundancy, and integrates new deployable operational C2 structures (notably NSHQ)

> agreed through the Peacetime Establishment (PE) Review of the NATO Military Command Structure [NCS]. NCS provides NATO with the capability to conduct both Article 5 and Non-Article 5 Crisis Response Operations (NA5CRO). (p. 3)

Later in the document, NATO addresses the key elements necessary for a force to be considered deployable: "For a HQ or a unit to be 'declared ready', it is to be manned, trained and equipped to the necessary predefined and agreed standards, laid down by SACEUR, which will be identified in the ACO Force Standards (AFS)" (NATO, 2011).

In this document, NATO also addresses SOF, specifically with a paragraph in the NATO Force Structure (NFS) section that breaks down SOF elements:

> SOF offer specific capabilities which are heavily reliant upon a wide range of enablers. Nations are expected to provide SOF with their full suite of organic enablers and Combat Support and Combat Service Support units. A Special Operations Component Command (SOCC) must in principle be generated for every operation involving the employment of SOF. A SOCC is formed around NSHQ or a SOF framework nation and is structured for each operation according to the number of Special Operations Task Groups (SOTGs) assigned and the degree of C2 required. (NATO, 2011)

The SOF policy with which NSHQ must operate is dictated in the *3rd Draft MC 0437/2 Special Operations Policy* (NATO, 2010a). This document includes a list of the items differentiating SOF from conventional forces:

> Politico-military considerations may require discreet or covert techniques and the acceptance of a degree of political, military, or physical risk not associated with conventional operations. SOF are strategic assets to be employed to help achieve strategic and specified operational-level objectives. They differ from other joint forces principally through their unique capabilities, agility, and flexibility. SOF are commanded through a SOCC usually under an operational-level HQ alongside land, air, or maritime forces. In a burgeoning crisis SOF may establish an early forward presence in order to initiate military and civilian liaisons, conduct area assessments, provide an early command and control capability, or advise friendly forces. SOF provide NATO with increased understanding of a developing crisis and, if required, help set the conditions for the initial entry of joint forces. (p. 3)

The draft policy also lists the three principal tasks of NATO SOF (see Table 1): military assistance (MA), special reconnaissance (SR), and direct action (DA).

Table 1. NATO SOF Principal Tasks

Military Assistance (MA)	Surveillance & Reconnaissance (SR)	Direct Action (DA)
Working by with and through Host Nation forces; provide advising, training and mentorship.	Personnel on the ground clandestinely providing "Eyes On" Intelligence.	Fast, Violent, Assault Operation with follow on exploitation of target.

The NATO document continues:

> MA is a broad range of activities that support and influence critical friendly assets through training, advising, mentoring, or the conduct of combined operations. The range of MA is thus considerable, and includes, but is not limited to, capability building of friendly security forces; engagement with local, regional, and national leadership or organizations; and civic actions supporting and influencing the local population. (NATO, 2010a)

Military assistance is important in building lasting relationships that benefit all involved nations in ways that cannot be quantified, as these relationships will enable NSHQ to operate more effectively through an enhanced collaborative network (NATO, 2010a).

The next NATO SOF and in turn NSHQ principal task is SR.

> SR is an activity conducted by SOF to support the collection of a commander's Priority Intelligence Requirements (PIR) by employing unique capabilities. These activities may vary widely, from traditional "eyes on target" surveillance in high risk environments to other actions that may include, but are not limited to: human intelligence (HUMINT) collection, close target reconnaissance, or the employment of Intelligence, Surveillance, and Reconnaissance (ISR) assets. (NATO, 2010a)

Surveillance and reconnaissance are two key methods to be used by the SOCC Core commander to gain essential intelligence generated from his own personnel on the ground. It is risky, because a compromise in the field could put future missions at risk and provide a warning to those being watched (NATO, 2010a).

DA is the third of the three principal tasks to be conducted by NSHQ. A definition of DA taken from the NATO SOF policy document:

> DA is a precise offensive operation conducted by SOF which is limited in scope and duration in order to seize, destroy, disrupt, capture, exploit, recover, or damage high value or high payoff targets. DA differs from conventional offensive actions in the level of risk, techniques employed, and the degree of precision utilized to achieve a specific effect. (NATO, 2010a)

Direct action missions are violent, aggressive, and surgical strikes conducted at great risk to the operators. Successful operations have the ability to yield an abundance of intelligence and generate strategic effects.

The SOCC has operational control (OPCON) of each individual nation's SOF SOTG. Individual alliance nations never relinquish full command of their forces. Because there is no standing SOCC, an SOCC must be generated for each operation in which the SACEUR and the NATO Security Council approves NATO involvement. NATO (2010a) defines an SOCC as "a multi-national or national command formed around a SOF Framework Nation and … structured for each operation according to the number of SOTGs assigned and the degree of C2 required" (p. 4). With the SOCC defined, the unit will not be considered deployable until it achieves full operational capacity. According to NATO (2010a), "At full operational capacity, NSHQ can provide a rapidly deployable initial core of an operational SOCC. This capability does not replace the requirement of a SOF Framework Nation but does serve as a requisite enhancement to SOF force generation" (p. 5).

There are two key responsibilities of NSHQ. The first responsibility is to "provide NATO SOF expertise and enablers while retaining an organic command, control, communications, computers and intelligence (C4I) capability in the support and employment of SOF in NATO operations" (NATO, 2010a). The other key responsibility of NSHQ is to provide an initial core of an operational SOCC upon the direction of the SACEUR (NATO, 2010a). The key responsibility of NATO SOF contributing nations is to supply the full suite of enablers, combat support (CS), and combat service support (CSS) elements that their SOF troops rely on. When an SOF troop is provided to NATO, and subsequently to an SOCC in a joint operations area (JOA), it must be fully enabled organically (NATO, 2010a).

E. STRATEGIC ENVIRONMENT IN WHICH NSHQ WILL OPERATE

The strategic environment in which NSHQ operates is a constantly changing and evolving environment. There are known flashpoints and areas of unrest throughout the world. NATO and NSHQ are in a constant cycle of gathering intelligence and making operational preparations in an effort to impact these areas for the greater good of mankind (and, in turn, NATO alliance nations). NSHQ's flexibility, agility, capability, training, and skills give it an advantage in responding to situations for which there could be no prior preparation. Through an exhaustive, thorough, and detailed intelligence analysis, NATO attempts to be preemptive in its analysis of all the things that could possibly happen. A part of its analysis is identifying indicators. Once these indicators are identified, it is up to NATO and its vast intelligence network to monitor them (NATO, 2010a).

Key worldwide indicators are addressed and analyzed in the classified NATO secret document *NATO Strategic Intelligence Estimate: Final Decision on MC 0161/NSIE/10* (NSHQ, 2010b). The document breaks down identifying indicators into three sections: transnational trends and emerging technologies (terrorism, cyber-threats, etc.), geopolitical environment (regional trouble spots that may include Sub-Saharan Africa, etc.), and transnational assessments. Transnational assessments may include the proliferation of weapons of mass destruction (WMD), and environmental and resource issues of special interest. Geopolitical assessments are then conducted on each worldwide region with indicators of potential crisis (NSHQ, 2010a).

The purpose of Chapter I was to illustrate how quick NSHQ has evolved. NSHQ's roots began with few motivated individuals acting as a liaison between the different nations' SOF commands. NSHQ has come a long way in a short amount of time. Adding operation command capability and developing a C4I infrastructure is the next milestone for NSHQ. This achievement will further increase their success while operating in a complex environment. In Chapter II, we discuss, in greater detail, the background of NSHQ's evolution.

II. BACKGROUND

In Chapter I, we provided an introduction to NATO Special Operations; in this chapter, we provide some background into the formation of NSHQ. In 1980, a failed mission to rescue U.S. hostages held by terrorists in Iran (Operation Eagle Claw) displayed how ineffective U.S. Special Forces were when they used ad hoc command and control with units brought together quickly to execute high-profile, high-risk missions. These units did not have a habitual relationship in a training or real-world environment. In 1987, the U.S. military rectified this shortfall by forming the United States Special Operations Command (USSOCOM).

NATO did not require an operational failure on the world stage to goad it into addressing the need to change the manner in which its SOF were employed. From 1991 to 2006, Norway, the United Kingdom, France, Germany, the Netherlands, Canada, and Italy followed suit by forming national SOF organizations (NSCC, 2008). On November 29, 2006, at the NATO Riga Summit, the heads of state and government officials of NATO member nations approved the NATO SOF Transformation Initiative (NSTI).

A. THE FORMATION OF NATO SPECIAL OPERATIONS HEADQUARTERS

In September 2006, the North Atlantic Military Committee (NSHQ, 2006) published *NATO Special Operations Forces (SOF) Transformation Initiative (NSTI) Advice*, a document in which the committee recommended three elements as the foundation for NATO SOF's transformation. The first element was enhancing staff capacity at Supreme Headquarters Allied Powers Europe (SHAPE) by creating the SHAPE Special Operations Office (SSOO); the second element was establishing a NATO SOF Coordination Center (NSCC); and the third element was developing a NATO Federation of SOF Training Centers.

With these three elements, NATO SOF went from a fusion center to a coordination center. The role of the SSOO was to provide the SACEUR with resident strategic-level special operations advice in order to direct and enable the employment of alliance SOF (NSHQ, 2006). The SACEUR made requests for NATO SOF through the SSOO, which passed these requests to the NSCC. The role of the NSCC was to provide the SACEUR with special operations expertise for strategic and operational planning to include the conduct of operations. The director of the NSCC was responsible for providing flag officer advice to the SACEUR. The NSCC coordinated the efforts of NATO SOF in the conduct of operations and missions (NSHQ, 2006). A diagram of the NSCC's structure is shown in Figure 3.

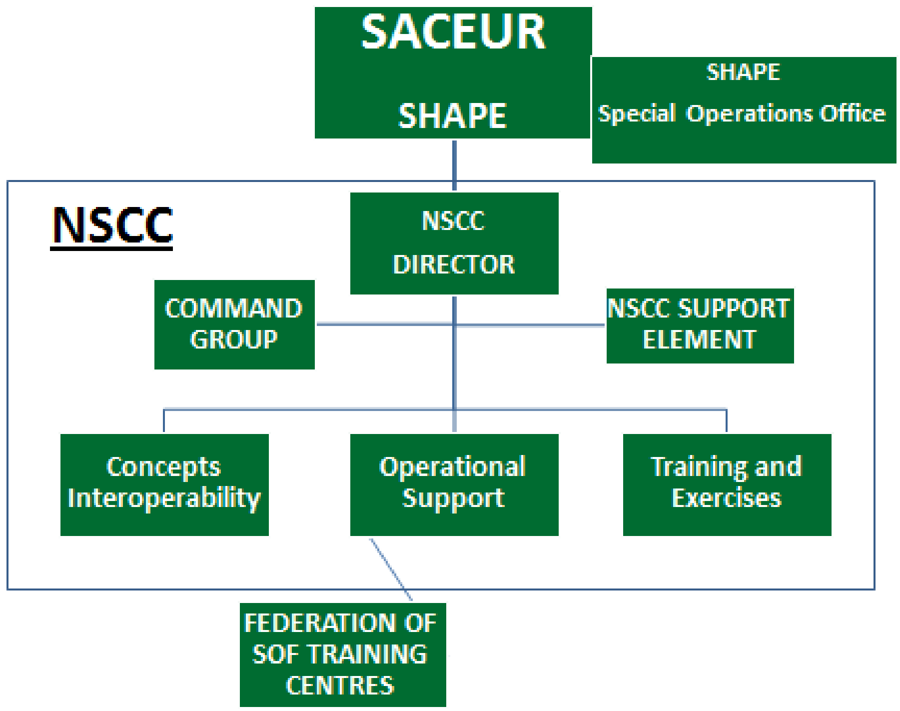

Figure 3. NSCC Structure
(NSHQ, 2006)

The U.S. became the framework nation for the NSCC. With framework nation status, the U.S. agreed to provide funds to establish the center and to supply 30% of the personnel. Each NATO nation with a mature SOF provided as few as two qualified SOF personnel on three-year tours to support the coordination center. The NSHQ's 2011 *Biennial Review* timeline states that the NSCC started as a 23-man implementation team in Stuttgart, Germany (NSHQ, 2011). By February 2007, the NSCC director led a NATO senior SOF leader assessment to Afghanistan, after which the NSCC began supporting the International Security Assistance Force (ISAF) in Afghanistan. In July 2007, the NSCC was relocated to SHAPE in Mons, Belgium. Between August 2008 and May 2009, the NSCC went from initial operational capability (IOC; approximately 56 personnel) to full operational capacity (FOC; approximately 150 personnel), as directed in the NSTI guidance (NSHQ, 2011).

In reaching IOC, the NSCC established a facility with a NATO communications information system capable of supporting the staff with synchronization and planning for SOF operations. From its inception, the NSCC has been in the process of rebuilding and redesigning NATO SOF doctrine. It also provided support to NATO military exercises. This is only a sample of an abundant list of accomplishments the NSCC achieved to reach FOC. Reaching FOC was quite an accomplishment for a command that started with one person: Rear Admiral William H. McRaven. It was under Rear Admiral McRaven that the NSCC blossomed from a 23-man implementation team into an organization with FOC and over 100 personnel (NSHQ, 2011).

In September 2009, the NAC authorized the reorganization of the NSCC into NSHQ. By March of 2010, the NSCC had transitioned into NSHQ (NSHQ, 2011). With the reorganization of the NSCC into NSHQ, NATO SOF took another step to reaching prominence in the worldwide arena of special operations. NATO SOF was set up to operate as the command and control element of NATO special operations missions. It is this role and its eventual accomplishment that is the focus of NSHQ.

B. THE MAKE-UP OF NATO SPECIAL OPERATIONS HEADQUARTERS

Seven NATO nations currently possess mature and highly trained SOF personnel who are properly equipped with individual member nation HQ command and control capabilities. These member nations lead the forward-deployed SOCC in a command and control role. These nations are the U.S., the United Kingdom, France, Spain, Italy, Turkey, and Germany. A possible eighth nation, Poland, is working to achieve this level of expertise in both tactics and strategy.

NSHQ is an MOU organization with NATO. It is also a separate organization within NATO. As part of this understanding, each nation is primarily responsible to fulfill its duties within NATO. Additionally, all the nations have agreed to support NSHQ without causing degradation in their NATO responsibilities. An example of fulfilling this agreement can be seen in the personnel that are supplied to NSHQ from individual NATO member nations. These personnel are in addition to any supplied to NATO. Within the MOU, NSHQ member nations have agreed to supply assets to lift and transport personnel and equipment in response to a crisis or operation in which NSHQ participates. This agreement exists because NATO itself does not possess strategic lift assets. NSHQ is also responsible for its own sustainment and the generation of forces (through NSHQ member nations).

NSHQ is currently manned at approximately 150 personnel with a goal of reaching 200 or more personnel to achieve FOC. These 200 personnel will man and supply a forward-deployed HQ element in support of NSHQ/NATO SOF operations. The U.S. is the framework nation of NSHQ; with this status comes a great responsibility. The U.S. is responsible for supplying 40% of the personnel for NSHQ, whereas it used to supply 30% when it was the NSCC. The U.S. has also agreed to provide all funding for the initial purchase of equipment to support forward-deployed operations with NSHQ as an SOCC Core element. The costs of this initial purchase are expected to exceed $10 million.

NATO member nations will supply NSHQ with the following elements to support its command and control capacity. SOTGs will be supplied by NATO member nations that are SOF capable. SOTGs will initially only be given from the seven NATO member nations with mature SOFs listed previously in this section. NSHQ's training element will increase the capabilities of the other SOF-possessing NATO member nations to a level that will enable them to support NATO SOF operations with their own SOTGs. The make-up of SOTGs will differ depending on the organization of each SOF-possessing NATO member nation. Each SOTG will be manned by 75–80 personnel and will have its own HQ element in direct communication with the SOCC Core element. Within each SOTG, there will be up to six Special Operations Task Units (SOTUs). Each SOTU will have between eight and 16 SOF-qualified operators or SOF-designated support personnel (e.g., K-9 handlers, translators, etc.). In a briefing we received from the NSHQ, Figure 4 diagrams some of the elements of an SOCC with its core functions/departments.

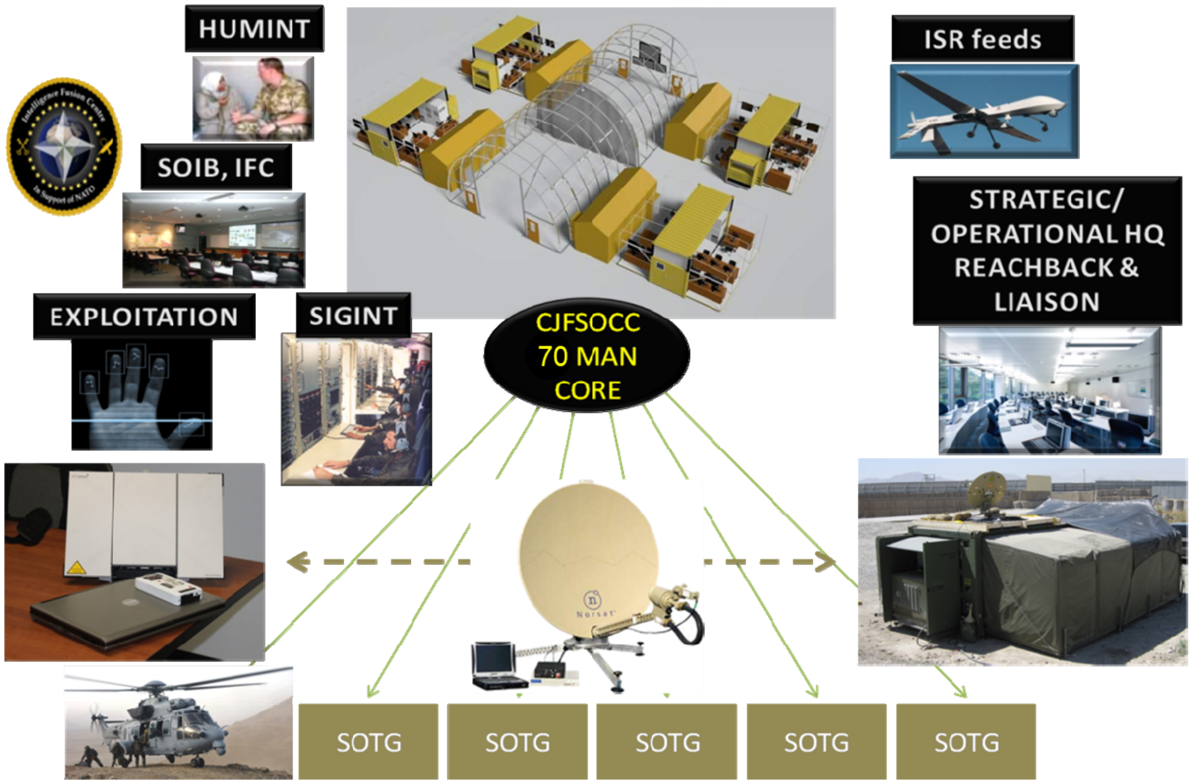

Figure 4. SOCC Diagram
(Unpublished NSHQ Brief, 2011)

Note: HUMINT = Human Intelligence
ISR = Intelligence, Surveillance, and Reconnaissance
SOIB = Special Operations Intelligence Branch
IFC = Intelligence Fusion Center
CJFSOCC = Combined Joint Force Special Operations Component Command
SOTG = Special Operations Task Group

The purpose of Chapter II was to discuss in detail NSHQ's background—how it was formed and how it was structured. In Chapter III, we review what has been written about rapidly deployable HQ.

III. LITERATURE REVIEW

Very little literature has been written about rapidly deployable HQ for military units. The literature that does exist fails to describe the layout of the HQ once deployed or the inventory of equipment used to support critical functions, such as communications and life support. The existing literature that is vaguely related to our study is focused on joint operations and the issues and concerns that are raised not only when operating jointly as a multinational military force, but also when different branches operate jointly.

Colonel Scott Schisser from the Institute for Defense Analysis discussed the shortfalls of joint task force (JTF) HQ in a 2001 paper entitled *Future Joint Force Headquarters*. Even though his paper was written in 2001, he identified challenges that are still prevalent in joint operations today. Schisser described how JTF HQ was unprepared and insufficient to meet command and control challenges. Throughout his research, Schisser (2001) found that "regardless of the scale or scope ... a common theme has been command control of joint forces" (p. 1). Lack of command and control significantly affects the success and efficiency of the deployable joint task force (DJTF). Schisser also concluded that the joint response teams (JRTs) should be redesigned to effectively offer DJTFs with the tools and means to increase their self-sufficiency in the field; furthermore, JRTs must stay informed to make quick and appropriate decisions. The future of the DJTF should include cost-effective designs and products that enhance the operational level of deployable task forces. Products need to be quick to set up and take down, efficient, and convenient for operations and personnel; overall, they must be assets to the operations, missions, and desired outcomes.

Colonel Mike McGinnis (2004) published a report about the development of a deployable HQ for the NATO Response Force (NRF). In his report, McGinnis (2004) identified many of the challenges that the JTF HQ faced in Operation Stavanger. As NATO moves forward in the development of multinational joint rapidly deployable HQ, leaders will need to preemptively emplace appropriate measures to avoid issues deriving from the challenges that McGinnis (2004) articulated:

- Varying language skills: NATO staffs have limited English language skills.
- Disparity in military experience: In a multinational HQ, rank alone is no guarantee that an individual assigned to a position possesses the requisite education and experience to do the job.
- National caveats: NATO operations require significant consensus building. All NATO nations must be in general agreement on the scope of military operations before the NAC will issue an activation order to take military action. Even after such an order is issued, nations may decline to conduct specific operations invoking national caveats. Claiming national caveats or other restrictions, individuals assigned to a NATO multinational HQ may elect to forego exercises and operations.
- Intelligence sharing, computers, and information systems: Successful operations depend on shared intelligence, good communications, and interoperable computer and information systems across echelons' HQ. Working in a multinational environment creates complex problems: deciding what intelligence can be shared, communicating with different equipment, and operating on systems that are not compatible with one another. NATO has not yet resourced a full suite of interoperable communications, information systems, and infrastructure for conducting such operations.

McGinnis (2004) emphasizes implementation of proper intelligence sharing practices, computers, and information equipment in a multinational environment; moreover, this equipment not only needs to be compatible at the HQ level and above, but also needs to be operable among all the units under the HQ's command. Given the national caveats, clear communications on all levels help ensure that status and intent is exchanged; clear communications increase the success of proper decision-making. Within this equipment, further advanced language interpretation tools could be utilized to help mitigate the complications that arise from language barriers. While training will allow the operators to gain knowledge and experience, uncomplicated equipment helps address the issues related to disparity in experience. Communications that allow the HQ and units the capability of reaching back to their home commands for information further alleviate the problems that arise from inexperience.

A solid communications infrastructure is essential for successful command and control. The *Joint Staff Officer's Guide*, JFSC PUB 1 (LaFountaine, 2000), states the following:

> Command and Control functions are performed through an arrangement of personnel, equipment, communications, facilities, and procedures employed by a commander in planning, directing, coordinating, and controlling forces and operations in the accomplishment of the mission. (p. 3-52).

McGinnis (2004) discusses the consequences of not having good command and control. In many cases, organizations that did not have effective command and control proved to be costly—not just monetarily, but in terms of lives lost. A good example of what can go wrong without proper command and control, from the top level to the lowest level, is Operation Eagle Claw (Radvanyi, 2002). Operation Eagle Claw, a U.S. joint military operation, failed to rescue U.S. hostages being held captive at the U.S. Embassy in Tehran, Iran, on April 24, 1980. In an investigation of Operation Eagle Claw, Admiral James L. Holloway and his investigative panel found that command and control was excellent at the upper echelons but became more tenuous and fragile at the intermediate levels due to the interoperability of communication equipment used among the different services (Kyle, 1990). Command relationships below the commander of the JTF were not clearly emphasized. When compounded with the lack of compatible communications equipment, these relationships were misunderstood under pressure. Lessons learned from Operation Eagle Claw revealed the significance of ensuring that all levels of a joint task force have the tools and training necessary to perform the mission; moreover, effective command and control at all levels is critical for any military operation. As McGinnis points out, command and control is more challenging for a multination joint task force to establish. Implementation of a solid communications infrastructure with compatible and interoperable equipment would help build the foundation for good command and control.

Both Schisser (2001) and McGinnis (2004) consistently discussed communication as being one of the most important aspects of command and control. For NATO organizations, communication is more difficult. English is the spoken language at NATO; however, English is a second language for most NATO operators. The language barrier can create problems and make communication extremely difficult. Technologies, such as virtual communications, are being utilized by NATO to help overcome the language barrier because they give individuals an opportunity to see facial and body expressions while hearing a fellow operator's voice.

In other joint operation cases, the use of different communication equipment was also a problem. For example, in the 1983 U.S.-led invasion of Grenada, Operation Fury, the coalition of forces had problems communicating. It was later documented that the problems were attributed to the different services operating with dissimilar types of communication equipment; the different types of communication equipment were not compatible from Service to Service. Navy ships, within line of sight of rangers and airborne troops, could not initially receive or respond to their requests for fire support. On two occasions, when Navy jets did respond, they attacked the wrong targets (Cole, 1983). Many of the member nations at NATO communicate with different equipment. Lessons learned from Operation Fury serve as evidence for the importance of standardizing communication equipment in joint operations to ensure compatibility—this is absolutely vital for multinational units to operate jointly.

The articles reviewed in this chapter show how important it is to have a robust command and control center to operate successfully in today's battlefield. At the forefront of the command and control issue is the ability to communicate effectively both up and down the chain of command. With the new technologies available to today's war fighter from both military and commercial sources, the communication challenges observed in the previous cases can be mitigated and eliminated.

The purpose of Chapter III was to analyze what has been written about rapidly deployable HQ. After our literature review, we can conclude that as NATO moves forward in conducting multinational joint operations, it is imperative that compatible and interoperable equipment, along with modern technologies, are being utilized to ensure the good command and control that is necessary for missions to succeed. In Chapter IV, we will begin laying out the problem that will be solved by the development of a rapidly deployable HQ at NSHQ.

IV. THE PROBLEM TO BE SOLVED BY THE DEVELOPMENT OF A SOCC CORE

Chapter IV focuses on establishing the problem that will be solved with the development of a Rapidly Deployable Special Operations Component Command (SOCC) Core Concept for the NSHQ. We conducted research and analysis to examine and determine the equipment and deployment configurations that will fulfill the mission requirements of the SOCC Core. In addition, we analyzed alternatives to determine which equipment types and configurations result in achieving the desired mission capability at the lowest possible cost.

The NATO Special Operations Headquarters Framework Nation Primer states the mission of NSHQ:

> The mission of NSHQ is to serve as the primary point of development, direction and coordination for all NATO Special Operations related activities in order to optimize the employment of SOF. Optimization is the intent to make SOF as effective, efficient, and perfect as possible to enhance the probability of collaborative success when these national assets come together to operate in a combined manner. The addition of a directing function in the mission includes an operational command and control role through provision of the core for a deployable Special Operations Component Command when directed by SACEUR. (NSHQ, 2009)

The addition of an operational command capability in the mission includes an operational command and control role through provision of the "core," which is an advanced party of 70–150 personnel, for an organic, rapidly deployable SOCC when directed by the SACEUR. The NSHQ does not currently have the ability to provide NATO with a rapidly deployable asset package, which would include robust operational command, control, communication, computers, and intelligence (C4I) capabilities, equipped with organic special operations forces (SOF) enablers. Possessing a rapidly deployable SOCC Core would be a sound step toward establishing and ensuring interoperability among allied SOF units and commands, and enhance the employment of NATO special operations forces.

The United States is the framework nation of NSHQ. With this position, the United States has the responsibility to provide 100% of the initial funding and support for the SOCC Core concept. This includes the initial issue of equipment required for a rapidly deployable HQ element. Once the initial issue of equipment is purchased and begins to be fielded, all 28 NATO member nations will share in the sustainment, operational, and maintenance costs of the SOCC Core.

In the NSHQ *Biennial Review*, in a section titled "Deployable CJSOCC Core," there is an explanation for this rapidly deployable concept:

> Currently, unlike NATO's Land, Maritime and Air capabilities within the military structure, the Alliance has no assured, deployable capability to provide C2 for NATO SOF. By capitalizing on the personnel currently assigned to the NSHQ, an opportunity exists for the proposed NSHQ to realize a more cost-effective use of personnel, without growing NATO's Peacetime Establishment (PE), while enhancing SACEUR's crisis response options, through the provision of a CJFSOCC [Combined Joint Force Special Operations Component Command] (Core) element. During peacetime or crisis, the NSHQ may be directed by SACEUR to assign the CJFSOCC (Core) to any NATO Command Structure (NCS) headquarters for CJTF operations and/or exercises. This CJFSOCC (Core), when deployed for NATO approved operations, would continue to be under operational command (OPCOM) to SACEUR, and under operational control (OPCON) to the operational commander; the CJFSOCC would exercise OPCON of assigned forces. This Core element relies on troop contributing nations to provide augmentees in accordance with standard NATO processes to transition the CJFSOCC from a short term to an enduring capability. (NSHQ, 2011)

There are currently seven nations that are trained and equipped to field a deployable HQ or SOCC. This means that they possess the operational SOF experience and knowledge to control SOF operational elements for employment purposes. They also possess limited issue communications equipment that could be used to control and oversee those operations. Those seven nations are the United States, the United Kingdom, France, Spain, Italy, Germany, and Turkey. Turkey may not be considered capable or willing to provide SOCC Core capabilities past 2011. Poland is attempting to become the eighth nation that is SOCC capable. Being SOCC capable does not mean that a country is a designated SOCC HQ. This just means that the country is capable of running the SOCC Core once the equipment is purchased for it (NSHQ, 2010).

In a SACEUR-signed document called the Bi-Strategic Command, there was an agreement and requirement to have 19 SOCC-capable countries. With only seven currently capable, this has created a gap of 12 countries desperately needed by NATO and NSHQ to be SOCC capable (NSHQ, 2010). More nations that are SOCC capable would mean more HQs that could be fielded by NSHQ on behalf of NATO. There are currently 29 situations, or possible contingencies, that NATO would respond to. Out of the 29, the NRF would respond to only seven. This leaves a gap of 22 possible worldwide contingency situations to which NSHQ could respond (NSHQ, 2010).

The NATO strategy MC 400/2 basically states that NATO will not specifically dictate how each country conducts SOF missions, but that each country should be capable of meeting seven key requirements. The requirements are force readiness, infrastructure that is able to operate an effective command and control element, an effective intelligence system, effectiveness in engagement, the ability to sustain organic logistics, the ability to be deployable and mobile, and survivability for the environment in which they are operating. These are the key requirements, but they are basic standards from the perspective of operating a SOCC Core (North Atlantic Military Committee, 2000).

NSHQ is a multinational organization of 27 countries. Having this many countries in an organization requires set standards for the equipment used in an operation, to ensure compatibility and interoperability. Although requiring each country to meet these standards is a major challenge, it is essential to the effective operation of a SOCC Core.

The SOCC Core is an advance party of 70 to 150 personnel. This is a rapidly deployable HQ that is organic to NSHQ and should be capable of overseeing command and control of six SOTGs and one Special Operations Air Task Group (SOATG). It should be capable of deploying in less than 14 days. It should also be capable of traveling by sea, air, or land. All the equipment of the SOCC Core must be transportable by CH-47 helicopters.

The environment in which the SOCC Core will operate is ever-changing; thus, the camp of the SOCC Core must be flexible and versatile. The camp must also be capable of supporting the three principal tasks of NSHQ and NATO SOF: direct action (DA), special reconnaissance (SR), and military assistance (MA). NSHQ and the SOCC Core, when fully operational and capable, could be tasked with conducting these three core tasks anywhere in the world and in any environment or climate.

The varieties of climatic conditions this camp may encounter make it necessary for the camp to meet NATO-directed guidelines, which are addressed in Chapter V. In terms of the environment, the camp must be capable of sustaining the force when operating in the following threat conditions: hostile, uncertain, and benign. These conditions encompass the wide spectrum of possible operations and environments—from a full-blown, mature warzone to a third world, underdeveloped country with little threat to the force. The SOCC Core camp must also be capable of having itself transported via C-130 from Belgium to the operating area, then transported via CH-47 for the last leg to the operational staging point for the SOCC Core.

The four sections into which the camp will be broken down are the Operations Center (OPCEN), All-Source Center (ASC; intelligence fusion node), Support Center (SUPCEN; provides Real Life Support [RLS]), and the Signals Center (SIGCEN, communications). The four sub-components will provide the needed versatility and flexibility for NSHQ to pick and choose from its parts and pieces to develop capability-based packages for each of the three SOF tasks/core missions.

The three options for the camp that the thesis team is choosing among are (1) commercial off-the-shelf (COTS) equipment, (2) items from a military logistics/supply system, or (3) a hybrid of these two options. The thesis team will specify which equipment should come from each source of supply. Structural options for the camp that are available are hard container structures, which are currently being fielded by NSHQ; soft container structures, which are currently being fielded by Special Operations Command (SOCOM); and cheap soft structures that NSHQ could leave behind after a mission (foam structures). Another option is for a camp to use a combination of hard and soft structures. NSHQ could also deploy to an area with existing structures and buildings; this may include a shipboard option, which would place the SOCC Core on a ship with its containers. All of the equipment has to be lightweight and air portable.

The NATO Special Operations Forces Study (NSSC, 2008) describes the major requirements of a NATO CJFSOCC, which is essentially a SOCC Core:

> The CJFSOCC headquarters has a combined and joint staff structure normally formed around a Special Operations Forces Fusion Node (SOF FN) nucleus providing, as a minimum, the commander, key staff personnel, base life support capabilities, and the command, control, communications, computers and intelligence (C4I) structure for operational control (OPCON) of all SOF in a designated theatre of operations. The CJFSOCC normally controls between two and six JSOTFs, SOTGs and /or SOATGs. Forces may also include conventional force under OPCON of the CJFSOCC. (pp. C4–C5)

Then there is a list of criteria for the CJFSOCC. It must be able to conduct NATO J1-J8 functions, advanced crisis response, time sensitive planning, and theatre-level campaign planning. It must be able to plan, coordinate, and direct special operations separately or as part of a larger force. It must be able to develop operational intelligence and integrate ISR platforms, sensors, and HUMINT into theatre-level collection plans. It must be able to operate, manage, and maintain NATO operational-level communication and information systems (CIS) down to SOTG level. It must manage the force protection for the SOCC Core camp. It must coordinate and oversee CSS functions for the SOTGs. It must have all classes of supply to sustain itself for at least 10 days. Lastly, it must be able to direct special operations organically on its own or as part of a larger force or HQ structure (NSCC, 2008, pp. C4–C5).

The purpose of Chapter IV was to lay out the problem. In Chapter V, we will provide the solution.

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V. THE MATERIAL SOLUTION FOR THE RAPIDILY DEPLOYABLE SOCC

The NSHQ is planning on procuring material for a rapidly deployable HQ. The procurement plan is broken down into four sub-components that correspond to the sub-components that comprise the NSHQ SOCC Core. These sub-components are SUPCEN (Support Center), OPCEN (Operations Center), SIGCEN (Signal Center), and ASC (All-Source Center).

The following considerations will be included in the Procurement Plan (NSHQ, 2011):

1. Maintenance and supply support—Establish near-term maintenance requirements to include spare part stocks and availability. Determine sustainment and life cycle replacement of parts and of systems.
2. Packaging, handling, storage, and transportation—Identify designs and methods to ensure the systems are preserved, packed, stored, handled and transported properly.
3. Support equipment—Identify all equipment required to support operations and maintenance of the system.
4. Technical data—Identify scientific and technical information used to support the systems.
5. Training and training support—Determine requirements to acquire training devices and conduct training of operators and maintenance personnel.
6. Facilities—Edentify real property and storage containers required to support each of the systems.

When building the life-support features of this rapidly deployable camp for this thesis, we considered many factors and characteristics, including, but not limited to, weight, size, cubic dimensions, ease of setup, durability, transportability, functionality, and cost. During this study, our team visited numerous operational units, along with several manufacturers, to gather our data. In this study, we compare four manufacturers: Alaska Structures, Base-X, DRASH, and Weatherhaven. These companies are by no means the only available manufacturers of military-style camps, but they are the vendors of camps that are predominantly used for not only SOF operations, but also for other combat units throughout NATO and the U.S.

When evaluating each camp manufacturer, we considered several factors. In Table 1, we present a general overview of these factors. Later in this thesis, we address the characteristics of the products of each vendor and explain the specific factors in more detail. The grading and evaluations are taken from our visits to the various units and manufacturers of these camps. The equipment manufacturers provided the weight, size, cube, and cost information. Information regarding the ease of setup, durability, transportability, and functionality came from both the manufacturer and from the current users of the particular camp. The manufacturers needed to meet or exceed specific factors in order to be considered for selection. We used the following guidelines and specifications we received from the NSHQ's J4 in our evaluation of each camp manufacture.

1. Environmental threats and conditions:
    a. Snow load of 10 lb (5 kg) per sq ft (m) for 12 hours without damage to the frame or structure
    b. No observed leakage during wind-driven rain of 2 in. (5 cm) of rain per hour at 35 mph (56 km/h) for 30 minutes
    c. Ability to withstand wind load of 55 mph (89 km/h), with gusts up to 65 mph (105 km/h)
    d. Operational at -20–120 °F (-29–49 degrees °C)
    e. Openings for 4 in. (10 cm) diameter flue stack and/or 16 in. (41 cm) diameter ECU ducts
    f. Sufficient natural ventilation to support recommended number of occupants and minimize condensation
    g. Ability to be configured to provide entry and egress under blackout conditions
    h. Ability to be erected on rough, uneven, or sloped terrain

2. Detection threats:
    a. Matte or dull finish to fabric and support systems
    b. Fabric in colors of green, tan, or white
    c. Not observable at night with light inside 100 m with naked eye or 300 m with night-vision goggles
    d. Fabric pigment matches infrared reflectance of intended climate (i.e., temperate, desert, or arctic)

e. Compatible with standard camouflage net systems

3. Safety:
   a. Flame resistance/char length/melt drip to meet ASTM d-6413-99, paragraph 3.4.7, self-extinguishing within 2 seconds after exposure to the flame source for 12 seconds in both the warp and fill directions. The damaged char length shall be less than 50% of the sample length of 12 in. (30.5 cm); no melt drip
   b. No toxic materials used in paints or preservative coatings for frame or fabric finish or coatings
   c. Meets human factors requirements for soldier lift (i.e., 37 lb/16.8 kg/soldier)

4. Durability:
   a. Can withstand 50 cycles of erect and strike for one year
   b. Sustainable with repair parts, manuals, and logistical support
   c. Capable of two years of continuous use

5. Other considerations:
   a. Insect screens, door openings, vestibules, and compatibility with soft and hard flooring
   b. Erected in all environmental conditions
   c. Transportable on 463 L pallet and by C-130, cargo HMMWV, FMTV, and LMTV
   d. Spare and repair parts available through contractor

A. SUPPORT CENTER, COMPARISONS AND CHARACTERISTICS SHELTERS: ALASKA STRUCTURES

We visited several U.S. Army SOF units in Fort Bragg, NC, and a U.S. Naval Special Warfare Command (NAVSPECWARCOM, NAVSOC, or NSWC) in San Diego, CA, where we met not only the users, but also the manufacturer of Alaska Structures shelters. We compared and considered several Alaska Structures models that could be used when building the camp. The first option we looked at was the Alaska Gable Shelter, a gable-roof, soft-sided structure (see Figure 5). The Alaska Gable Shelters are designed to be light and compact for rapid deployment, quick setup, and improved transportability. (Initial training for these structures is provided by Alaska Structures.)

When assembled, the Alaska Gable Shelter measures 18 ft (5.5 m) wide and is 9 ft (2.7 m) at its apex, and is available in multiple lengths. The standard shelter is 18 ft x 26 ft (5.5 m x 7.9m), weighs 620 lb (281.2 kg), and can be fully operational in fewer than 15 minutes with six trained personnel. During our visit to NSWC in San Diego, the Seabees who set up the camps for NSW said it took three or four men about .5–.75 hours to set up a tent with structuring, wiring, liner, etc. The Alaska Gable Shelters have a 20-year shelf life and are designed for up to 10 years of extended use in the field (Alaska Structures, 2011f).

Figure 5. Alaska Gabled Structures
(Alaska Structures, 2011f)

The second Alaska Structure option we looked at is called the Alaska Small Shelter System (AKSS). This shelter is 20 ft wide x 32.5 ft long x 10 ft high (6.1 m wide x 9.9 m long x 3 m high) and is soft sided. The AKSS can be connected end-to-end, side-to-side, or end-to-side to create multi-shelter complexes. All AKSSs come with a cover system, complete insulation system, a non-slip floor, a 30 in. x 80 in. (76 cm x 203.2 cm) hard door, four windows, plenum, an incandescent light string, and a quick-connect electrical harness with 24 outlets (Alaska Structures, 2011c). Additional standard features of the AKSS models include side windows, side entries, and stovepipe flanges.

In terms of their ability to withstand environmental conditions, Alaska Structures' soft-sided shelters, both the gable roof system and the AKSS, far exceed the requirements we received from the NSHQ for wind and snow loads. The gable-roof system can withstand snow loads of up to 125 lb/sq ft (56.7 kg/m^2), and it tested successfully for wind loads of up to 120 mph (193 km/h). The AKSS successfully withstood 70 mph (112.7 km/h) wind loads with 80 mph (128.75 km/h) gusts, and it also successfully met a 20 lb/sq ft (9 kg; PSF) snow load (Alaska Structures, 2011c).

Both the gable structure and the AKSS can be customized with entry vestibules that can help reduce dust entry into the shelter as well as reduce light exposure at night, a functionality that meets the light restrictions stated previously. Additional options that are available for both shelters include containers, one-piece liners, fluorescent lights, European lighting and electrical distribution systems, and generators. Both styles of structures were used operationally, and the structures' capabilities and quick erect systems were noted during Operation Enduring Freedom (OEF) and Operation Iraqi Freedom (OIF) and were reported to far exceed the requirements imposed by the Air Force, Army, USSOCOM, and the British Mod in extreme heat, wind, and sand (Alaska Structures, 2011f). The users at several Fort Bragg commands were extremely happy with the overall operation of the Alaska Structure products, especially with their transportability (see Figure 6), ease of setup, durability, and comfort.

Transporting the AKSS

- 41" wide x 102" long x 49" high
- 104 cm wide x 259 cm long x 124.5 cm high
- One complete Alaska Small Shelter per container
- Four containers per 463 L pallet position

Figure 6. Transporting the AKSS
(Alaska Structures, 2011b)

Alaska Structures has also developed two new energy-efficient products that will significantly reduce the carbon footprint of base camps, decreasing the amount of fuel required to heat and cool any Alaska Shelter. These new eco-friendly systems are available for all Alaska Shelter models, and they are called Enerlayer and Alaska Solar

Fly (see Figure 7). The first Alaska Enerlayer sits in between the outer cover and inner liner of the structure. With the Enerlayer installed, there is a 35% reduction in the heat required to maintain a 70 °F (21 °C) interior temperature at -25 °F (-32 °C) ambient temperature, a 22% reduction in the air conditioning required to maintain a 70 °F (21 °C) interior temperature at +125 °F (52 °C) ambient temperature, a further 33% reduction in the air conditioning required when used in conjunction with AKS Solar Fly. These systems save up to 2,650 gal (10,031 L) of fuel per year (per shelter/5-ton ECU; Alaska Structures, n.d.).

Alaska Structures also offers a variety of Environmental Control Units (ECUs), including a 2.5-ton unit, a 5-ton unit, and a 10-ton unit. Each Alaska ECU is available in either a U.S. version (3-ph, 208V, 60Hz) or an EU version (1-ph, 230V, 50Hz). AKS also offers a 5-ton split system for NBC applications. Alaska Structure's ECUs come with forklift pockets on all four sides, one set of 36-in. long insulated ducts, a 25-ft power cable with a U.S. military cannon plug connector, and a 60-day spares/repair kit. Alaska ECU options include wheels kits, various lengths of insulated ducts, and remote control units (Alaska Structures, 2011a).

Figure 7. AKSS Shelters with Solar Fly
(Alaska Structures, 2011d)

Alaska Structures provides 24/7 emergency customer service, technical support, and product information via phone, e-mail, or on location. Most spare and replacement parts are shipped within 24 hours to locations around the world.

B. HDT GLOBAL BASE-X AND AIR BEAM STRUCTURES

Headquartered in Solon, Ohio, HDT Global is the manufacturer of the Base-X shelters. We studied their products, which are used by the U.S. and NATO military units, civilian governments, and commercial customers around the world. We observed the Base-X structures at the U.S. Marine Corps 1st Marine Expeditionary Force (MEF) unit at Camp Pendleton, CA, and at NSWC in San Diego, CA. A key characteristic of Base-X shelters is their lightweight folding frame, specifically developed to reduce the setup time of this tactical soft-walled shelter system. (Initial training for this system is provided by HDT Global.) The folding frame design gives the system its strength and helps in the ease of setup. The system has the strength required to meet specifications, and the lightweight frame keeps the system to a minimum in weight and size, while still making it mobile and easy to deploy. The folding frame shelters range in size from personal tents to corps-level command and control complexes.

Specifications	307 Shelter	
Interior Dimensions		
Floor Space	18 x 35 ft	5.49 x 10.67 m
Area	630 ft^2	58.5 m^2
Packed Dimensions		
Package 1*	63" x 46" x 29"	160 cm x 117 cm x 74 cm
Package 2**	63" x 32" x 23"	160 cm x 81 cm x 58 cm
Weight		
Package 1*	474 lbs	215 kg
Package 2**	240 lbs	109 kg
Total Shelter Weight	714 lbs	324 kg
Total Package 1 & 2	785 lbs	356 kg
Set-Up		
Time	10-16 min	
Personnel	6 each	

Figure 8. HDT Base-X® Model 307 Shelter Specifications
(HDT Global, 2011d)

The HDT Base-X® Model 307 (Figure 8) is a mid-sized shelter with an interior clear span of 18-ft wide x 35-ft long (5.49 m x 10.67m) with eight entry and egress points. This shelter houses 14–18 personnel, and it could also be used for mid-sized command and control, medical, communication, logistics operations, and private offices. The HDT Base-X® Model 307 comes as a sleeping kit (Part# 60307GPSLP-KTTN; Figure 9), which consists of the following components:

1. 1-307 Ready-Fold Flooring
2. Two Light Kits (set of two)
3. Ready-Roll Flooring

Figure 9. Model 307 Ready-Fold Floor

Note. Image provided by HDT Global.

The 307 has electrical outlets every five ft (1.5 m) and hang points every five ft (1.5 m) that can hold up to a 100-lb (45.4 kg) weight-load at each point (HDT Global, 2011d). It has an integral liner with floor and HVAC plenum, a relatively low weight, and cubic size. In addition, the personnel requirements for setup and field maintenance are minimal. This shelter is also energy efficient when utilizing the HDT Solar Shade Fly (see Figure 10), which provides an additional layer of solar protection, reducing shelter interior temperatures and temperature gradients, and lowering the fuel consumption associated with environmental control. Use of the Shade Fly with HDT's shelters has been proven to reduce internal shelter temperatures by 10–18 °F (5.5–10 °C; HDT Global, 2010a).

Figure 10. HDT Global Solar Shade Fly
(HDT Global, 2010a)

HDT's radiant barrier (Figure 10), which helps to improve conductive, convective, and radiant heat transfer, is a beneficial feature to have in some of the extreme climates of the world where military forces deploy. Both of these barriers can help reduce the amount of energy required to heat and/or cool these shelters as well as reduce the logistical burden on the deployed forces. HDT tested both barriers and claim that the new barrier lowers the shelter's interior temperatures by 10–18 °F (5.5–10 °C) in non-ECU cooled shelters, and it lowers the temperature gradients up to 63% in non-ECU cooled shelters. In addition, having these energy-efficient products installed on the shelters reduces ECU run times to 70% below normal, thus reducing fuel consumption. The ECU-cooled shelters are up to 10.8 °F (6 °C) cooler when using the Shade Fly (HDT Global, 2011f). The radiant barrier is currently being used in the field by the Marines.

As a possible standalone operation, energy sources and supply line management are critical to consider, and HDT had some interesting options to offer in the use of alternative energy sources. One option of particular interest is their expeditionary power-grid management technology that makes the most of every watt, distributing power efficiently throughout the camp to where it is needed and conserving it when it's not. The HDT Balance of Systems (BOS)[1], shown in Figure 11, utilizes this technology to manage the distribution of power harvested from alternative energy resources, such as solar, shore power, and generator power. In addition, the BOS can interface with tactical vehicle power via a NATO connector from the battery of a tactical vehicle. The battery array (see Figure 11) can be added in series for increased generator run time (HDT Global, 2011a).

[1] This item and the technical data and defense services directly related to this item are subject to the International Traffic in Arms Regulations (ITAR; 2011), 22 C.F.R. § 120–130, and may not be exported to any foreign destination or any foreign entity or foreign national, inside or outside the United States, without prior approval by the U.S. Department of State (HDT Global, 2011a).

Figure 11. HDT Balance of Systems and Battery Array
(HDT Global, 2011a)

Specifications	Balance of Systems Unit	
Ordering Info		
HDT part number	49-SPINB01	
Power		
AC output	20 Amps (70 Amp surge)	
DC output	60 Amps	
Solar input	1600 Watts	
Physical Characteristics		
Weight	150 lbs	68 kg
Pack	33″ x 21″ x 19″	83.8 x 53.3 x 48.3 cm
Cube	7.6 f^3	0.215 m^3

Specifications	Expandable Battery Platform	
Ordering Info		
HDT part number	49-SPBB01	
Power		
Storage	90-120 Amp hours per platform	
Operating Temperature	-40°F – 122°F	-40°C – 5-°F
Physical Characteristics		
Weight	190 lbs	86.2 kg
Pack	33″ x 21″ x 14″	83.8 x 53.3 x 35.6 cm
Cube	5.6 f^3	0.159 m^3

Figure 12. Balance of System Characteristics
(HDT Global, 2011a)

Figure 13. HDT Alternate Energy Solution

Note. Images provided by HDT Global.

C. AIR-SUPPORTED TEMPER HDT AIR BEAM STRUCTURE

Another shelter option from HDT is the high-pressure Air Beam Structure, (see Figure 14). The Air Beam Structure has several key advantages as a shelter system, which includes its strength, durability, rapid deployment capability, and minimal manpower requirements. Another key benefit is the low life cycle cost for each unit due to the small logistics chain and parts count. The durability of these shelters has been demonstrated in nearly 200 consecutive Air Beam shelter erection-strike cycles without incident. The Air Beam-series shelters come in three models that are 21-ft (6.4 m) long and four models that are 32-ft (9.8 m) long. These models have identical 10-in. (25.4 cm) diameters and a 20-ft (6.1 m) clear span. Standard models range in size from 430–640 sq ft (131.1–195.1 m^2) and are offered in a variety of configurations. The Army selected the HDT Air Beam Shelter (Air Supported temper types) for Force Provider, their premier base camp (HDT Global, 2011g).

Figure 14. HDT Air Beam Shelter System
(HDT Global, 2011g)

We did not personally see the Air Beam setup at any of the sites we visited, but, based on the idea and concept, we expect this system would be user friendly and easy to deploy and erect. The shelter is laid out and staked to the ground at just four anchor positions. The AirBeams are then inflated simultaneously with a commercial air compressor that comes with the package. The company states that two people can deploy the shelter in fewer than 10 minutes. The shelter is deployed and struck with the prepositioned inflation hoses. The Air Beam's specific characteristics include the following: weight (including the compressor) is 646 lb (293 kg); packed volume is 6.9 cu yd (5.3 m^3); wind load is 64.4 mph (103.7 km/h); and snow load is 10 lb/sq ft (4.5kg/m; HDT Global, 2011g).

HDT Global provides 24/7 customer service, technical support, and product information via phone, e-mail, or on location. Most spare and replacement parts are shipped within 24 hours to locations around the world.

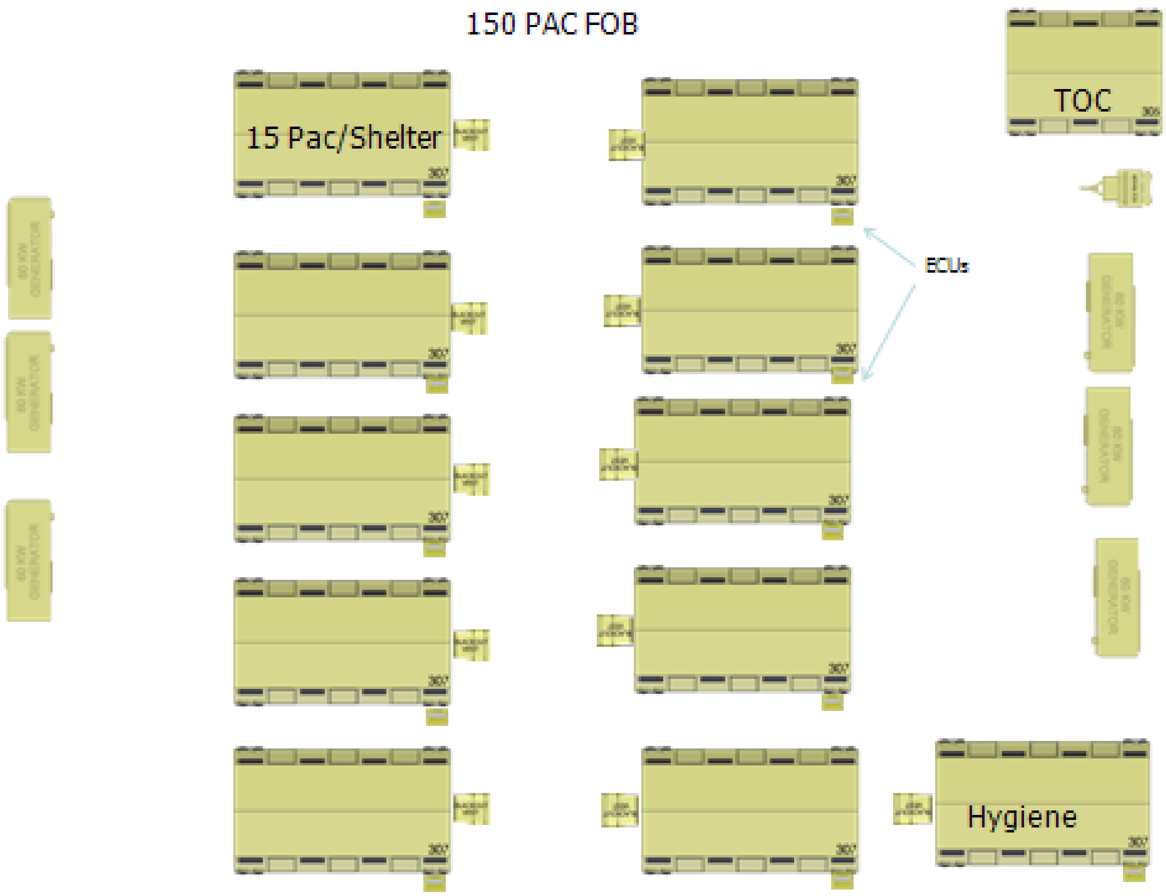


Figure 15. DRASH Structure System

Note. We received these drawings from an HDT Global sales representative.

D. DRASH STRUCTURE SYSTEM

DRASH's HQ and manufacturing facility is located in Orangeburg, NY. Its systems are currently used by all branches of the U.S. military and by the armed forces of Australia, Austria, Germany, Israel, Japan, Norway, Singapore, Spain, Turkey, and the United Kingdom. More than 17,000 shelters and over 7,500 trailers have been deployed worldwide with U.S. and NATO forces (DRASH, 2011a). We met with representatives from DRASH in Fort Bragg, NC, during an exercise with the 82nd Airborne. The 82nd Airborne had its command and control setup for the exercise and was in the process of setting up the remaining camp.

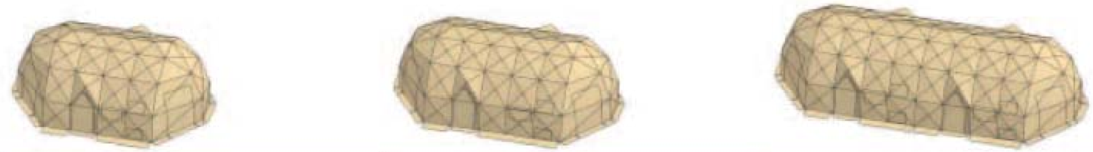
DRASH uses a soft-walled shelter system solution for command and control, medical, life support, logistics, and maintenance facilities. It is a rapidly deployable system that requires no special equipment, site preparation, or extensive training (initial training is provided). The shelter can be set up rapidly without the use of special tools. DRASH has a patented frame design, composed of what is called Titanite, which makes up most of the shelter's frame. The Titanite is an aerospace composite that has been independently tested, and its flex strength is 270% greater than aluminum's (DRASH, 2011a).

The basic DRASH shelter design consists of a frame with two pre-attached covers and a ground cover. It has a double layer of fabric that helps provide a naturally temperature-controlled environment, even without environmental support; however, in extreme conditions, this shelter needs environmental support. The command and control center at Fort Bragg was comfortable when the outside air temperature was 95 °F (35 °C).

The shelter's covers are made with XYTEX®, which is a specially coated fabric that is fire retardant, mildew resistant, water repellent, and highly resistant to abrasion and ultraviolet rays. All cover fabrics include blackout in the visual- and near-infrared spectrum and meet Mil-Standard requirements for soft-walled shelters (DRASH, 2011a). The DRASH systems are modular and vary in size from 109–1,250 sq ft (33.2–381 m^2). They can interconnect with each other, regardless of model or series, to increase operational areas as necessary.

DRASH has several models to choose from (see Figure 16). One of the models we observed in the field was from DRASH's M Series (see Figures 16 and 17). The M Series shelters include one of DRASH's military dome tents with an interior width of 18 ft (5.5 m) and an interior height of 9.7 ft (3 m). These shelters come in three basic models and in varying lengths. In addition, the M Series shelters can be lengthened to increase an operating area by removing the shelters' end caps and adding additional center sections. The M Series shelters pack down to less than 2% of their deployed size for easy transport (DRASH, 2011d). The DRASH M Series shelters can operate in temperatures ranging from -50– +131 °F (-45.5–55 °C). The M Series shelters can be assembled in approximately 15 minutes with about four to six trained individuals (DRASH, 2011d). The units at Fort Bragg took slightly longer to set up the shelters, because several more junior troops assembled the structures. DRASH had an area representative on site, assisting the soldiers and answering questions. DRASH provides 24/7 customer service, technical support, and product information via phone, e-mail, or on location. Most spare and replacement parts are shipped within 24 hours to locations around the world.

M SERIES



			MX	MX5	M
Part Numbers	Green		MXA2000G	SH201-0601G	MA100100
	Tan		MXA2000T	SH201-0601T	MA100500
NSNs	Green		8340-01-538-1822	8340-01-540-7566	8340-01-533-1654
	Tan		8340-01-538-1823	8340-01-540-7592	8340-01-533-1653
Length	Exterior	ft. / m.	30.7 / 9.4	34.9 / 10.6	47.7 / 14.5
	Interior	ft. / m.	29.1 / 8.9	33.3 / 10.1	46 / 14
Usable Area	Entire Shelter	sq. ft. / sq. m.	442 / 41	519 / 48.2	748 / 69.5
	Center Section Only*	sq. ft. / sq. m.	306 / 28	383 / 36	612 / 57
	Individual Endcap**	sq. ft. / sq. m.	68 / 6.3	68 / 6.3	68 / 6.3
Total Weight	Entire Shelter	lbs. / kg.	625 / 283.5	724 / 328.4	1,115 / 506
	Center Section Only*	lbs. / kg.	490 / 222.3	590 / 267.3	980 / 443.9
	Individual Endcap**	lbs. / kg.	67 / 30.4	67 / 30.4	67 / 30.4
Packed Dimensions	Center Section Only*	in. / cm.	56 x 44.5 x 31.5 / 142 x 113 x 80	56 x 44.5 x 33.5 / 142 x 113 x 85.1	56 x 44.5 x 31.5 / 142 x 113 x 80
	Individual Endcap**	in. / cm.	51 x 23 x 23 / 130 x 58 x 58	51 x 23 x 23 / 130 x 58 x 58	51 x 23 x 23 / 130 x 58 x 58
Packed Volume	Center Section Only*	cu. ft. / cu. m.	45.4 / 1.3	48.3 / 1.4	45.4 / 1.3
	Individual Endcap**	cu. ft. / cu. m.	13.6 / 0.4	13.6 / 0.4	13.6 / 0.4

Figure 16. DRASH M-Series Specifications
(DRASH, 2011c)

Figure 17. DRASH Series M Style Shelters
(DRASH, 2011d)

DRASH's power and environmental controls can be integrated with a Utility Support Transport (UST) trailer (see Figure 18) that provides a seamless power package and environmental control system for deploying in extreme conditions. UST trailer models include Genset outputs ranging from 5–33 kW and/or 5-, 8-, or 12-ton ECUs with an integrated strip heater. The trailer has lift points for sling loading by a CH-47. The system is mounted on a large trailer that has both benefits and challenges.

One of the benefits of the system is that it is compact on the trailer, and the trailer has additional storage space for other shelters, which makes for easy transport. That is also one of the problems with the type of camp we are setting up. The trailer that DRASH's power and environmental control system sits on is very large. This trailer is ideal for a large operation that has semi-trucks delivering equipment to the camp;

however, without a large vehicle to move the system, the shelters are immobile and cannot be moved into an ideal position. This system was designed to operate in an all-terrain area acceptable for military vehicles and to track behind, but it was not necessarily designed to be airdropped into an environment.

Figure 18. DRASH UST Trailer
(DRASH, n.d.b)

If deploying with vehicles, the DRASH UST trailer with the shelters attached (see Figure 17) can be towed via HMMWV, LMTV, FMTV, or non-tactical vehicles. DRASH shelter systems are also certified for transport via military sea vessels and aircraft. The shelters can be packed on a 463 L pallet for easy deployment, making them flexible for shipping. The DRASH shelters meet all U.S. military standards, and they have been tested at the Aberdeen Test Center (ATC) and the Nevada Automotive Testing Center (NATC; see Figure 19).

DRASH DURABILITY TESTING				
Test Criteria/Shelter Series	**S Series**	**XB Series**	**M Series**	**J Series**
Rain Able to withstand 2 inches per hour of free falling and blowing rain for 30 minutes without intrusion of water into the shelter.	PASSED	PASSED	PASSED	PASSED
Wind Able to withstand a steady wind of 55 mph with gusts up to 65 mph.	PASSED	PASSED	PASSED	PASSED
Temperature Able to sustain inside ambient temperatures of +40F to +80F within an hour when subjected to extreme high and low temperature ranges of -50F to +131F.	PASSED	PASSED	PASSED	PASSED
Durability Able to withstand a minimum of 36 erect/strike cycles without structural damage.	PASSED	PASSED	PASSED	PASSED
Blackout Interior shelter lights not visible during ingress/egress within 100 meters with the naked eye, or within 300 meters with night vision goggles.	PASSED	PASSED	PASSED	PASSED
Snowload Able to withstand 10 lbs/sq.ft. of snow load for 12 hours without damage while using All Weather Kit.	PASSED	PASSED	PASSED	PASSED

Figure 19. DRASH Durability Testing Results
(DRASH, 2011a)

E. WEATHERHAVEN STRUCTURES

Weatherhaven corporate HQ is located in Vancouver, Canada, and the company has manufacturing facilities in South Africa and South America. Our team visited Weatherhaven's HQ and met with their representatives in Vancouver. We took a tour of their facilities and viewed many of their products and shelters. The company stressed to us that Weatherhaven builds to their customers' requirements and specifications. Their representatives showed us several examples where a customer asked Weatherhaven to build an item to meet a certain requirement, and the company's designers and engineers did just that.

Weatherhaven fabric shelters (see Figure 20) and systems can be packaged for shipment in standard 20-ft ISO shipping containers or on pallets for cargo aircraft of any size. Weatherhaven shelters do require a few specialty fitted tools for assembling and disassembling their shelters. (Initial training is provided by Weatherhaven.) The components of the shelter systems—such as the flooring and the electrical and mechanical systems—are also specifically designed to facilitate an easy set-up and teardown. Weatherhaven claims its shelters and systems have been used in the field for projects that have lasted 15–20 years (Weatherhaven, 2011c). Weatherhaven's Modular Tentage System (MTS) comes in a variety of sizes that can be connected with other shelters to form larger complexes (see Figure 21). The MTS is commonly used for accommodation, ablutions, kitchens, laundries, command posts, workshops, and medical facilities.

Figure 20. Weatherhaven Shelter
(Weatherhaven, 2011b)

Figure 21. Weatherhaven MECC and Soft-Sided Shelter
(Weatherhaven, 2011b)

The Series 4 is another Weatherhaven soft-sided and has been used for over 20 years by various countries. It is a shelter that is in use worldwide in all climates, including polar regions. Weatherhaven's Solarshade system is similar to the environmental control systems that Alaska Structures and Base-X offer. Like the other two manufacturers' systems, the Solarshade is designed to reduce the internal temperature within the shelter in extreme environmental conditions. The Solarshade is designed to be used in combination with a Weatherhaven shelter when deployed in areas of extreme direct solar radiation. The Solarshade also helps to prolong the life of the Weatherhaven shelter by reducing its exposure to harmful radiation and solar gain. The Solarshades also helps reduce the demand on climate control systems by blocking between 66–93% of solar rays (Weatherhaven, 2007).

F. HYGIENE SYSTEMS AND KITCHENS

We consulted several sources to figure out the correct solution for constructing hygiene facilities. We received several different answers, and we concluded that it depends on the environment the camp deploys to. We received a wide range of solutions, everything from a best-case scenario (use the facilities already in place in country, such as buildings, hangars, etc.) all the way down to a worst-case scenarios (digging ditches and burning the waste). The options we explored scratch the surface in this area, but, to provide an accurate solution, we would have needed to make too many assumptions. The ideal hygiene solution must be determined during mission planning, but our options provide a good base point to build from and could be deployed in any theater, in any circumstances, with the right support.

1. Alaska Structures Ablutions

Alaska Structures offers a four-person and a one-person shower system, as shown in Figure 22. Their system includes one 20-ft x 19.5-ft (6.1 m x 5.9 m) Alaska Structures shelter, one 2.5-ton Alaska Structures FCU, one lighting/electrical kit, one three-basin sink, four Alaska Structures shower-in-a-box shower stalls, a hot water heater, a self-priming pumping system, 2000-gal (7,571 L) potable and grey-water bladders, a wastewater drainage pump, a ventilation fan, and a plug-and-play quick-connect hose kit. The shower system can handle over 100 showers per day (Alaska Structures, 2011b).

Figure 22. Alaska Structures Shower System
(Alaska Structures, 2011b)

2. DRASH Mobile Hygiene System

The DRASH Mobile Hygiene System includes private shower stalls and a common wash area with wash basins and benches (see Figure 23). A rigid-wall containment berm sits on the inside perimeter of the shelter to ensure that runoff water is contained within the entire system. Raised flooring sits inside the berm, along with a wastewater pump system that automatically turns on when water is present and shuts off when the water level is below a quarter inch. Water can then be delivered from any fixed, pressurized water source, and from a fresh-water bladder or body of water via a pressurized pump system. The water can be heated using a diesel water heater.

The DRASH G2 Water Heating System is a 425,000 BTU, self-heating, thermostatically controlled system. One of the benefits of this DRASH water heating system is its ability to use multiple fuel sources (diesel, kerosene, home heating oil, and JP4). The system produces a flow rate of up to 28 gallons per minute (106 L per minute) with a 10-gal on-board fuel tank with drain plug (DRASH, 2011b).

Figure 23. DRASH Hygiene System
(DRASH, 2011b)

The DRASH shower shelters are composed of fire-retardant, mold- and mildew-resistant, waterproof covers. The frame is manufactured from Titanite, and the shelter is pre-plumbed into the interior of the shelter frame, making it easier to set up and take down. The showers are supplied by 35-ft (10.67 m), abrasion-resistant hoses that connect to the water heater.

3. Weatherhaven Support Facilities

Even though Weatherhaven has a soft-side shelter version for their ablutions, kitchens, and laundry facilities, their hard-side container version is top of the line and the best we have seen. In camp applications, the Weatherhaven Mobile Expandable Container Configuration (MECC) is commonly used for ablutions, kitchens, and laundry facilities. One of the big benefits of the Weatherhaven solution is its stainless-steel interior and furnishings, which help maintain a high standard of health and sanitation. The ablutions are referred to as the "5 and 5," because they include five showers, five toilets, two urinals, one washtub, and six sinks (see Figure 24). This ablution configuration can be expanded to accommodate up to 100 persons as a deployment module.

Figure 24. Weatherhaven Ablution System
(Weatherhaven, 2011c)

In 2011, Weatherhaven introduced its new shelter system. It includes the Tactical Re-deployable Expanding Container Capability (TRECC-H) and (TRECC-V), which are helicopter- and vehicle-based variants, respectively (see Figure 25). When we first came across the TRECC shelter system, it was going through initial testing. It was referred to as the SHARC (Specialized Helicopter and Aircraft Re-deployable Container). The TRECC was initially developed and designed for the NSHQ to meet its requirements for being able to deploy from the inside of a CH-47 Chinook helicopter. The TRECC (see Figure 25) is constructed of lightweight aluminum and is deployable via air, road, rail, and sea, and it fits within a 20-ft ISO container. It provides for a secure and weather-proof internal payload capacity of 418 cu ft (11.8 m^3) and has an internal load capacity of 6500 lb (2900 kg) for stowage of specialist equipment (Weatherhaven, 2011d).

Figure 25. Tactical Re-deployable Expanding Container Capability (TRECC)

Note. Image provided by Weatherhaven.

When the TRECC is fully deployed and open, it provides approximately 255 ft^2 (23.7 m^2) of working space with a ceiling of 8 ft (2.44m; see Figure 26). The TRECC can be configured as required to include operations rooms, command posts, medical centers, and specialist workshops (Weatherhaven, 2011d).

TARE Weight excluding generator set:	1,588 kg	3,500 lbs
Maximum Payload:	2,948 kg	6,500 lbs
Maximum Gross Weight:	4,536 kg	10,000 lbs
Maximum Payload Volume:	11.8 m³	418 ft³

Dimensions - closed:	Width	2007 mm	6 ft 7 in
	Length	5385 mm	17 ft 8 in
	Height	1524 mm	5 ft
	Area	10.81 m²	116 ft²

Dimensions - deployed:	Width	4404 mm	14 ft 5 in
	Length	5385 mm	17 ft 8 in
	Height	2438 mm	8 ft
	Area	23.7 m²	255 ft²

Figure 26. Weatherhaven SHARC Fact Sheet
(Weatherhaven, 2011e)

Figure 27. TRECC Being Loaded into the Back of a CH-47

Note. Image provided by Weatherhaven.

G. MEDICAL FACILITIES

The next goal of our study was to find the right setup for an SOF medical unit. We discovered a wide spectrum of options and varying viewpoints regarding the right size and the required structure to treat troops in the field. For example, the Army uses hard-sided (containerized) facilities for all of the surgery and clinical care in its combat support hospitals (CSHs), but it uses tents for wards and sleeping. The Air Force uses tents from Alaska Structures for its Expeditionary Medical Facility (EMEDs; see Figure 28). The Army also uses tents for its forward surgical teams (FSTs; A. Resnick, personal communication, October 19, 2011).[2] The four soft-sided shelter systems provided by Alaska Structures, Base-X, DRASH, and Weatherhaven are all very similar and offer no real distinctions beyond the features we discussed in the SUPCEN section of this report. The question is what to use as a medical facility in a rapidly deployable camp?

[2] This information came from our personal communications with Adam Resnick at the RAND Corporation.

Figure 28. Soft-sided Medical Facilities

Note. Images provided by DRASH and Alaska Structures.

H. OPTIONAL EQUIPMENT: BOBCAT

During this study, we looked at options for assisting in the setup and placement of a camp and found that a few commands were using compact skid loader-type equipment (see Figure 29) to assist in their operations. We contacted Bobcat Company for information on their loaders. Bobcat is not the only manufacturer of skid loader equipment. There are others (i.e., Caterpillar and John Deere) who also make good skid-steer loaders. But we were not studying who makes the best skid loader; instead, our goal was to make general suggestions on the capability available to units. We choose the skid-steer/compact track loaders due to their performance, which was based on weight. The heavier the loader, the better it performed, because the added weight and extra ground-to-surface contact (from the track option and not the wheel option) increase the load capacity. The added loader weight gives it better power and performance in difficult soil conditions, a benefit we thought was important enough to go with a heavier option. The added size enables the loader to push heavier loads in rough terrain, sandy surfaces, and muddy conditions. The option we looked at was the Bobcat T770 Compact Track Loader; it was one of the largest, but not the largest, option. We looked at its basic weight compared to its operating capacity and found its ratio to be better than that of some of the higher end models. The T770 comes with a 92 HP diesel engine, Rated Operating Capacity (ROC) of 3,475 lb, strong lifting power (up to 11 ft of vertical lift; see Figure 30).

Figure 29. Bobcat T770 Compact Track Loader
(Bobcat, 2011)

Dimension	T770	T770 (Roller Suspension Option)
Length	141.6 in	141.6 in
Length without Attachment	114.3 in	114.3 in
Length with Standard Bucket	141.6 in	141.6 in
Width	78 in	78 in
Width (with bucket)	80 in	80 in
Height	81.3 in	81.3 in

Engine	T770	T770 (Roller Suspension Option)
Engine Cooling	Liquid	Liquid
Emissions Tier (EPA)	Tier 3	Tier 3
Engine Fuel	Diesel	Diesel
Horsepower	92 HP	92 HP
Turbocharged Engine	Yes	Yes

Performance	T770	T770 (Roller Suspension Option)
Rated Operating Capacity (SAE)	3475 lbs	3100 lbs
Operating Capacity (50% of Tip)	4960 lbs	4429 lbs
Tipping Load	9929 lbs	8857 lbs
Operating Weight	10327 lbs	10887 lbs
Travel Speed	6.6 mph	6.6 mph

Figure 30. Bobcat T770 Compact Truck Loader Specifications
(Bobcat, 2011)

I. OPERATIONS CENTER COMMAND AND CONTROL CENTER SHELTERS: ALASKA STRUCTURES COMMAND AND CONTROL

Alaska Structures has a couple of different options for their Tactical Operations Centers (TOCs) from their expeditionary command and control center unit, which utilizes the 18-ft wide or 20-ft wide Alaska Gable Shelters. They also have larger systems available for division-sized TOCs or Joint Special Operational Task Force Headquarters that offer over 10,000 sq ft of floor space (see Figure 31). The tentage systems used for the TOCs utilizes the same features as the life-support shelters. As seen in Figure 31, they are soft-sided shelter systems that can expand out with corridors for the different departments in the TOC. The system we observed was spacious, and it was easy to set up as an effective command and control center. We highly recommend this system.

Figure 31. Alaska Structures Large TOC
(Alaska Structures, 2011e)

J. HDT GLOBAL COMMAND AND CONTROL SYSTEM

The HDT Global/Base-X Command and Control system also utilizes soft-side structures and comes in various sizes to meet the command and control requirements of the unit (see Figure 32). When studying HDT's display packages, we discovered some interesting options. The HDT Expeditionary Systems Video Display System (VDS) weighs approximately 88 lb (39.92 kg), including the carrying case. The company claims the system can be up and running in fewer than five minutes, but we were unable to see their VDSs on our visits. The VDS is fully compatible and immediately employable with unit legacy systems and equipment. HDT appears to have a robust training support team available to help set up and operate their equipment. Their training team offers complete operator training on all new equipment, with continuous training for rotating troops. Training for in-field maintenance and repairs is also provided. HDT support staff members are strategically located to provide 24-hour emergency support; on-site warranty service and parts replacement; in-field support during training and exercises; and global in-field support during deployment (HDT Global, 2010b).

Figure 32. HDT Global Command and Control System

Note. Image provided by HDT Global.

HDT has a digital control unit (DCU; see Figure 33) that controls video and audio feeds from various sources to multiple outputs and is quad-screen capable. The DCU is contained in a single shock-mounted transport case, complete with all cables and modules to expand system capabilities. Components are customized to support specific mission requirements (HDT Global, 2011c).

DCU basic characteristics:
- Video and audio run over CAT5/6 cable
- Up to 32 inputs and 16 outputs over one system
- Accessible control from any computer on your network
- HTML interface requires no special software
- Available touchscreen interface
- Supports digital DVI and analog VGA
- Dimensions 28.25 in. D x 29 in. W x 26.25 in. H 71.76 cm D x 73.66 cm W x 66.68 cm H
- Weight 103 lb (46.72 kg)

Figure 33. HDT Digital Control Unit
(HDT Global, 2011c)

The HDT VDS uses a projector with the shortest throw in the world. The free-standing screen and projector device are fewer than 26 in. (66 cm) apart. The system is ideal for smaller spaces as it takes up a lot less floor space than other video systems and eliminates any sight-line obstruction in the field of view to the screen. The system is lighter and faster to set up than traditional overhead frame systems. Another nice feature is that the whole projector system can be set up in fewer than five minutes. The VDS comes in two sizes, small and large.

HDT has another interesting product option available. Although this option is not necessarily required, it could be useful. It is their Interactive Video Display System (IVDS; see Figures 34 and 35), which allows the user to write and draw on the screen surface, enabling digital capture of content from the screen to a computer.

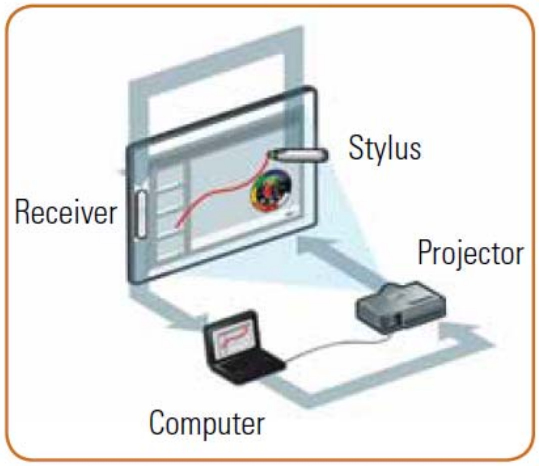


Figure 34. HDT Interactive Video Display System
(HDT Global, 2010b)

Specifications

VDS Small (40PRS011)	Screen Size	40 x 52″	1 x 1.3m
	Diagonal	60″	1.5m
	Packed Size	59 x 22 x 14″	150 x 56 x 35.5 cm
	Weight	84 lbs.	38 kg
	Deployed Size	53 x 30.2 x 72-90″	1.3 x 76.7 x 1.8-2.3m
VDS Large (40PRS012)	Screen Size	54 x 74″	1.4 x 1.9m
	Diagonal	100″	2.5m
	Packed Size	59 x 22 x 14″	150 x 56 x 35.5 cm
	Deployed Size	75 x 41.1 x 72-90″	1.9 x 1 x 1.8-2.3m
	Weight	88 lbs.	39.9 kg
eBeam Detector	Dimensions	9 x 2″	24 x 5.1 cm
	Weight	2.65 oz.	73g

Figure 35. HDT Global VDS Fact Sheet
(HDT Global, 2010b)

HDT's command and control chairs and tables (see Figure 36) seem to be heavier than some of the other manufacturers', but they appear to be sturdier and more rugged. Each chair weighs 11.5 lb and can support up to 800 lb of distributed weight. They are made of hardened polycarbonate plastic and 18-gauge oval steel tubing. For storage or transport, the chairs are stacked four high (6-in. height) in a mildew-resistant storage bag. The HDT table seems to be a rugged table with no special features, except that it comes with a cable management bag that hangs over the end of the table for keeping the cables neat and organized. The table was not pre-wired.

Figure 36. HDT’s Command and Control Tables and Chairs
(HDT Global, 2011b)

K. DRASH COMMAND AND CONTROL SYSTEM

The DRASH system (see Figure 38), utilizes the same basic shelters used in its life support system. The Army uses its command and control centers widely as part of the Army’s Standard Integrated Command Post System (SICPS). The system incorporates the Trailer Mounted Support System (TMSS) Medium and Large Systems (see Figure 37), which includes the shelter, power, environmental control, and tactical mobility that makes up the complete command operation center. One of the better features we observed was a tactical platform system, which is a two-tier platform that really enhanced the visibility and functionality for all of the users in the TOC. The platform system we observed came from a company out of Vermont called Bike Track, Inc. They also provided the hard flooring systems in the DRASH shelters we observed.

Figure 37. DRASH Trailer Mounted Support System and Optional Shipping Container

Note. Image provided by DRASH.

DRASH's Medium Command and Control System (see Figure 38) provides approximately 442 sq ft of usable space for command, control, and communications on the battlefield. The SICPS TMSS Medium System measures 26.6 ft long and 18 ft wide, and includes two end sections that can be removed to add additional center sections to increase the total length of the shelter. The Medium System can be packed on a HMMWV-towable DRASH trailer with an 18-kW power source and a 5-ton ECU to cool the inside of the shelter. The SICPS TMSS Medium System can be set up in about an hour, according to the soldiers we talked with. The Medium System can be set up with approximately four people and does not require any assembly or special equipment to either erect it or take it down. When operational, this DRASH system can withstand extreme weather conditions, such as blowing rain and high wind. The SICPS TMSS

Medium System can also sustain ambient temperatures of 40–87 °F when subjected to extreme high and low temperature ranges of -50 to +131 °F (DRASH, 2011).

Figure 38. DRASH Command and Control Center
(DRASH, n.d.a)

The other option DRASH offers for a command and control system is the DRASH TMSS Large (see Figure 39). With the TMSS Large, the shelter system provides more than 1,120 sq ft of usable space for command, control, and communications on the battlefield. The SICPS TMSS Large System measures 51.4 ft long and 31.33 ft wide, and comes with either a regular end section or an optional maintenance door. It is packed on to an FMTV-towable DRASH trailer with 33 kW of power and a 12-ton ECU to cool the inside of the shelter. The trailer also provides the means to set up or take down the shelter via an inflatable air bladder. To erect the shelter, the trailer is tilted so that the shelter can be positioned above a low-pressure air blower and bladder, which pushes the shelter up from below. The entire process takes approximately 45 minutes and requires a minimal number of experienced personnel. Like the Medium, the SICPS TMSS Large is also operable in extreme weather conditions, such as blowing rain and high wind. It is also able to sustain ambient temperatures of +40–87 °F when subjected to extreme high and low temperature ranges of -50 to +131 °F. DRASH's SICPS TMSS Systems are currently being fielded to all Army maneuver brigade combat teams, including units in Iraq and Afghanistan. This system might be too large for a rapidly deployable SOF HQ but could be a viable option for an operation with less restrictive requirements.

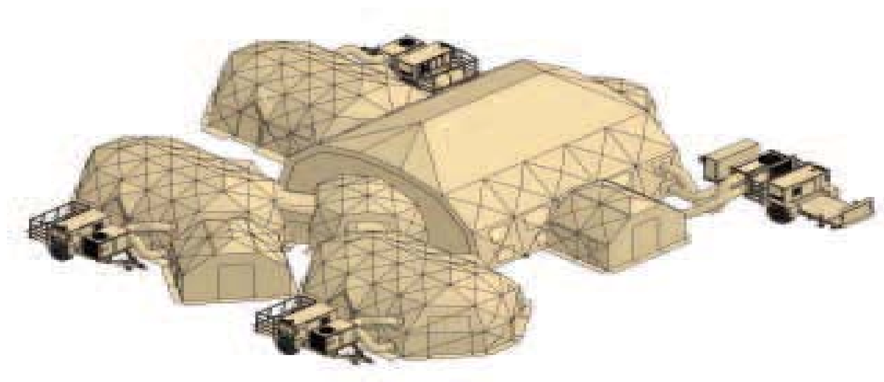


Figure 39. DRASH Large Command and Control Center

Note. Image provided by DRASH.

L. THE WEATHERHAVEN COMMAND AND CONTROL SYSTEM

The only hard-sided shelter option we looked at is manufactured by Weatherhaven. Other hard-sided options are available, but Weatherhaven's shelter is currently used by the NSHQ, which currently has nine MECCs in its inventory, and we viewed interoperability and standardization as key factors. We looked at both the MECC (see Figure 40) for its compatibility, and the TRECC (see Figures 41 and 42), because it was specifically built to NSHQ specifications. The benefits of a hard-sided shelter are obvious. Not only is the shelter itself ready to ship in its own container, but all of the equipment that will be used in the command center is now also self-contained within the container. The Weatherhaven hard-sided option is an expandable container shelter where the sides fold down, making the container 1/3 the size of a standard command and control trailer. It provides a living and working space that is three times larger than its shipping footprint. In its packed configuration, the MECC (see Figure 32) is a certified ISO container, and nine units can be stacked on top of each other when outfitted with a steel core. With the aluminum version of the MECC, three units can be stacked on top of each other. The MECC can be transported anywhere in the world by road, rail, sea, or air.

Figure 40. Weatherhaven MECC

Note. Image provided by Weatherhaven.

One of the stated features of the Weatherhaven hard-sided structures includes the ability to pre-wire and pre-plumb fixed mechanical and electrical systems, which helps facilitate rapid on-site setup. The setup time varies, but the manufacturer states it takes two experienced people 10–15 minutes to set up the MECC. A unit we visited that was using the MECC stated that it took four to six people about an hour to build and complete the system. The MECC comes in two standard sizes: 8-ft wide x 8-ft high x 20-ft long and 8-ft wide x 8-ft, 6-in high x 20-ft long. The MECC is insulated for hot or cold climates. The MECC allows various-sized interconnector kits and vestibules to be added end-to-end and side-to-side to create larger complexes. The MECC can be set up on the ground, linked to a vehicle, or mounted on a trailer. It can also be outfitted with collective protection equipment when nuclear, biological, and chemical warfare are a threat.

Figure 41. Weatherhaven TRECC

Note. Image provided by Weatherhaven.

As we stated earlier, the internal equipment is stored and transported in the center core of the MECC and TRECC, and this equipment does not need to be removed from the unit for shipping; thus, sensitive electronic equipment is not exposed to the outside elements. Weatherhaven allows for customizing electrical packages with outlets for radios, computers, and other required equipment. Another nice feature of the MECC is that, when space is an issue, it can be used with a stacking kit that allows the units to be deployed on top of each other. The kit consists of a stairway with platform support, a roof, and six extended wing supports.

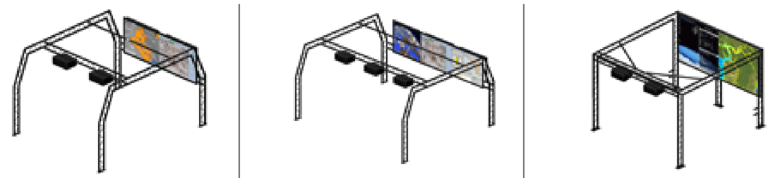
Figure 42. Weatherhaven TRECC

Note. Image provided by Weatherhaven.

M. SPEC OPS, INC.

The last company we looked at for the OPCEN piece was Spec Ops, Inc. (SOI). They are a company out of Ashland, VA. They specialize in command and control systems that range in size from two-person operators to brigade-level operations. They have deployed over 30,000 products worldwide. Their customers include all branches of the U.S. military, U.S. intelligence services, U.S. homeland security, and municipality-level emergency responders. One of the SF units at Fort Bragg told us about SOI and how good their equipment was. Unfortunately, we did not have time to visit them or a unit that used their equipment; however, after researching their products, we felt it was important to include them in our discussion of possible OPCEN solutions.

SOI currently offers over 100 commercially available command and control products. They also design new systems based on customer-specific requirements. A few of the items we looked into were their tactical displays. One of these displays is called Megawall (see Figure 43) and is a projector-based, soft-edged blended video display for powerful, high resolution images. A single image from each projector is blended to create one desktop background picture. Multiple display windows are then overlaid onto the Megawall desktop, offering a robust, powerful command and control picture.



	512MWD	513MWD	712MWD
WEIGHT:	650 lbs	750 lbs	800 lbs
DIMENSIONS PACKED (HxLxD):	3 cases 33 in x 64 in x 18 in	3 cases 33 in x 64 in x 18 in	4 cases 33 in x 64 in x 18 in
DIMENSIONS SETUP (HxLxD):	96 in x 122 in x 156 in	96 in x 177 in x 156 in	96 in x 137 in x 132 in
DISPLAY (Quantity/Size):	One/96 in x 36 in	One/144 in x 36 in	One/130 in x 64 in

Figure 43. Spec Ops, Inc.'s Megawall Options
(SOI, n.d.)

The Megawalls might be too large for most applications, but SOI has another good option available: the Rapid Tactical Operation Center (RTOC; see Figures 44 and 45). The RTOC are large-screen displays that are mounted on a durable, lightweight aluminum framework. All components set up and strike quickly, and they fit within their own weatherproof, ruggedized aluminum case. All RTOCs are one- to two-person portable. The RTOC C4ISR Platforms are ideal for displaying computer application data, UAV surveillance feeds, network TV, and other communication feeds. The RTOCs vary in size; they start at 3 ft x 4 ft and increase up to 3 ft x 12 ft. RTOC video display options include projectors (standard and high resolution), plasma, LCD, and now LED. RTOCs also support many types of interactive technologies, such as SMART Boards, table-top Smart Podiums, and DLP Interactive Projectors with wireless pens. Multiple images on one display are possible by adding a Video Distribution Unit (VDU) to the RTOC. These multiple images can be moved and resized to maximize the amount of information displayed on the screen. The RTOCs can also receive data and images directly from the Tactical/Smart Tables (SOI, 2011b).

Figure 44. SOI's Rapid Tactical Operation Center
(SOI, 2011a)

Figure 45. SOI's Rapid Tactical Operation Center
(SOI, 2011a)

SOI’s Video Distribution Units (VDU; see Figure 46), offers operators the ability to take images from many different video inputs and project them to any number of displays. Video outputs are moved between displays by a front panel, button interface, or they can be moved using SOI’s AV Commander Software. The VDU is mounted inside a rugged, transportable, and weather-resistant case. VDUs support multiple display types, including projectors, monitors, and TVs. Typical video switches are configured for eight inputs x eight outputs, and they can be configured for up to 32 x 32. The VDUs can support VGA, DVI, Twisted Pair, Fiber, Composite, HDMI, and so forth (SOI, 2011c).

Figure 46. SOI’s Video Distribution Units
(SOI, 2011c)

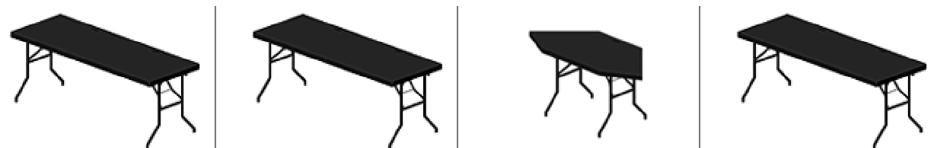
SOI’s Tactical Smart Tables (see Figure 47), seem to be some of the best options we have come across. According to SOI’s website (SOI, 2011b), these tables include the following features:

> Made from lightweight, rugged aluminum, all tables are prewired for power, secure and unsecure data, voice and video. Standard Tactical Tables offer two separate, switched GB networks channeled within the table. With pre-wiring and daisy-chain capabilities SOI's Tactical Tables significantly reduce cable management issues and control reconfiguration

costs in both deployable and fixed TOCs/EOCs. SOI also offers Gigabit and managed switch upgrades for our installed base of tables.

Figure 47. SOI Tactical Smart Tables
(SOI, 2011b)

The Standard Tactical Tables come in lengths of five and six ft, and also include a corner table. Aluminum Tactical Cases hold three tables, or two tables and four standard chairs. Figure 48 shows the specifications for these tables.



	ST5	ST6	STC	ET5
WEIGHT:	50 lbs	60 lbs	45 lbs	53 lbs
SETUP (HxLxD):	27.5 in x 60 in x 26 in	27.5 in x 72 in x 26 in	27.5 in x 60 in x 26 in	27.5 in x 60 in x 26 in
POWER	110V	110V	110V	110V-220V
NETWORK	Up to 4; Min. 1 classified, 1 unclassified	Up to 4; Min. 1 classified, 1 unclassified	Up to 3; Min. 1 classified, 1 unclassified	Up to 4; Min. 1 classified, 1 unclassified
DISTRIBUTION	2 VGA	2 VGA	1 VGA	2 VGA

Figure 48. SOI Standard Tactical Tables
(SOI, 2011b)

N. ALL-SOURCE CENTER: SOCC'S INTELLIGENCE FUSION CELL

Fusion of intelligence gathering and sharing across government agencies and among allied nations has become a major priority. Strides to improve intelligence gaps have been made since the beginning of the Global War on Terror. All U.S. SOF task forces are implementing intelligence fusion cells, as seen in Figure 49, at the deployable HQ level.

Figure 49. All-Source Center
(Joint Intelligence, 2007)

Intelligence fusion is defined as

> the process of collecting and examining information from all available sources and intelligence disciplines (Figure 48 identifies these disciplines) to derive as complete an assessment as possible of detected activity. Intelligence fusion draws on the complementary strengths of all intelligence disciplines, and relies on an all-source approach to intelligence collection and analysis. Fusion relies on collection and analysis efforts that optimize the strengths and minimize the weaknesses of different intelligence disciplines. Information is sought from the widest possible range of sources to avoid any bias that can result from relying on a single source of information and to improve the accuracy and completeness of intelligence. The collection of information from multiple sources is essential to countering the adversary's operations security and deception operations. The operations of all collection sources must be synchronized and coordinated to allow cross-cueing and tip-off among

collectors. All-source, fused intelligence results in a finished intelligence product that provides the most accurate and complete picture possible of what is known about an activity. While the level of detail in single-source reports may be sufficient to meet narrowly defined customer needs, fused reports are essential to gain an in-depth understanding. Because the adversary will engage in deception efforts, analysts should guard against placing unquestioned trust in a single-source intelligence report. (Joint Intelligence, 2007)

Figure 50. Intelligence Disciplines, Subcategories, and Sources
(Joint Intelligence, 2007)

The ASC must be capable of managing large amounts of data. The requirements of the data management for the ASC can be broken down into three basic areas or categories: satellite communications (SATCOM) bandwidth, data storage, and processing speed.

1. SATCOM Bandwidth

The ASC will be utilizing most of the SOCC bandwidth. The ASC's bandwidth consumption includes the following components:

1. full-motion video (FMV) from the ISR feeds;
2. high-resolution imagery files;
3. large target intelligence package (TIP) files—usually containing large images, more imagery, maps, video, etc.; and
4. Reach-back capability—communicating to host command, higher headquarters, or larger intelligence fusion centers, which will allow the ability to communicate by voice or post office protocol video teleconferencing (PoP-VTC), as well as transmitting large data files that contain satellite imagery, HUMINT files, power, and so forth. This capability requires significant amounts of bandwidth over a network.

The number of ISR assets, the size of the files transmitted, and the frequency of transmission will drive the requirement for SATCOM bandwidth. Additionally, the way in which operations are conducted can also drive SATCOM bandwidth requirements. For example, if the SOCC must reach back for support in terms of satellite imagery, target analysis, and so forth, then this may drive larger SATCOM bandwidth requirements than if imagery were preloaded into computers or servers that are part of the organic SOCC package that is fielded with the advance party.

NSHQ requires each SOTG to be able to monitor up to two ISR feeds at one time. NSHQ also requires that the SOCC be capable of monitoring up to 12 ISR feeds at one time. As mentioned earlier, ISR feeds are one of the largest consumers of SATCOM bandwidth. The SATCOM bandwidth must also support the SOCC HQ (75–150 personnel) and six SOTGs (30–60 personnel each). NSHQ's initial estimate of its SATCOM bandwidth requirement is for a meshed network with a total of 38 Mbps over a JOA and six Mbps dedicated for reach-back. Figure 51 illustrates this bandwidth estimate, which includes four Mbps for each SOTG (one Mbps for each of the two ISR feeds, two Mbps for PoP-VTC, voice over internet protocol [VOIP], e-mail, and web); 14

Mbps for the SOCC (one Mbps for each of the 12 ISR feeds; two Mbps for PoP-VTC, VOIP, e-mail, and web; two Mbps for NSHQ reach-back; and four Mbps for data traffic outside of the joint operations agreement).

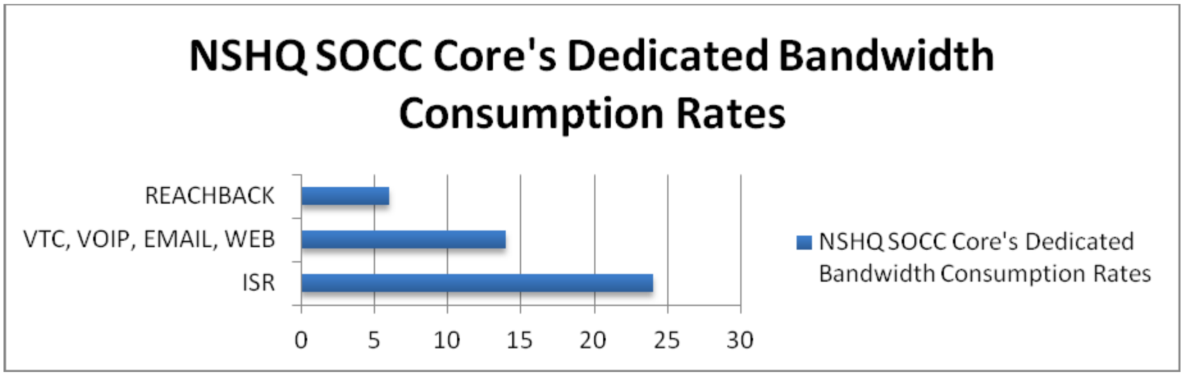


Figure 51. Estimated SATCOM Bandwidth Consumption

Note. This table was built based on information provided by NSHQ.

SATCOM bandwidth is very expensive, and it is not getting any cheaper.

> The U.S. Defense Department in recent months has seen price increases as great as 300 percent for commercial satellite communications. Military customers experienced 'sticker shock' as task orders for bandwidth and managed network services expired and were replaced with new orders—reflecting current market prices—awarded under the recently established Future Comsatcom Services Acquisition (FCSA) contract. (Brinton, 2011)

In our research, we found that bandwidth consumption is far more complex than assigning a few Mbps here and there. Several variables determine bandwidth consumption, such as the types of frequency bands, satellites, equipment, computer hardware and software, encryption, number of bits, and so forth. Many of these variables fall outside the scope of our research. Because the ASC will be utilizing the majority of the bandwidth, our goal is to identify the largest drivers of bandwidth, illustrated in Figure 52, and suggest some simple solutions to use the bandwidth more efficiently.

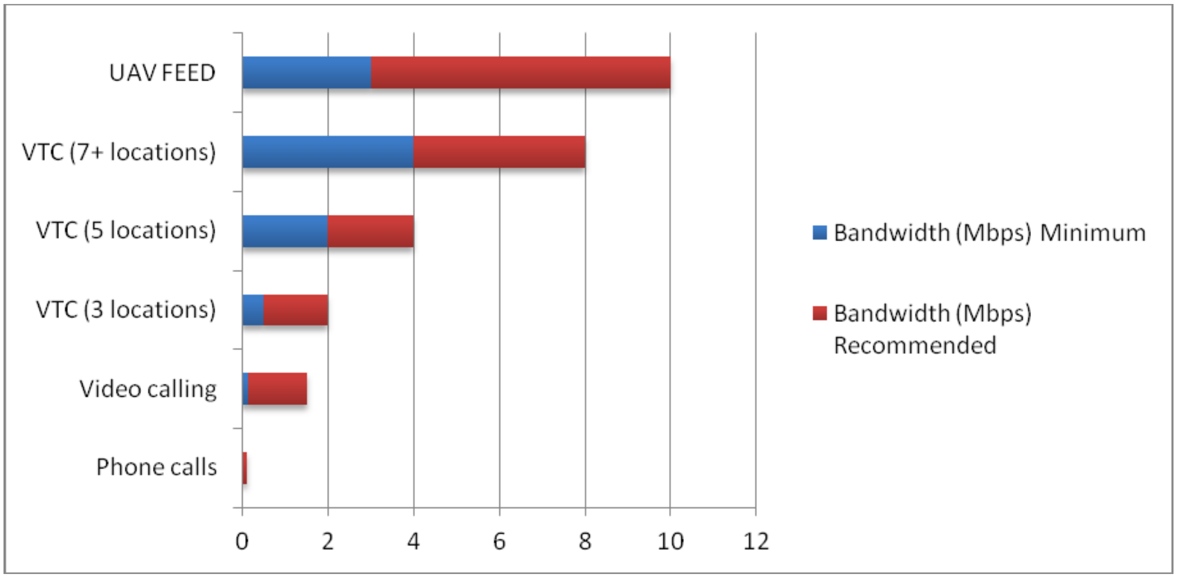


Figure 52. Typical Bandwidth Consumption Rates Spectrum

Note. This graph was developed from information gathered from multiple sources.

To gain a better understanding of the factors that determine bandwidth usage, our research team visited the following sites: Support Activity One (SUPACT 1), which is Naval Special Warfare Group One's (NSWG-1) intelligence ASC command and NSWG-1's mobile communication's team (MCT). These units suggested two alternatives to cut down on SATCOM bandwidth usage. The first, as we mentioned earlier, involves preloading as much data (e.g., imagery, TIPs, etc.) pertaining to the area of operation (AOR) as possible onto storable hard drives. Intelligence analysts require detailed satellite imagery and pictures to conduct their analyses. The level of detail, the size of the file, and the time it takes to send and receive the file on a network are correlated. Preloading as much satellite imagery and pictures will save time and bandwidth consumption. The second alternative is to utilize the global broadcast service (GBS). The GBS leverages commercial direct broadcast satellite technology to deliver critical information to the nation's warfighters (Raytheon, 2011). It will eat up less bandwidth because it acts as what could be termed "DirectTV for the warfighter," in that it is a receive-only technology that streams data and video through your broadband communications link, but at a smaller fraction of bandwidth because you do not need the same amount of bandwidth to transmit and receive. GBS offers a Department of Defense

(DoD) wideband asset that provides both classified and unclassified high data rate, direct broadcast to military members worldwide. NATO is also planning to launch a Satellite Broadcast Service (SBS) as a counterpart to the U.S. Global Broadcast Service (NATO, 2003).

Windmill International, Inc., provides commercial off-the-shelf GBS packages that would be ideal for NSHQ. Table 2 illustrates the pricing packages that Windmill (2011) has to offer.

> The system is made up of two key components, the Receive Terminal (RT) and the Receive Broadcast Manager (RBM). The Receive Terminal includes the antenna/positioner, integral Integrated Receiver Decoder, an accessory kit for the RT, shipped in a hard-sided airline rolling bag suitable for checked baggage. The RBM consists of a PC, standard windows software, FazzT software, and interconnect and power supply cables. This is shipped in a hard-sided rolling case suitable for airline carry-on. Total system weight in the cases is 78lbs. The system is designed to be hand carried—the RT can be carried over-the-shoulder or by hand and outside its transit case it meets airline carryon luggage requirements. The PC, and any needed cables, can be carried separately in a standard briefcase or computer bag. Total system weight in this hand-carry configuration is approximately 31 pounds.

Table 2. Commercial Pricing for Windmill GBS
(Windmill, 2011)

		Commercial Pricing	
Qty	RT	RBM	Suite
1	$109,842.33	$18,686.73	$128,529.07
10	$ 91,535.28	$15,572.28	$107,107.55
25	$ 78,432.27	$15,977.49	$ 94,409.76
100	$ 62,734.25	$15,438.75	$ 78,173.01

Product Support	$ 9,950.00
On-Site Training	$ 23,750.00
Solar Power Accessory Kit	$ 4,385.00

2. Data Storage

Large volumes of data storage are necessary to house the working and reference files necessary to support operations. Table 3 shows the many variables and the wide spectrum in imagery file size. As an illustration, if a mission requires 10 images and each image averages 800 MB, then data storage for satellite imagery alone will require 8 GB of space. In addition to storage for imagery, HUMINT operations require large volumes of data storage for various file types (e.g., images, text, audio, and video) for one particular source or target; such files can require gigabytes of storage space. In addition, working files need to be stored on site, and these also include image files, large databases, text and rich text format, briefings, audio, and video. All of these different capabilities, taken together, require several terabytes of storage. We realize that as data compression technology becomes better and more available, storage requirements could go down. However, our experience has shown that as more new technologies are fielded on the battlefield—such as Lighthouse[3] and the Biometric Analysis Tracking System (BATS[4]; see Figure 53), other intelligence gathering and analysis tools and data,and so forth—the demand for storage is more likely to increase than to decrease. Further, data storage technologies are becoming cheaper and smaller every day.

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[3] Lighthouse is a revolutionary technology innovation system for smart phones, capable of quickly mapping elements in the human terrain, such as tribes, family, links, livelihood, basic necessities consumption, and customs.

[4] The BATS uses thumbprints and facial and retinal scans to identify foreign persons of interest to human intelligence and counterintelligence personnel.

Table 3. Imagery File Size Spectrum
(DigitalGlobe, 2005)

	Product Option and Ground Sample Distance								Bit depth
	Black & White		Color (3-band)		Multispectral		Pansharpened (4-band)		
	60 cm	70 cm	60 cm	70 cm	2.4 m	2.8 m	60 cm	70 cm	
Standard and Orthorectified Imagery (1 km^2)	3 MB	2.2 MB	8.5 MB	6.3 MB	0.75 MB	0.55 MB	11.3 MB	8.4 MB	8
	6 MB	4.4 MB	17.0 MB	12.6 MB	1.5 MB	1.1 MB	22.6 MB	16.8 MB	16
Standard and Orthorectified Imagery (100 km^2)	300 MB	220 MB	850 MB	630 MB	75 MB	55 MB	1130 MB	840 MB	8
	600 MB	440 MB	1700 MB	1260 MB	150 MB	110 MB	2260 MB	1680 MB	16

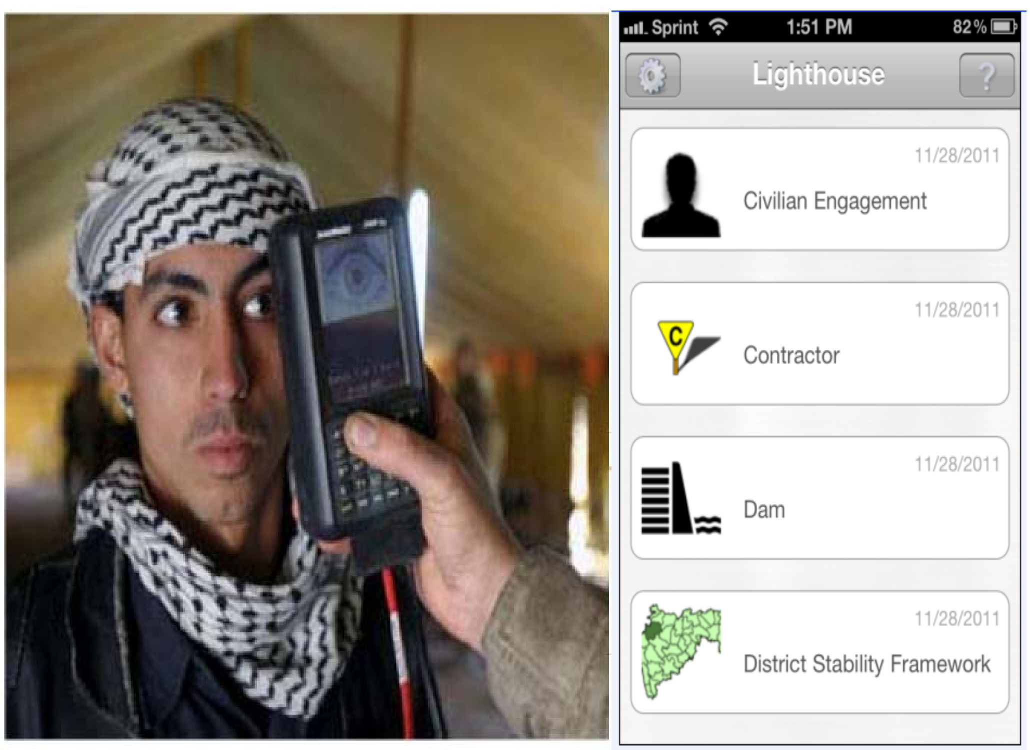

Figure 53. The Biometric Analysis Tracking System, left (Joint Intelligence, 2007)**, and Lighthouse Main Menu, right**

Note. Lighthouse menu image provided by Naval Postgraduate School Core Lab.

3. Processing Speed

Processing speed is critical for operating large database programs that include social network analysis software such as Palantir[5] (see Figure 54), which manipulates large databases and other files to rapidly analyze tactical information obtained from the battlefield so that the information and knowledge may be utilized for follow-on missions and targets. The ability to do this better and faster than the enemy is what provides the SOCC with its ability to establish and maintain intelligence dominance. Therefore, purchasing machines with the highest processing speeds, dictated by the latest technology, is highly recommended.

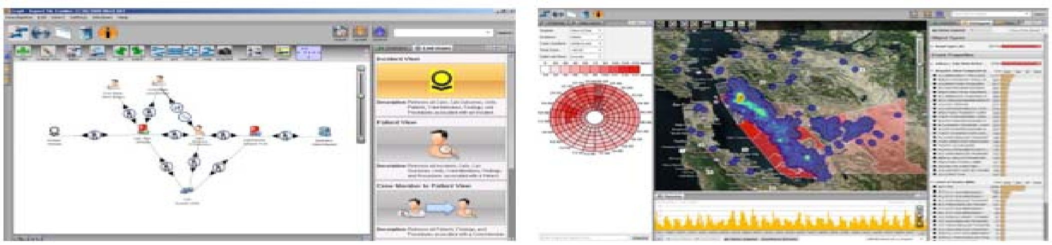

Figure 54. Images from Palantir Intelligence Analysis Software
(Palantir Technologies, 2012)

O. THE BATTLEFIELD INFORMATION COLLECTION AND EXPLOITATION SYSTEM

The Battlefield Information Collection and Exploitation System (BICES) is the U.S.'s designated system for intelligence sharing with NATO and the NATO member

[5] "Palantir empowers decision-makers at every level by providing them with a robust analytics platform that displays, organizes, stores, and analyzes the complex fabric of friendly, threat, neutral and clandestine human terrain in a multi-dimensional environment.

1. **Save thousands of man hours.** Palantir allows you to see all of your data, from many systems, in a single place and automates hundreds of tasks that analysts currently do manually. Search through all your data at high speed to pull out significant intelligence.
2. Palantir's power allows organizations to **make discoveries that would otherwise be impossible to make** even with 10x the manpower. Palantir's advanced analytical functionality not only reveals important connections, but allows users to share in real time so that **a unit's discovery is automatically shared** with the larger organization and stored for future retrieval.
3. **Units obtain the intelligence they need immediately**, instead of waiting for it to be disseminated down (automatically controlled to their authorization and clearance level). Democratized intelligence makes the whole organization smarter and more effective." (Palantir Technologies, 2012)

nations. The diagram in Figure 55 illustrates how BICES operations are centered at RAF Molesworth, UK (Joint Analysis Center), and are extended to Kabul, Tampa, Hawaii, and Washington, D.C. U.S. BICES provides NATO Secret with connectivity to all U.S. Combatant Commands (COCOMs), Services, and many agencies. The U.S. BICES framework (services and capabilities) acts as an extension to all the COCOMs. In addition, there is heavy NATO usage of BICES, because several non-NATO nations make use of it to share information with NATO nations and to obtain releasable information. In addition to access to nationally released intelligence products, BICES provides intelligence tools that can be used for analysis and operations planning.

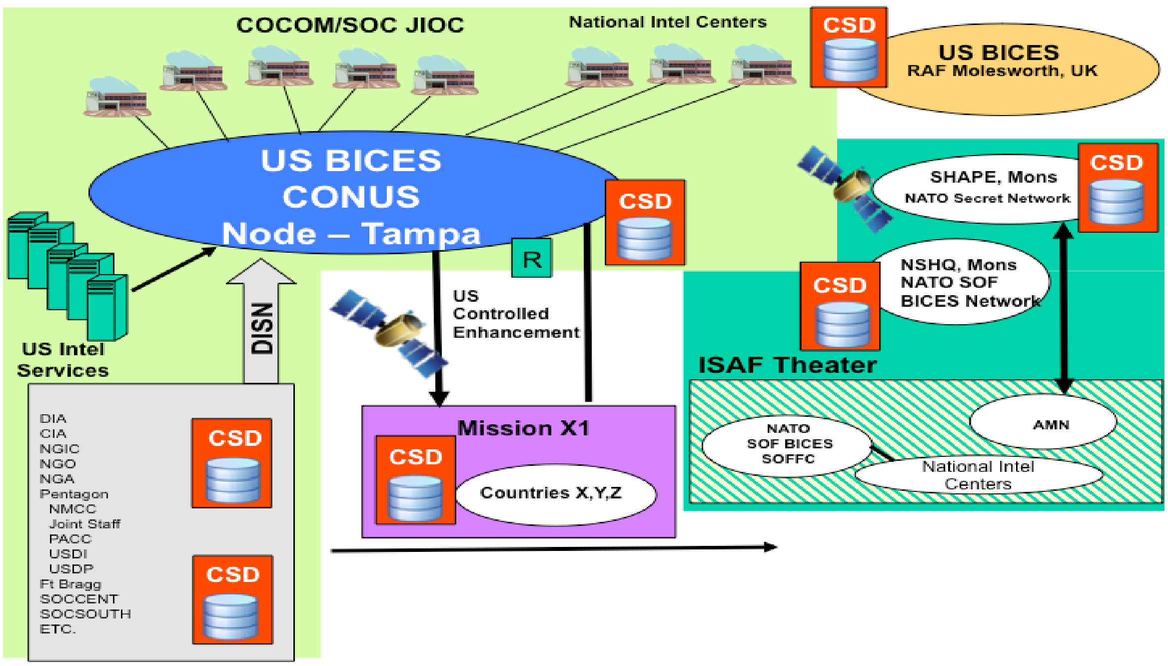

Figure 55. BICES Network Diagram

Note. Diagram provided by SOCOM.

BICES provides NATO Secret with the ability to communicate with BICES member nations and NATO using secure e-mail, secure voice and VTC (via VOIP Face Phone), and shared early warning of Tactical Ballistic Missile (TBM) launches. The services that U.S. BICES provides are a metadata tagged product database (finished and tear line); an Imagery Product Library (IPL); Global Command and Control System—Integrated Imagery and Intelligence (GCCSI3); Harmony; Google Earth; FMV via

PSDS2; Combined Information Data Network Exchange (CIDNE); and secure social networking. BICES provides access to operational tools to support strategic, operational, and tactical communications requirements (see Figures 55 and 56). BICES is currently being utilized by NSHQ and its SOTGs in Afghanistan (see Figure 57).

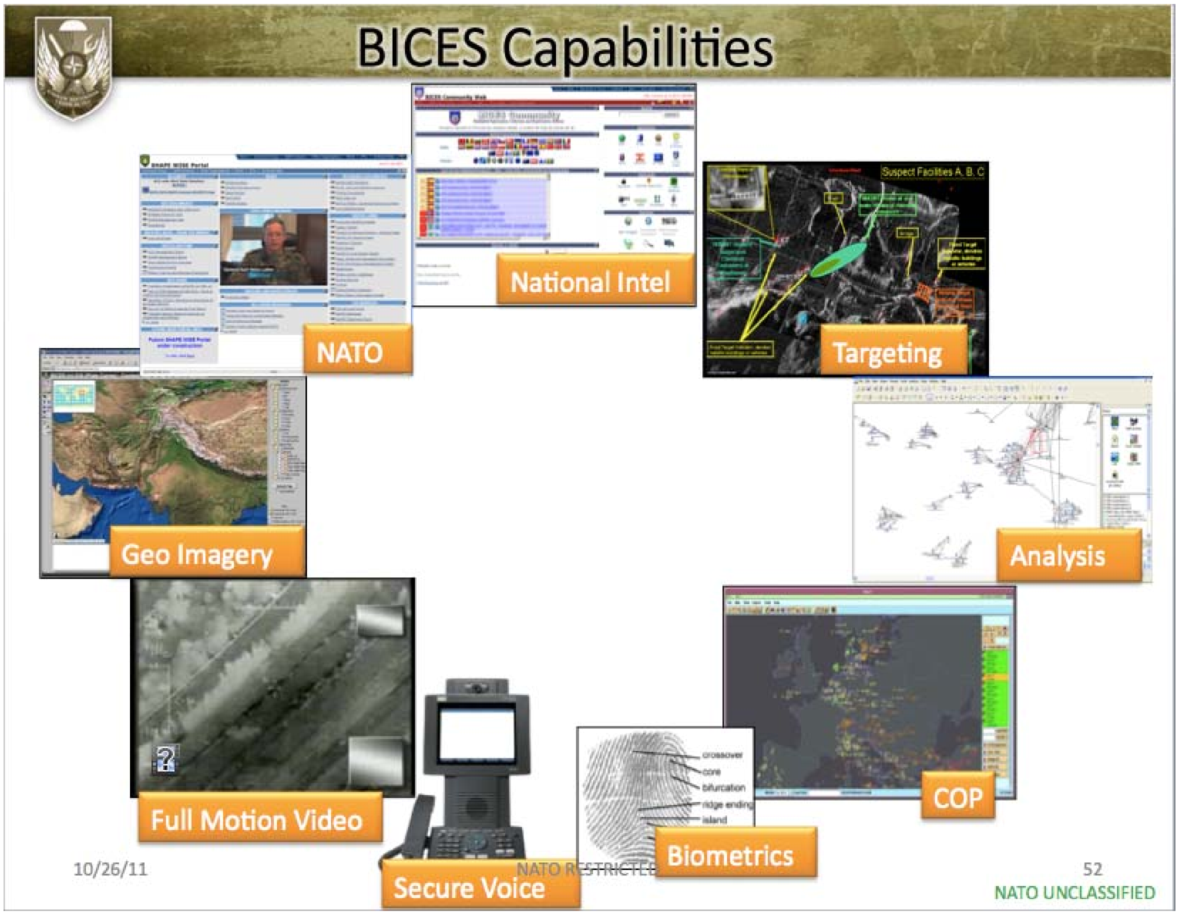

Figure 56. NSHQ SOCC Concept for BICES

Note. Diagram provided by NSHQ.

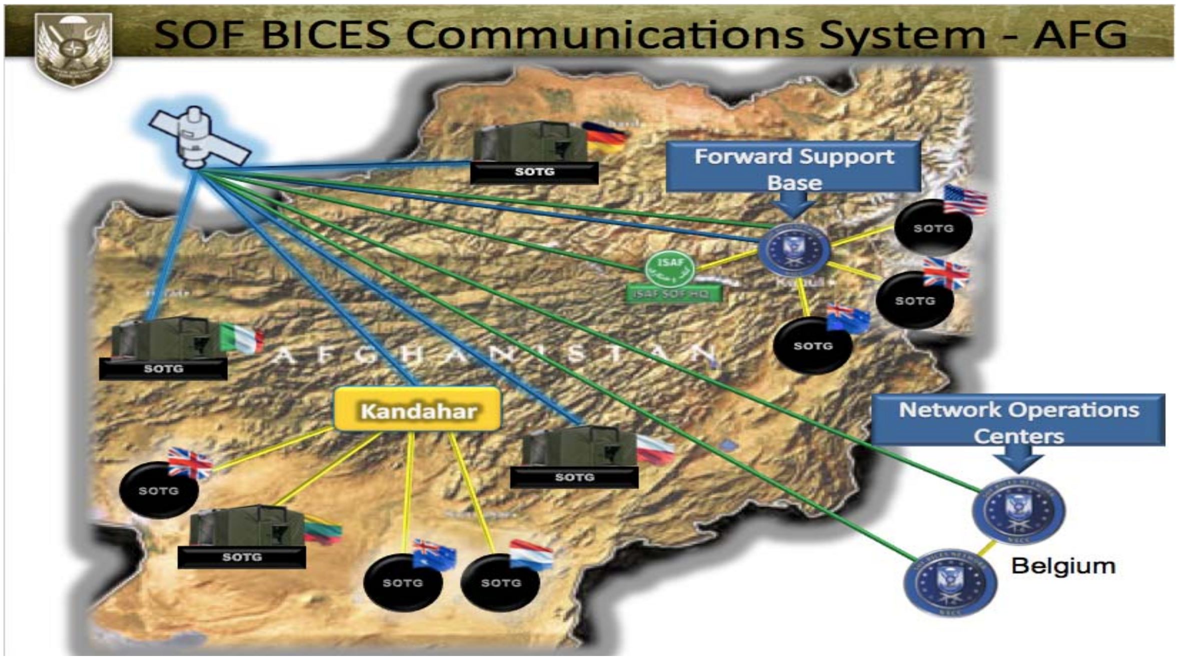

Figure 57. BICES Currently Being Used in Afghanistan

Note. Diagram provided by NSHQ.

P. SIGNAL CENTER

Special Operations Force Deployable Node-Lite (SDN-Lite[vx]; see Figure 58) is a deployable secure satellite communication system that provides secure voice, video, and data via a lightweight, commercial air transportable kit. The SDN-L(vx) provides high-capacity BLACK voice/data and RED voice/data/video to small SOF teams (four to eight personnel) operating self-sufficiently at remote locations. The SDN-L(vx) provides essential communication capability for situational awareness, mission planning, analysis, collaboration, and real-time mission coordination for SOF teams. It provides deployed SOF teams seamless interaction with their respective theater; the USSOCOM; the DoD; and any national-level command, control, communications, computers, and intelligence (C4I) systems during short-term deployments or during the initial phases of an operation when no other in-theater, secure, tactical C4I structure exists.

Figure 58. Special Operations Forces Deployable Node-Lite(vx)

Note. Image provided by SOCOM.

The USSOCOM has developed and fielded the SDN-L(vx), and tailored it to the C4I requirements of the tactical SOF community. The concept of the SDN-L(vx) (see Figure 59) is to provide high bandwidth network-centric communications capability in a very small package that requires minimal specialized operator training. The SDN-L(vx) package will be ideal for a small advanced liaison (ADVON) and liaison elements that will be representing NSHQ throughout the AOR.

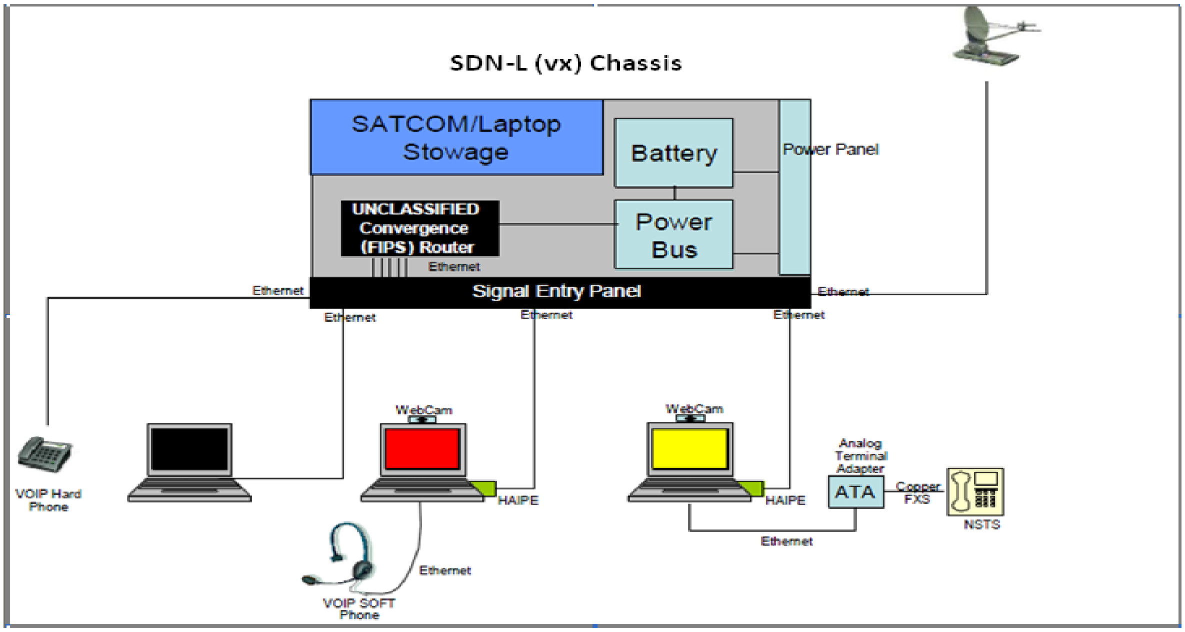

Figure 59. SDN-L(vx) Systems Capabilities Diagram

Note. Image provided by SOCOM.

SDN-Medium (SDN-M) is a deployable, lightweight, commercial air transportable, secure satellite communications system that provides secure voice, video, and data services. The SDN-M (see Figure 60) includes everything in the SDN-L(vx) plus additional equipment that provides deployed SOF with a first-in, robust C4I capability. It ensures deployed SOF seamless interaction with their respective theater, the USSOCOM, the DoD, and any national-level C4I systems during short-term deployments or during the initial phases of an operation when no other in-theater, secure, tactical C4I infrastructure exists. In prolonged, large-scale operations, sustained C4I support can be provided by theater communications assets with the SDN-M being used in an augmentation or supporting role.

Figure 60. Special Operations Forces Deployable Node-Medium

Note. Image provided by SOCOM.

USSOCOM has developed and fielded the SDN-M to meet the C4I requirements of the tactical SOF community. The concept of operations, illustrated in Figure 61, is simple: Enable a deployed SOF team of 10–15 personnel with the ability to access the same sensitive compartmented information (SCI), collateral, and unclassified C4I services that are available to them in garrison (via SOF tactical gateways) from deployed locations around the world. The SDN-M package will be ideal for the initial 70-man Core element that will deploy during the first phase.

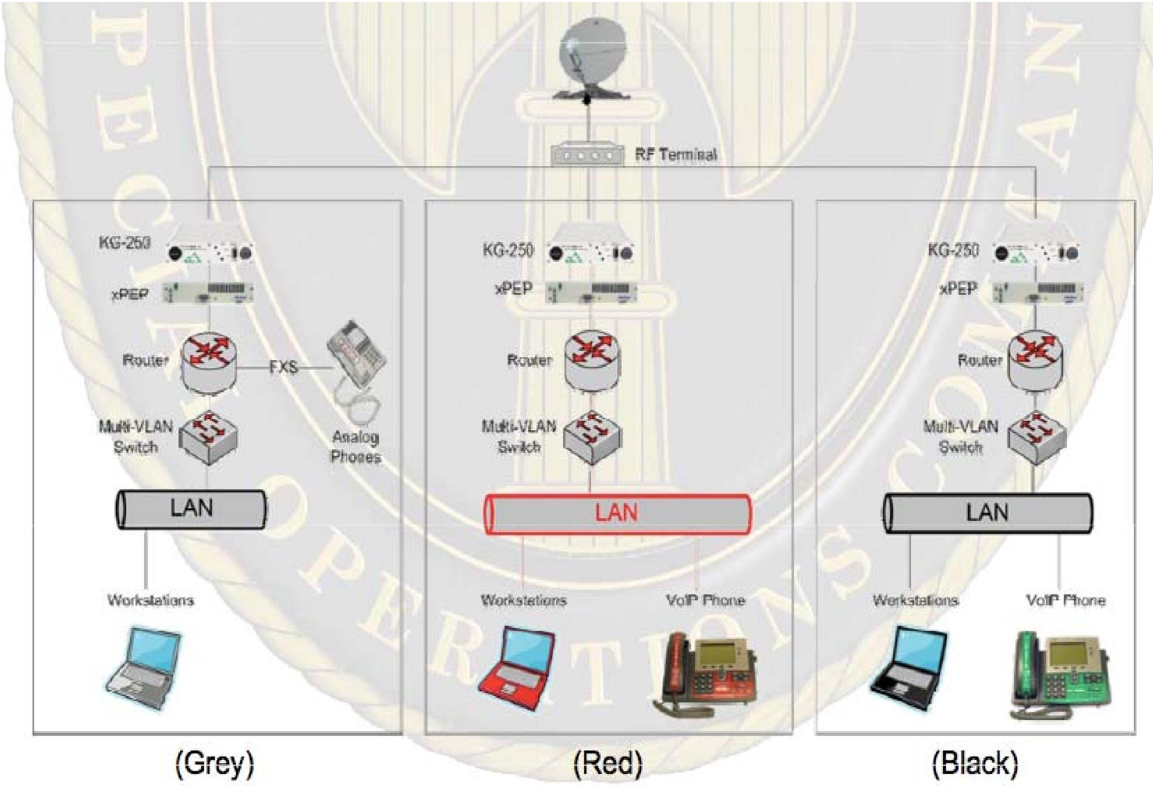

Figure 61. SDN-M Systems Capabilities Diagram

Note. Image provided by SOCOM.

The SDN-Heavy (SDN-H; see Figure 62) provides a deployed SOF Headquarters with a first-in, robust C4I capability. It ensures deployed SOF seamless interaction with their respective theater, the USSOCOM, the DoD, and any national C4I systems during short-term deployments or during the initial phases of a long-term operation when no other in-theater, secure, tactical C4I infrastructure exists. In prolonged, large-scale operations, sustained C4I support will be provided by theater communications assets, with the SDN-H being used in an augmentation or supporting role.

Figure 62. Special Operations Forces Deployable Node-Heavy

Note. Image provided by SOCOM.

The SDN-H concept of operations is simple: Enable the deployed SOF commander (for example, the commander of the Joint Special Operations Task Force [JSOTF]) and his staff with the ability to access the SCI, collateral, and unclassified C4I services that are available to them in garrison, from deployed locations around the world as illustrated in Figure 63. The SDN-H is ideal for the SOCC Core at its full operational capacity.

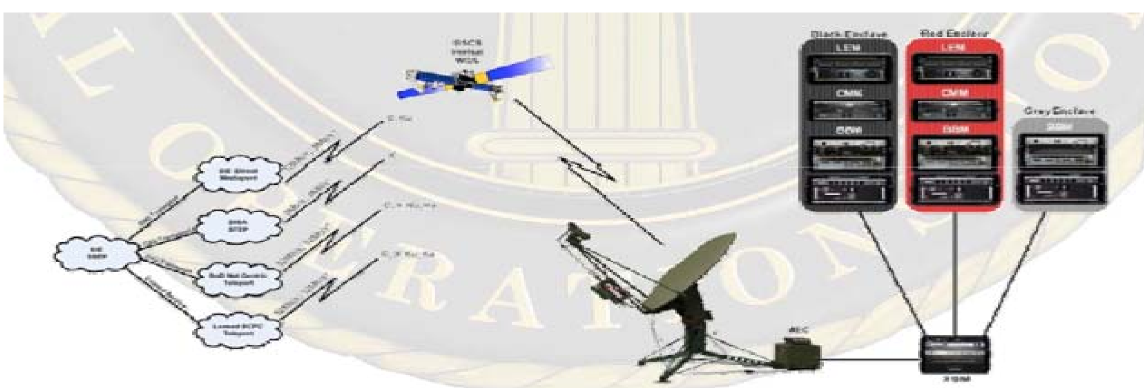

Figure 63. SDN-H Systems Capabilities Diagram

Note. Image provided by SOCOM.

In this section, we introduce the concept of light, medium, and heavy SDN systems. Different organizations may have different definitions of these terms, but we present ours in order to create a common language for our discussion of these terms in this thesis. Table 4 describes the capabilities, Table 5 lists the major pieces of hardware, and Table 6 estimates the package costs of each of these three levels.

Table 4. SDN-Family Capabilities Chart

Note. Information provided by SOCOM.

SDN-Lite(vx)	SDN-Medium	SDN-Heavy
Capabilities: Black Services: • Voice • Data Red Services: • Voice • Data • VTC and full-motion video	**Capabilities**: Black Services: • DSN and commercial voice • Black data Red Services: • Red voice (SCAMPI/DRSN) • Red data • Red VTC • Special circuits Grey Services • Grey voice • Grey data • Grey VTC • Special circuits	**Capabilities**: SDN-H is everything over IP (EoIP) system that employs a flexible and modular design. Black Services: • 96 available data ports • 96 supported IP phones • 36 POTS phone ports (incl. STUIII/STE) Red Services: • 144 available data ports • 144 supported IP phones • 60 POTS phone ports (incl. STUIII/STE) Grey Services: • 46 available data ports • 12 POTS phone ports (incl. STUIII/STE)

Table 5. SDN-Family Major Pieces of Hardware Chart

Note. Information provided by SOCOM.

SDN-Lite(vx)	SDN-Medium	SDN-Heavy
Major pieces of hardware: VSAT: • 0.9M VSAT • iDirect Evolution Modem • 700 BRX UPS Black Baseband: • Cisco 1812 Router • FIPS 140-2 certified • 6 port switch with PoE • Power conditioner • Power backup • 4 conditioned AC outputs Red Baseband: • SecNet 54 • Klas 2150 • 8 ports, 1 w/PoE • Integrated power backup Devices: • CF-19 laptop • CF-52 laptop • Cisco 7941 IP phone	**Major pieces of hardware:** 1.0M Hawkeye Lite Ku-Band auto acquire SATCOM terminal Everything included in the SDN-L(vx) plus the following equipment: COTS equipment CISCO routers • Multi-VLAN switches • 8 port switches • Laptop computers • Cisco/Avaya IP telephones • VoIP soft telephones • Flatbed scanner • Projector • Desktop cameras • Headsets • Color printers • KG-250 • xPEP	**Major pieces of hardware:** DMSC 2.4M Deployable Tri-Band or Quad-Band SATCOM Terminal Everything included in the SDN-M plus the following equipment: Black and Red Baseband Modules (BBM) • ViaSat KG-250 HAIPE Encryptor • ViaSat xPEP TCP accelerator • Cisco 3825 Router • Net VX900t voice accelerator • BlackBox VDSL wire modems Grey BBM • ViaSat KG-250 HAIPE encryptor • ViaSat xPEP TCP accelerator • Cisco 3825 Router • BlackBox VDSL wire modems

		Uninterruptible Power Supply (UPS) • 1500VA UPS Local Expansion Module (LEM) • Cisco Catalyst 3560 switch • Cisco VG224 analog phone gateway • BlackBox VDSL wire modem • 1000VA UPS Call Manager Module (CMM) • Cisco 7825 call managers with CM

Table 6. SDN-Family Estimated Cost

Note. Information provided by SOCOM.

SDN-Lite(vx)	SDN-Medium	SDN-Heavy
Cost**:** **$220 thousand** each	Cost: **$400 thousand** each	Cost: **$2.2 million** (comes with complete tactical local area neatwork [TACLAN] suite)

In addition to the SDN packages, the U.S. SOF units supplement their communications with a TACLAN suite. Each TACLAN suite, illustrated in Figure 64, consists of three easily transportable, multiple-integrated networks; 60 general use laptops; and 10 intelligence laptops. A TACLAN network contains commercial servers, routers, and hubs, which can operate at user-selectable classification levels (e.g., unclassified, collateral, coalition, or SCI networks). A TACLAN suite will allow SOCC to create its own domain. It includes three large racks of servers, 70 computers, and its own UPS. The TACLAN holds a huge amount of storage, runs its own e-mail exchange, and can be remotely accessed. The TACLAN suite provides a package of independence and an abundance of storage.

Figure 64. Tactical Local Area Network

Note. Image provided by SOCOM.

SDN-L(vx) packages can be used for liaisons who represent the SOCC and allow them to travel with a small portable communications package that gives them compatible/interoperable communication equipment so they can send and receive information. Secure iridium satellite phones (see Figure 65) can be a cheaper alternative for this task. As their last resort communication alternative, all U.S. SOF units use iridium satellite phones. These phones will be a necessity at the SOCCs and SOTGs. They cost $1,500 for unsecure phones and $3,000 for the secure iridium satellite phones.

Figure 65. Iridium Phones
(Iridium Communications, n.d.)

All the SOF units that our research team visited concur with a phased-in approach as a solution for a signal and communications infrastructure. This entails purchasing an SDM-H that comes with a TACLAN, an SDN-M, and a GBS suite for the SOCC Core HQ. The SDN-M, GBS, and TACLAN will deploy with the 70–man Core during the first phase. The TACLAN and GBS can supplement the SDN-M to make a more robust package that will increase its capabilities. The SDN-H will arrive with the main body during the second phase. The SDN-H will take the place of the SDN-M as the primary communications platform and the SDN-M will be used as back-up for the high priority users. The SOCC Core will also deploy with at least two SDN-L(vx) and three iridium phones. Additionally, each SOTG will deploy with a SDN-M, GBS suite, and an iridium phone. The total cost for this SIGCEN is estimated at $6.5 million (see Table 7).

Table 7. Total Cost of SIGCEN

Item	Quantity	Unit Cost	Total Cost
SDN-H	1	$2,200,000	$2,200,000
SDN-M	7	$400,000	$2,800,000
SDN-L(vx)	2	$220,000	$440,000
GBS SUITE	7	$128,529	$899,703
GBS Support	7	$9,950	$69,650
GBS Training	1	$23,750	$23,750
Iridium Phone	9	$3,000	$27,000
		Total Basic Cost of SIGCEN=	$6,460,103.00

VI. RECOMMENDATIONS

In developing our conclusions for the SUPCEN, we considered the following factors: weight, size, costs, ease of setup, durability, transportability, environmental factors, and function. All of the manufacturers we compared surpassed the minimum requirements and standards we received from the NSHQ's J4. As we stated earlier, there are other manufacturers of military camps, but these four companies were most often recommended to our team during our initial meetings with several operational military units. As our data shows (see Table 8), Alaska Structures came out on top in almost every category. We used three measuring criteria for our table: exceeded requirements (●), met requirements (◑), met requirements/substandard (○). In our study, *exceeded requirements* meant the manufacture was well above the minimum requirements we received from the NSHQ or the feedback we received from the various units was well above average. *Met requirements* meant the manufacture met all of the minimum requirements we received from the NSHQ and the feedback from the units in the field was either neutral or had a mix of both positive and negative comments. *Met requirements/substandard* meant that the manufacturer met all of the NSHQ requirements but most of the feedback from the units in the field was negative. In the following section, we briefly cover each manufacturer and discuss some of the bigger factors that led to our conclusions.

When we started the camp study, we initially wanted to analyze each manufacturer's shelters, generators, and ablutions. We studied the shelters and ablutions in great detail, but, when it came to generators, we found that the commands and units were looking for smaller generators. Most of the units we talked to could not tell us who manufactured their generator or where it came from. Most of the units did not care who manufactured the generators; instead, what they wanted were smaller generators. For example, for the soft-sided shelter systems (AKS, Base-X, and DRASH), users preferred the 35 kW generators over the 60 kW generators that are standard for most camps. With the Weatherhaven systems, users wanted a smaller generator than the current 35 kW generator, which is standard for this system; the noise was the primary reason. Users found that the 60 kW generators were more unreliable, and if they lost one generator, they did not necessarily have a back-up option. To overcome this issue, users suggested getting two 35 kW generators instead of one large 60 kW generator. This gives the camps more options if one generator goes down for any reason. A generator loss can be more easily compensated for, if a redundant system is available. Also, the 35 kW generators make considerably less noise than the bigger 60 kW generators.

Table 8. Manufacture Comparison

	WEATHERHAVEN SOFT SHELTER	WEATHERHAVEN HARD SHELTER	ALASKA STRUCTURES	DRASH	BASE-X
Availability in the supply system?	Yes	Yes	Yes	Yes	Yes
Has it been tested operationally (Y or N)?	Yes	MECC has been test operationally, The TRECC has not	Yes	Yes	Yes
CH-47 (transport inside, sling load or both)	Both	MECC sling load only TRECC—both	Both	Both	Both
Training provided By company	Yes	Yes	Yes	Yes	Yes
Ease of set-up (time/personnel)	◑	◑	●	◑	◑
Transportable Package	◑	●	◑	◑	◑
Durability	◑	◑	●	◑	◑
Modularity	●	○	●	●	●
Environmental Protection of Equipment	◑	◑	●	◑	◑
Purchase Cost	●	○	●	◑	◑
Lifecycle Cost (maint, refurbishment, storage)	●	○	●	●	●
Spares Availability & Cost	●	◑	●	●	●

As we studied each manufacturer, we discovered that each was very good in the areas of training, transportation/shipping, and spare parts availability. Most of their customer service departments' promise 24/7 customer service availability. In the rest of this section, we break down several of the differences in these manufactures. When it came to transportation, we assumed the camp would have a HUMVV-type vehicle available for transporting some of the equipment for the last mile. As a result, we found several of the solutions we examined, particularly the HDT Global and DRASH systems that are set up on trailers, to be useful and effective.

One of the problems we heard from users in the field regarding HDT's Base-X was that this system's frames are not as rugged and sturdy as Alaska Structure's frames. We were told that the plastic and aluminum framing breaks. In addition, these systems have a field life of three years, while the Alaska Structures and DRASH systems have a field life of five years. We had problems gathering all of the cost data from HDT Global, the manufacturer of Base-X; they were reluctant to share their cost data with us, even after we had contacted them several times, so we could not do a good cost comparison against the other manufacturers. We really liked Base-X's alternative energy equipment. No other manufacturer came close to the equipment that HDT Global had available in the field. Their equipment was revolutionary, and we highly recommend looking into HDT Global's alternative energy equipment for any power requirements solution. Users with available alternative energy solutions were not as worried about the supply convoys making it to their camp, because they knew they had electric power available to them via the solar power they used in camp.

With the DRASH systems, we liked the M Series shelters for their overall size and for the convenience of shipping on DRASH's TMSS. Traditional DRASH systems are fitted on trailers and are convenient for a rapidly deployable DRASH. DRASH's trailer system was done well and users liked it. However, the shelter system itself was not rated as highly as the Alaska Structures and Base-X shelters. Several users had switched over to Base-X and Alaska Structures for their shelter systems, and they preferred these shelters due to their durability, ease of setup, and comfort. The DRASH representatives were very helpful in gathering information, and they provided great customer support when we were working toward a solution. Several units in the Army and Marines use DRASH and are happy with their shelters.

Weatherhaven had some of the most deluxe camp solutions we came across, and their products were exceptional. Their hard-sided shelters, the MECC and TRECC, truly show the convenience of a shelter system that is ready for rapid deployment and transportation. It is the convenience of having the shelter basically in a shipping container and ready to move. One of the issues we saw, but were unable to verify, related to the mobility of the MECC and the TRECC on sandy or soft ground terrain, or in a snow environment. The shelters move easily on firm, hard surfaces, but deploying them to an unknown area, where the terrain could easily change from mission to mission, could drastically affect the camp's ability to move to a more suitable place, which is a big concern. Weatherhaven's hard-sided shelters were very dependent upon deploying to an area with perfect conditions. In terms of the transportation of the SOCC, we were initially designing for a camp that could be internally loaded into a CH-47 "Chinook" helicopter. We visited a CH-47 squadron in Stockton, CA, that had supported Special Operations missions during Operation Enduring Freedom, and these aircrew members stated they preferred a tandem load underneath the helicopter (see Figure 67), rather than an internal load (see Figure 68). Several factors went into that recommendation, with increased safety being the first and most important. The aircrews (loadmasters) must be able to walk around the aircraft to perform visual checks outside the aircraft, while reporting continuous updates to the pilots throughout the flight/sortie. These safety checks are particularly important during landings and movement close to the ground, especially while operating in hostile environments. We gave the aircrew the dimensions of the TRECC, and they commented that it would be difficult to perform their safety checks with a large item, such as a TRECC, inside. Although it would not be impossible, they would rather tandem sling load the TRECC, if they had a choice. They preferred a tandem sling load to a single sling load (see Figure 66). The aircrews can drop off a sling-loaded item quickly, safely, and accurately (inside of a parking space), which results in less time spent in the operating area. The crew lands to drop off personnel and any internally loaded equipment.

Figure 66. CH-47 Single Sling Load

Figure 67. CH-47 Tandem Sling Load

Note. Image provided by Weatherhaven.

Figure 68. CH-47 Internal Load with TRECC

Note. Image provided by Weatherhaven.

Another issue we heard about from one of the users was the ability to keep the elements out of the Weatherhaven shelter. This issue affected the shelter's poor durability rating. The user told us that his unit encountered several leaks in their MECC and that mice had gotten into the wiring bundles under the MECC floors, because they were unable to seal off those areas. We spoke with Weatherhaven's representatives about this issue, and they said that they had addressed it, and it was fixed.

We also scored the MECC poorly in the life cycle cost area, because a user told us that the MECC had to go back to the manufacturer for upgrades and overhaul after 18 months, if exposed to the elements, and after 24 months, if it was under cover in theater. Each shelter costs an average of approximately $17,500 to repair. One of the users MECCs had to go back to the manufacturer for upgrades and modifications totaling approximately $70,000. Granted, it could be argued that the command asked for the upgrades to their MECC, and that these were the initial MECCs, so Weatherhaven has now incorporated the lessons learned into its current MECC design. However, we are concerned because, instead of just one component having to be sent in, the entire unit had to be sent in, thus increasing the total cost of maintaining the system over the whole life of the shelter.

The cost for the Weatherhaven solution was more than double the cost for the Alaska Structures solution. The cost could be better managed if Weatherhaven scaled back some of the MECCs that were slated for the ablutions. Each ablution cost $275,000, and a 150-person camp would require four MECCs to meet the camp requirements. Choosing a soft-sided shelter in that area alone would not only save over $1 million, but would also eliminate three sorties in getting these ablution facilities into the theater. We understand how nice the Weatherhaven MECC and TRECC are, but at that cost of luxury, our team did not see the cost benefit in going with the Weatherhaven solution. By eliminating the requirement for internally carrying the TRECC, we reduced the sortie requirements for a CH-47 helicopter from 40 to 31 and from 36 to 31, if the sorties combined the troop movement of 150 troops with moving the camp into theater.

We chose Alaska Structures for multiple reasons, but one of the biggest reasons was our observations of these shelters in the field. They were of the best quality compared to the other systems evaluated, and their ease of operation was high. The units we visited also had high praise for Alaska Structures' products. Numerous SOCOM units in the U. S. currently use Alaska Structures as their camp of choice. We did not select them for that reason alone. We considered several other factors, but we felt that it was important to mention that some of the leading SF units in the entire world use Alaska Structures' products: We wanted to find out why, and we did.

Several users said Alaska Structures were the easiest to set up and tear down, and most of the users we visited used multiple manufacturers' products for their camps. In fact, when that was the case, Alaska Structures was always the recommended manufacturer. A few of the other manufacturers' frames did not go up as easily and as quickly as the company stated.

Alaska Structures also surpassed the other manufacturers in the area of environmental conditions. Their shelters far exceeded our minimum requirements. For example, Alaska Structures' gable roof system shelter can handle snow loads of up to 125 lb/sq ft (56.7 kg/m2); and it tested successfully for wind loads of up to 120 mph (193 km/h). The AKSS was tested to successfully withstand wind loads of 70 mph (112.7 km/h) with gusts of 80 mph (128.75 km/h). Tests also showed that it can handle successfully a snow load of 20 lb/sq ft (9 kg/sq ft; (Alaska Structures, 2011f). Our minimum requirements were as follows:

1. able to withstand snow loads of 10 lb (5 kg) per sq ft (m) for 12 hours without damage to the frame or structure; and
2. able to withstand wind loads of 55 mph (89 km/h), with gusts up to 65 mph (105 km/h).

All of the shelters performed equally well in the area of temperature control and were operational from -20–120 °F (-29–49 °C).

Our final comparison point was cost data. In Table 9, our cost data includes all of the shelters, ablutions, and generators for the SUPCEN piece of the camp. We were given very close estimates from all of the manufacturers we studied, except for HDT Global's Base-X camp. We made several attempts to gather this data from multiple sources, but were unable to get the data from them.

Table 9. Shipping and Cost Comparison Table

Note. The data we received for this table were obtained from the manufacturers. These costs were approximations and were not actually quoted in a request for proposal.

Manufacturer	Cost	Required Number of 20-ft Shipping Containers
Alaska Structures	$2.8 M	27[6]
DRASH	$2.9M	17[7]
Weatherhaven	$5.9M	31[8]

Our comparison of all of the data and parameters set forth in this study shows that Alaska Structures is the best option. Figure 70 shows how each manufacturer ranked on a scale of 1–5, with 1 being the poorest result and 5 being the highest. Each manufacturer had the best product in at least one area; however, when all the factors were considered as a whole, Alaska Structures came out on top, and we would recommend it for use by any military force looking to assemble a rapidly deployable camp anywhere around the world. Our final solution is depicted in the drawing below from Alaska Structures of the 150-person SOCC camp (see Figure 69).

[6] The shipping data was received from Alaska Structures Engineering Department.

[7] The shipping data was received from DRASH Sales representative as an estimate.

[8] The shipping data was based off inputs received from Weatherhaven on an 84-man camp set-up. We multiplied the life support areas of the camp by a factor of 1.5 to get an estimate on shipping.

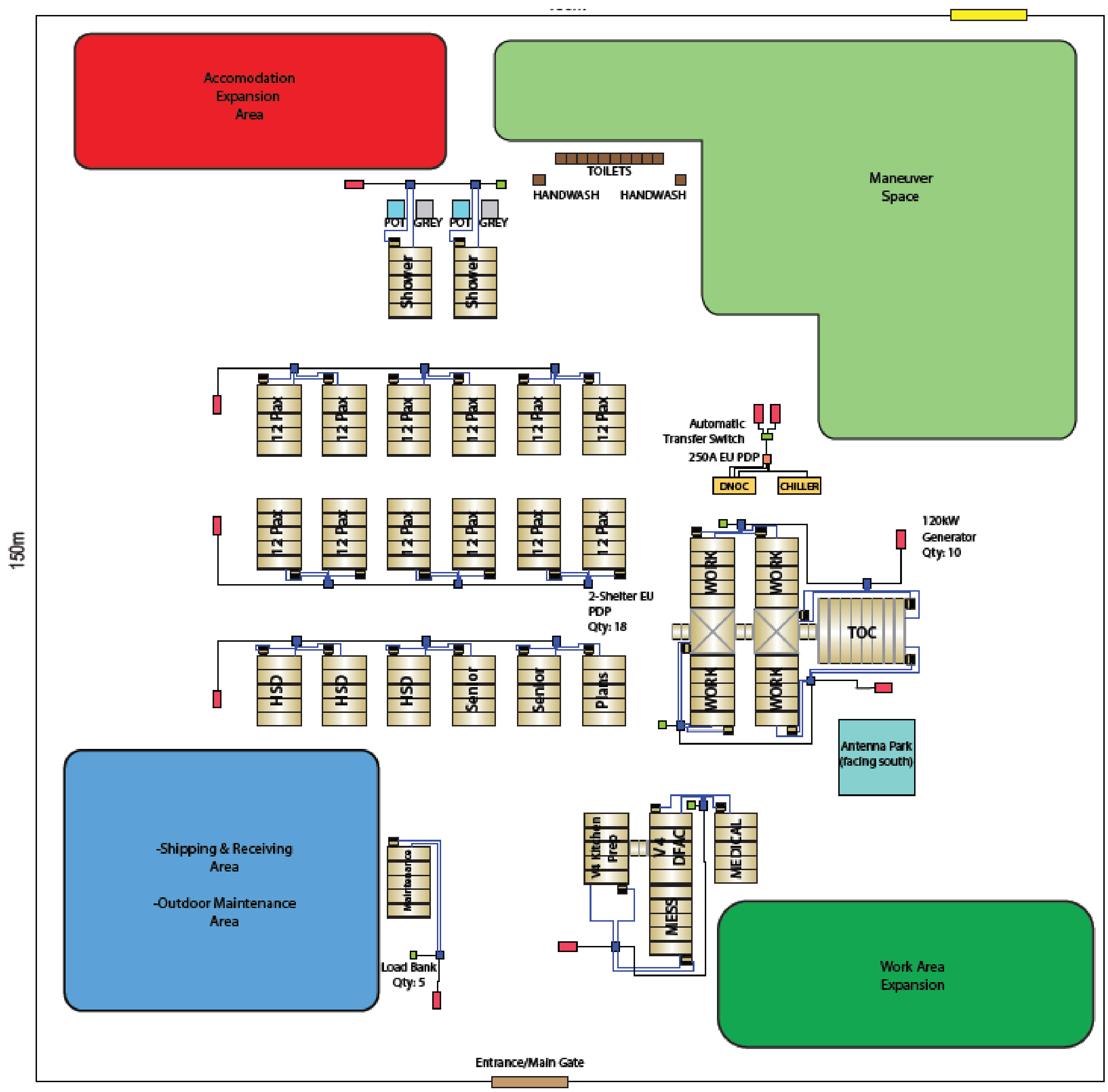

Figure 69. Alaska Structures 150 Camp Drawing
(Alaska Structures, personal communication, November 11, 2011[9])

[9] We received permission from Alaska Structures to use the camp diagram via an e-mail dated November 11, 2011.

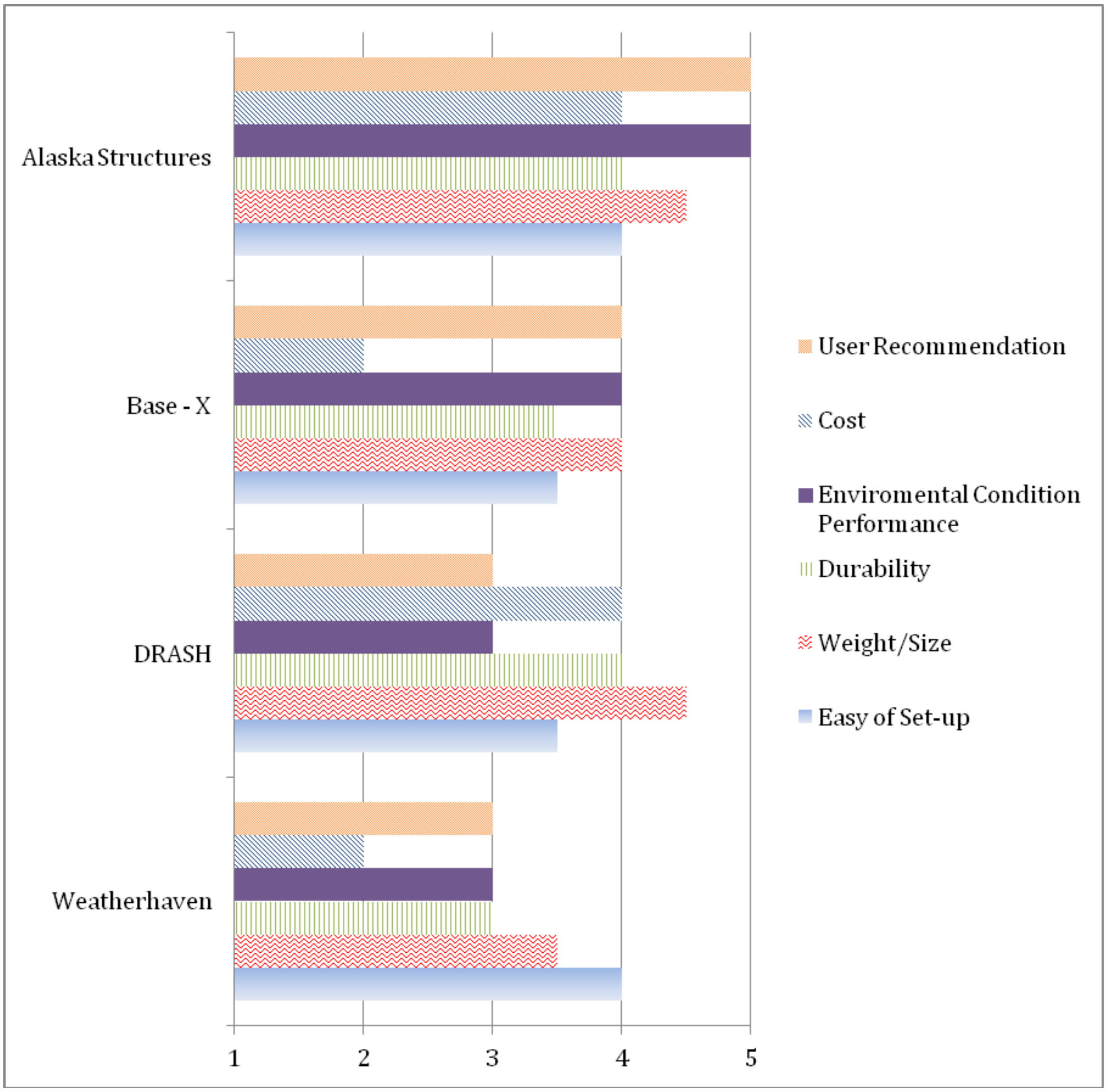

Figure 70. Major Decision Factors

In Figure 70 we present six of the major decision factors we took into account with this study. The first factor was the user recommendations we received from each of the units we visited. We measured everything on a scale of 1–5. In the user recommendations area, a 5 indicated that the users had no complaints and would recommend the product to another user. A score of 1 meant none of the users liked the product and would not recommend this manufacturer's camp. With the cost data, we gave a product a 5 if it was very cost effective and a 1 if it was not very cost effective. In the environmental conditions and performance area, we based the scoring criteria on published testing conducted on each camp, with a score of 5 indicating that the camp far exceeded the requirements and a 1 indicating that the camp did not meet the established requirements. With durability, we took into account not only published life expectancies, but also reports from users on how well a particular shelter performed under field conditions. A 5 meant well above average durability, and a 1 meant well below average durability. With weight and size, we looked at the ability to minimize and condense the camp for transportation: A 5 represented a small shipping footprint, and a 1 represented a very large shipping footprint. Our final criterion was ease of the setup, which included the time required to build the camp, as well as the equipment required to set up the camp. A 5 represented minimal time and tools required to set up the camp, and a 1 represented a long and difficult setup time and the requirement for outside tools and equipment to build the camp.

A required piece of special equipment is the skid loader. It is useful when setting up and tearing down the camp and is capable of handling many of the situations/issues encountered while operating a forward-deployed operational camp.

For the medical solution of this rapidly deployable camp, several good soft-sided shelter options were available by all of the manufacturers and were equally good at meeting general medical care requirements. But if the medical care requires a hard-sided shelter, the TRECC is a good option. The SOCOM units we visited in the U.S. used soft-sided systems for their solution. Our study did not evaluate the requirements necessary to perform the mission of the medical staff, but only compared what is currently available in the supply system and what is used by all military forces.

A. COMMAND AND CONTROL CENTER DISPLAYS

For the OPCEN, we considered either LCD or projector displays. Discussions with operational users revealed that plasma displays create too much heat and have a larger failure rate then LCDs and projectors. This explains the omission of plasma displays in the compilation of our final recommendations. DRASH and SOI were stood out from other manufacturers. In regards to the cables used to connect equipment in the OPCEN, there were two major choices: twisted cables (CAT6) and video graphics array

(VGA) cables. The VGA are less expensive, but heavier (.8 lb at 6 ft). On the other hand, the CAT6 twisted cable is much lighter (.15 lb at 6 ft), but more expensive. The weight has been the determining factor in numerous U.S. military units that have chosen the CAT6, and that cable is also our recommended choice.

We made a comparison of both manufacturers during a site visit to Ft. Bragg. The equipment of both manufacturers is currently fielded by operational SOCOM units. The operators were satisfied overall and provided recommendations in support of the equipment provided by both manufacturers. We also received price quotes from both manufacturers. SOI provided larger screens, several HD/LED monitors, and an overall better display package. When requesting future quotes, both manufacturers should be asked to provide a proposal, because both are competitive and their cost are comparable and come in around $200,000.

The SOI quote included the following:

1. Large Screen Display (LSD): Rapid setup/strike display system consisting of a rugged but lightweight aluminum frameset and three 1024x768 (XGA) DLP projectors. The overhead front setup produces an 18' x 4.5' display area and the lower rear setup produces 15' x 3.75' display area. All components pack inside three rugged, aluminum cases measuring 84" x 18" x 18".

2. Two 65" HD LED monitors with remote controls; auto-lift mounting system; external waterproof electronic interface I/O panel for power, audio, Internet Protocol (IP), and video inputs; aluminum transit case meets U. S. military transit and vibration specifications.

3. Video and audio, 21 input/12 output, twisted pair-based distribution system; features three multi-image processors capable of producing 2–4 resizable image windows through a single display.

4. 20 standard tactical tables, 6' in length, rugged, lightweight aluminum, integrated and internally enclosed 120/240VAC power, two data networks and twisted pair video distribution.

5. 10 external jumper cables and all necessary cabling to connect multiple tables together with two networks, twisted pair video and power.

The tiered flooring in use by operational SOCOM units is available from Bike Track, Inc. Their two tiered flooring system provided the greatest visibility for all users. The wiring is hidden underneath the floor for safe and uninterrupted operations. Their flooring system was recommended by DRASH, SOI and the operational units we visited. The approximate cost for the flooring and platforms was around $180,000. Due to proprietary and confidentiality requirements on the information (quotes) provided, we are unable to include them in this document. This information is available to government agencies, upon request.

B. THE PHASE-IN APPROACH

As we mentioned earlier, the ASC will be a driving requirement for a robust communications infrastructure. During our visit with the U.S. SOF, NSWG-2 MCT and SOCOM, both gave the same recommendations given NSHQ's requirements for SOCC capabilities. They recommended a phased-in approached. First, the initial advance party, SOCC Core, should start with an SDN-M with a TACLAN; additionally, GBS or NATO's SBS should be utilized to cut down on SATCOM bandwidth. Users can also supplement the SDN-M with a larger dish (i.e., larger bandwidth). Second, when the main body (the full SOCC will be up to 150 personnel) deploys, they will bring out an SDN-H-like package. The SDN-M will be retained as a backup, in case any or all of the SDN-M is taken out of action for any reason. This kind of redundancy is recommended for "no-fail" missions. The estimated total basic cost for this communications package is $6.5 million.

Our study shows that the basic cost structure for a rapidly deployable camp can be built with ideal equipment for approximately $10 million (see Table 10) to include the basic life support, operations center, and communication structure.

Table 10. Approximate Cost for NSHQ Camp

Function	**Solution**	**Cost**
LOGCEN	Alaska Structures	$2,800,000
OPCEN	SOI or DRASH	$440,000
ASC/SIGCEN	1 x SDN-H 7 x SDN-M 2 x SDN- L(vx) 7 x GBS	$6,460,103
	Total Cost=	$9,700,103

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