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Air Force Inspection System: An Application For System-Of-Systems (SOS) Engineering

Joseph R. Lay

AIR FORCE INSPECTION SYSTEM: AN APPLICATION FOR SYSTEM-OF-SYSTEMS (SOS) ENGINEERING

THESIS

Joseph R. Lay, Capt, USAF

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Joseph R. Lay, BS

Captain, USAF

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Joseph R. Lay, BS
Captain, USAF

Approved:

________//Signed//___________________	6 June 2014
John M. Colombi, Ph.D. (Chairman)	Date
________//Signed//___________________	6 June 2014
David R. Jacques, Ph.D. (Member)	Date
________//Signed//___________________	6 June 2014
Lt Col Thomas C. Ford, Ph.D. (Member)	Date

Abstract

The Air Combat Command (ACC) Inspector General (IG) assesses the operational readiness and combat effectiveness of units by evaluating individual wings. Today's conflicts, however, are waged as a joint force. The Joint Forces Commander (JFCC) leverages the resources of the entire military complex to achieve strategic objectives. The synergistic effects, created by the integration of individual weapon systems, produce greater results than the individual components. Evaluating wings outside the joint System of Systems (SoS) architecture doesn't provide a true assessment of combat readiness. Using a case study method, this research examines the integration of a joint SoS architecture with the ACC/IG inspection system. This study assesses the current nature of military operations and the risks associated with joint operations. It recommends ACC/IG assess the following four joint characteristics during inspections: rapid integration, interoperability, joint training, and flexibility/adaptability. It outlines several joint exercises as areas for implementing a joint inspection system. Finally, this study explores limitations and counter arguments to adopting a joint SoS within the inspection system. This analysis recommends the ACC/IG assess units through a larger SoS framework, which offers the possibility to reduce integration risks prior to deployment and provide a better assessment of wing readiness.

I would like to dedicate this thesis to my spouse and our daughter. To my wife, thank you for your patience, understanding, and sacrifices, which allowed me to finish this project. I owe you! To my daughter, thank you for all the interruptions that made me smile and laugh. You reminded me to not worry and made me work even harder to finish so we could spend more time together as a family. I love you both very much.

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Joseph R. Lay

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List of Acronyms

Acronym	Meaning
A2/AD	Anti-Access/Ariel Denial
ACC	Air Combat Command
AEF	Air and Space Expeditionary Force
AEFT	Air and Space Expeditionary Task Force
AF	Air Force
AFI	Air Force Instruction
AFIA	Air Force Inspection Agency
AFIS	Air Force Inspection System
AFMC	Air Force Materiel Command
AFPD	Air Force Policy Directive
AFSC	Air Force Specialty Code
AMC	Air Mobility Command
ART	AEF UTC Reporting Tool
ATO	Air Tasking Order
BCT	Brigade Combat Teams
C2	Command and Control
C3	Command, Control, and Communication
CAOC	Combined Air Operations Center
CAS	Close Air Support
CC	Commander
CCIP	Commander's Inspection Program
CDE	Collateral Damage Estimate
CENTCOM	Central Command
CFLI	Core Function Lead Integrator
CGI	Commanding General's Inspection
CIED	Counter Improvised Explosive Device
CJCS	Chairman of the Joint Chiefs of Staff
COCOM	Combatant Commander
COIN	Counterinsurgency
COMACC	Commander Air Combat Command
CONOP	Concept of Operation
CONPLAN	Contingency Plan
DCGS	Distributed Common Ground System
DCO	Defense Connect Online
DIME	Diplomatic, Information, Military, and Economic
DOC	Designed Operational Capability
DoD	Department of Defense
DMOC	Distributed Mission Operations Center
DRRS	Defense Readiness Reporting System
EO	Executive Orders
FAA	Federal Aviation Administration
GAO	Government Accountability Office

Acronym	Meaning
GEF	Guidance for Employment of the Force
GLO	Ground Liaison Officer
HAF	Headquarters Air Force
HQ	Headquarters
IG	Inspector General
ISR	Intelligence Surveillance and Reconnaissance
JCMB	Joint Collection Management Board
JCS	Joint Chiefs of Staff
JFC	Joint Forces Command
JFCC	Joint Forces Commander
JP	Joint Publication
JSPS	Joint Strategic Planning System
JTAC	Joint Terminal Attack Controller
LFE	Large Force Exercise
LVC	Live Virtual Constructive
LVE	Live Virtual Environment
MAJCOM	Major Command
MCCRES	Marine Corps Combat Readiness Evaluation System
MDS	Mission Design Series
MEU	Marine Expeditionary Units
MFR	Memorandum for Record
MGA	Major Graded Area
MICT	Management Internal Control Toolset
NDS	National Defense Strategy
NMS	National Military Strategy
NSC	National Simulation Center
NSS	National Security Strategy
OEF	Operation Enduring Freedom
OIF	Operation Iraqi Freedom
OPLAN	Operational Plan
OR	Operational Readiness
ORE	Operational Readiness exercise
ORI	Operational Readiness Inspection
POTUS	President of the United States
PR	Personnel Recovery
QDR	Quadrennial Defense Review
ROE	Rules of Engagement
RPA	Remotely Piloted Aircraft
RSTA	Reconnaissance, Surveillance, Targeting and Acquisition
SA	Situational Awareness
SAM	Surface to Air Missile
SAV	Staff Assistance Visit
SCF	Service Core Function
SEAD	Suppression of Enemy Air Defenses

Acronym	Meaning
SECDEF	Secretary of Defense
SII	Special Interest Item
SME	Subject Matter Expert
SOF	Special Operations Force
SoM	Scheme of Maneuver
SORTS	Status of Resources and Training System
SoS	System of Systems
SoSE	System of Systems Engineering
TF	Total Force
TIC	Troops in Contact
TPFDD	Time Phased Force Deployment Data
TTP	Tactics, Techniques, and Procedure
UC	Unit Compliance
UCP	Unified Command Plan
UEI	Unit Effectiveness Inspection
UOA	Unit of Analysis
US	United States
USAARL	United States Army Aeromedical Research Laboratory
USAF	United States Air Force
USAFE	United States Air Forces Europe
USMC	United States Marine Corp
UTC	Unit Type Code
VF	Virtual Flag
VTC	Video Teleconferencing
WMD	Weapons of Mass Destruction

AIR FORCE INSPECTION SYSTEM: A SYSTEM-OF-SYSTEMS DILEMMA

I. Introduction

General Background

An uncertain global economy, new technological developments, and growing competition for natural resources create a constantly shifting global environment. The United States (US) Government continuously monitors this changing environment and assesses the impact on US national interests. The President of the United States (POTUS), through the direction of the national strategy, establishes the priorities for US national interests. The US government relies on the four elements of national power to preserve and defend the national strategy and shape the global environment[1]. As one of the four elements, the nation may call upon the US military on a moment's notice to secure and defend those national interests.

As US global policy and national strategy changes, so must the US military. Admiral Mullins, the Chairman of the Joint Chiefs (CJCS), acknowledged this need in the 2011 *National Military Strategy* writing, "While the strength of our military will continue to underpin national security, we must continuously adapt our approaches to how we exercise power" (Mullins, 2011). The current trends in global change present

[1] The four tools available to the US government are: Diplomatic, Information, Military, and Economic. These four tools are often referred to as DIME

new challenges for the US military, which in order to ensure an always ready and capable force, must also evolve. Admiral Mullins further codified this trend stating (2011):

> "In this interdependent world, the enduring interests of the United States are increasingly tied to those of other state and non-state actors. The complexity of this global system and the challenges therein demand that we – the Joint Force – think anew about how we lead."

Today's military operates as a joint force, combining the capabilities, resources, and knowledge of the three military branches to increase lethality, flexibility, and responsiveness[2]. Strategic, operational, and tactical planning and execution span all three branches. Evolving tactics techniques, and procedures (TTPs), technology, communications systems, and weapons, used by US and adversarial forces continue to increase the complexity of warfare. These evolving factors continue to increase the reliance on and integration of the US service branches. The armed forces of the US, when operating as a joint force, reflect a System of Systems (SoS) architecture (see Methodology, Assumptions, and Limitations section for a definition of SoS). According to Joint Publication (JP) 1 (Joint Chiefs of Staff, 2009):

> "The nature of the challenges to the United States and its interests demand that the Armed Forces operate as a fully integrated joint team across the range of military operations…The challenges are best met when the unified action of the Armed Forces elicits the maximum contribution from each Service…The resulting synergy from their synchronized and integrated action is a direct reflection of those capabilities. Joint warfare

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[2] For the purpose of this thesis, the three military service branches refer to the Army, Air Force, and Navy. The Marines and Coast Guard are considered service components of the US Navy.

> is team warfare. Effective integration of joint forces exposes no weak points or seams to an adversary."

The terms "fully integrated", "joint team", "unified action", "synergy", and "synchronized and integrated" alluded to the existence of a joint SoS architecture. The DoD's *Systems Engineering Guide for Systems of Systems* in facts states the "way military commanders bring together forces and systems to achieve a military objective," operates as SoS (ODUSD(A&T)SSE, 2008). Further the guide states that acknowledging the SoS perspective is critical to the future development of the military force (ODUSD(A&T)SSE, 2008). The Joint Chiefs of Staff definition for integration states "The arrangement of military forces and their actions to create a force that operates by engaging as a whole" (Joint Chiefs of Staff, 2014). Compared to the DoD definition of a SoS, the Joint Chiefs are essentially using the word integration as a substitute for SoS. As such, each branch must view its capabilities within the joint architecture, acknowledging how they integrate, operate, and achieve success within this construct. Further, the characteristics of a joint SoS architecture are manifested in the United States Air Force (USAF) vision, core competencies, and distinctive capabilities. Each of these elements reference the needs to support, interoperate, or provide for the joint team (Air Combat Command, 2013).

Air Combat Command (ACC) relies on the Inspector General (IG) to evaluate unit combat readiness. The IG manages the Air Force Inspection System (AFIS), which uses a variety of tools (interviews, inspections, checklists, surveys, self-evaluations, and staged exercises) to evaluate a unit's ability to fulfill its wartime mission(s) (United States Air Force, 2013). "The intent of the IG is to continuously improve the AFIS so there is an ever-shrinking difference--both real and perceived--between mission readiness and inspection readiness" (United States Air Force, 2013).

Currently the ACC/IG inspects a single wing at a time and thus does not incorporate a SoS perspective to account for the co-dependency and integration of wings with other Air Force (AF), Army, Navy, or even coalition partners/weapon systems. According to JP-1, the NMS, and 2001, 2006, and 2011 Quadrennial Defense Reviews (QDR), integration and interoperability are necessary for today's military to achieve operational and ultimately strategic success. These key strategic documents define several joint characteristics not fully evaluated during ACC/IG inspections (see Chapter 4 for a list of characteristics). The NMS provides a general summary of these documents stating the changing global environment and the complex challenges this environment bring, demand a fully integrated joint force capable of working as one (Mullins, 2011). While not explicitly stated, these documents are referring to the existence of a joint SoS and the need to develop forces who can quickly assimilate into the SoS. This work acknowledges the existence of a joint SoS and the need to evaluate weapon systems within this architecture. The only way to measure a unit's capability to meet joint hallmarks is to evaluate a unit under similar conditions. This work validates the concern that single wing inspections fall short of capturing the interdependent relationships characteristic of joint operations.

Problem Statement

Today's joint operational environment is a large system of systems, relying on the symbiotic relationships which form between weapon systems to create synergistic effects on the battlefield. JP-1 summarizes this relationship stating (Joint Chiefs of Staff, 2000):

> "Joint warfare is team warfare. The engagement of forces is not a series of individual performances linked by a common theme; rather, it is the integrated and synchronized application of all appropriate capabilities. The synergy that results from the operations of joint forces according to joint doctrine maximizes combat capability in unified action."

It is therefore less effective to evaluate a wing outside the joint construct where its impact on the SoS cannot be assessed. The Commander of ACC (COMACC) relies upon the ACC/IG to assess the combat readiness and effectiveness of its assigned forces. However, the current inspection system does not acknowledge the intra and inter-service relationships, which form during joint operations and are necessary for mission success. In addition, the current AFIS process of evaluating a single wing at a time runs counter to ACC's strategic vision, which seeks to develop airmen capable of working as integral parts of the joint force. According to Air Force Instruction (AFI) 90-201, inspection programs should be consistent with command mission requirements, and are "inherently wasteful if not directly aligned with mission readiness" (Secretary of the Air Force, 2012). CJCS Guidance 3401D defines readiness as the synthesis of joint forces at the operational and tactical levels culminating "in the Combatant Commanders' ability to integrate and synchronize ready combat and support forces to execute assigned missions" (Chairman of the Joint Chiefs of Staff, 2013). This statement from General Dempsey connects mission readiness with joint readiness. Accordingly, ACC strives to develop airmen with the proper training, equipment, and resources necessary to project combat power, anytime, anyplace, in order to create effects and conditions aligned with joint objectives (Hostage, 2012).

Hypothesis

An AFIS which views a wing's mission within the context of the joint SoS architecture will provide a better evaluation of a wing's combat readiness and effectiveness.

Investigative Questions

The following research questions seek to confirm this work's hypothesis and lead to the development of recommendations to improve the current ACC/IG system. The main research question is:

How can the AFIS be improved to account for the integrated nature of military warfare reflective of a System-of-Systems architecture?

Specific investigative questions include:

1. *How does the Air Force align/posture forces for joint operations?*
2. *What is the focus of the current ACC/IG Inspection system?*
3. *How does the current inspection system account for the integrated nature of military assets during operations?*
4. *What system-of-systems examples or incidents exist that have a direct relation to an operational readiness inspection?*
5. *What system-of-systems metrics or attributes can be used to evaluate and determine the status and health of ACC units?*

Research Focus

The primary focus of this thesis is two fold. First is to establish modern warfare as a SoS operation where the importance of a wing's role relies on the relationships formed between the individual components comprising the SoS. Second is to demonstrate how evaluating a wing's combat readiness outside the SoS construction creates additional risk during joint operations.

Methodology, Assumptions, and Limitations

This work uses an embedded case study research method to answer the main research question (Yin, 2009). The cost and time of implementing recommendations is outside the scope of this work. In addition, while recommendations may apply to other service branches and AF Major Commands (MAJCOM), this work focuses on ACC and its IG.

This thesis uses the Department of Defense's (DoD) definition for system of systems, which states a SoS is "a set or arrangement of systems that results when independent and useful systems are integrated into a larger system that delivers unique capabilities" (Department of Defense, 2004) (ODUSD(A&T)SSE, 2008). Further, the DoD emphasizes a SoS "consists of parts, relationships, and a whole that is greater than the sum of the parts" (Department of Defense, 2004).

To clarify the hypothesis it is important to define at what echelon the AF assess combat readiness/effectiveness. Further, it is important to define the level of war at which forces integrate and combat readiness/effectiveness impact the joint mission. Accordingly, this work only examines wing level inspections also known as Unit

Effectiveness Inspections (UEI). UEIs and are designed to assess unit readiness and combat capability (Secretary of the Air Force, 2012). The “iron” or weapon systems (aircraft, security forces, Special Operations Forces (SOF), maintenance, etc), which provide ACC’s combat capability and deploy in support of joint operations, reside at the wing level.

The operational and tactical levels of warfare are the two levels where the effects of weapon systems merge to create synergistic effects. The third level, not explored, is the strategic level of warfare. The operational level refers to operations conducted among units and organizations, the proficiency and interaction of units across organizations, and the integration and coupling of capabilities (Joint Chiefs of Staff, 2011), (Hoing, 2003), (Joint Chiefs of Staff, 2003). The operational level is the level where operations are “planned, conducted, and sustained to achieve strategic objectives” (Joint Chiefs of Staff, 2014). It bridges the gap between the tactical and strategic levels of warfare (Joint Chiefs of Staff, 2014). The tactical level refers to unit level capabilities, daily proficiency at basic skills, and the application of those skills when required (Joint Chiefs of Staff, 2011), (Hoing, 2003), (Joint Chiefs of Staff, 2003). It is the level at “which battles and engagements are planned and executed” (Joint Chiefs of Staff, 2014) and “focus on the ordered arrangement and maneuver of combat elements in relation to each other and to the enemy to achieve combat objectives” (US Army, 2004).

These two levels imply a direct connection between individual units and the interaction of these forces to achieve specified objectives. At these levels, units must be proficient and practiced in joint operations to ensure success. The IG’s UEI directly correlates to these two levels of warfare as it seeks to evaluate unit effectiveness and combat readiness.

Finally, this work does not attempt to determine if the recommended changes provide a more effective measure of merit.

Implications

This work provides a defendable case for changing how the ACC/IG determines wing readiness. Applying a joint SoS architecture to wing readiness inspections has applications outside ACC and the AF. There is a direct application for a similar SoS approach to DoD acquisition programs during the developmental test and operational test phases of project management. In addition, other MAJCOMs, service branches, and COCOMs may wish to adopt an analogous model to reduce risk and provide a better assessment of force readiness within their organizations.

Preview

The following chapters examine the above research questions and provide sufficient and verifiable evidence to defend the hypothesis. Chapter 2 provides contextual information to support chapters three and four. It provides a brief history on the IG before explaining how the AFIS works. Chapter 2 also provides historical information on the evolution of joint operations and examines how the AF postures its forces to meet global taskings. Chapter 3 explains the case study methodology used to answer the proposed research questions. Chapter 4 analyzes the three case study units of analysis identified in Chapter 3. Finally, Chapter 5 restates the hypothesis, summarize the main research points, and recommends actions and further areas of study.

II. LITERATURE REVIEW

Chapter Overview

Chapter 2 provides the necessary background information to support the research presented in Chapter 4. It examines the rules and regulations governing Joint, AF, and wing operations. Further, this section examines the AFIS and how the IG implements the AFIS at the wing level. Chapter 2 also provides information on the history of joint warfare and its evolution. It provides an understanding of the development of JPs and how the Air Force postures forces to deploy in response to a Joint Force Commander's (JFCC) request. In reviewing the history of joint warfare, this chapter shows how operations rely on combined effects of joint and coalition capabilities to be successful. Additionally analyzing joint operations and AF deployment cycle creates an understanding of the joint SoS wings operate within. Providing this information lays the framework for why adopting a joint SoS architecture within the AFIS is necessary to effectively evaluate a wing's combat capability.

Research Areas and Relevant Research

Similar Research

LtCol Jeffrey Hoing, United States Marine Corp (USMC), conducted similar research in 2003. Analogous with this work, LtCol Hoing analyzed the Marine Corps Combat Readiness Evaluation System (MCCRES) and Commanding General's Inspection (CGI) programs to determine their effectiveness at measuring Marine Corps operational readiness. At the time, the wars in Iraq and Afghanistan were exposing weaknesses within the services to conduct sustained joint operations. The Secretary of

Defense (SECDEF) and CJCS published guidance to all the service branches emphasizing the importance of interoperability, agility, integrated operations, and flexibility. LtCol Hoing examined the MCCRES and CGI programs ability and effectiveness to train, test, and measures these joint characteristics within Marine tactical aviation units.

Using joint guidance, LtCol Hoing noted a similarity in the definitions for the operational and tactical levels of warfare. A major point of his research, LtCol Hoing separated these two levels, relating the tactical level to single unit or person proficiency in basic skills. His definition for the operational level related to the level at which forces or units integrate to form the joint force. Further, he decoupled the definitions for combat readiness and operational readiness. Combat readiness is tactically focused, were operational readiness is the “organization, manning, and training level of a unit that allows it to be rapidly deployed, integrated, and immediately employed as part of a joint, allied, or coalition force” (Hoing, 2003). By separating these definitions, he linked tactical warfare to combat readiness and operational warfare to operational readiness. He then focused his work on operational readiness concluding that the Marine Corps has a fairly robust combat readiness program. This also aligned his work with the issue addressed by the SECDEF and CJCS

LtCol Hoing examined the evaluation systems of the Navy, AF, Army, and North Atlantic Treat Organization (NATO) to determine how these systems capture the aforementioned joint characteristics specifically during operation readiness inspections. Similar to this work, he concludes that the MCCRES and CGI fail to adequately evaluate operational readiness. He suggests these programs be replaced with evaluation systems that better capture operational skills. He concluded that the only way to successfully elevate marine tactical air to the next level was to adopt a new system with the ability to evaluate the effectiveness of units at integrating with other marine and joint organizations.

Contrary to LtCol Hoing's work, this work does not differentiate between the tactical and operational levels, nor combat versus operational readiness. It is the perspective of this work that all these areas are intertwined. In order to truly adopt a joint perspective and to better evaluate joint readiness requires a full change from training up to execution. However, his work is significant in that the general problem statement is a substandard evaluation system failing to adequately ensure Marine units are prepared for joint operations.

History of the Inspector General

The Air Force IG traces its lineage back to the American Army of 1777 and the creation of the IG function (Headquarters US Air Force, 2014). When the AF separated from the Army in 1947, a similar oversight organization continued to provide oversight on AF aviation activities (Headquarters US Air Force, 2014). In 1948, General Hoyt S. Vandenberg officially established the AF IG function. General Vandenberg "outlined the IG's mission as: determining the combat and logistic effectiveness of the Air Force, [and] insuring the maintenance of discipline and security" (Headquarters US Air Force, 2014). The Goldwater-Nichols Act of 1986 established the AF IG as an independent organization reporting to military and civilian leaders (Headquarters US Air Force, 2014). A large AF reorganization in 1990 separated the IG's safety and inspection roles into two different organizations. The result created the Air Force Safety Center and the

Air Force Inspection Agency (AFIA) as a component of the AF IG. AFIA's mission remained strikingly similar to General Vandenberg's proposed IG, requiring an organization to independently assess combat capability (Headquarters US Air Force, 2014).

The Air Force Inspection System

AFI 90-201 and Air Force Policy Directive (AFPD) 90-2 govern the AFIS. AFPD 90-2 acts as the parent document, directing the implementation of an AFIS overseen by the IG. AFI 90-20 carries out the policies outlined in AFPD 90-2. The objective of the AFIS is to assess and report on a unit's readiness, efficiency, and effectiveness to execute its assigned mission(s). The responsibility of the IG is to implement and carry out the AFIS by establishing an inspection program consistent with the command's mission requirements (Secretary of the Air Force, 2012). AFI 90-201 specifies the AFIS must link inspection compliance with mission readiness to ensure a robust and efficient program. At the wing level, the AFIS places an emphasis on identifying unknown risk and developing mitigation strategies (Secretary of the Air Force, 2012).

To assess and measure a wing's capability and effectiveness, the IG uses a checklist derived from AFIs, DoD instructions, joint publications (JPs), public law, Executive Orders (EO), and other regulatory documents (Secretary of the Air Force, 2012). The complete list of governing regulations is provided in Appendix A. Using regulatory documents reduces subjectivity and provides a baseline for all wing inspections. AFI 90-201 specifies four Major Graded Areas (MGAs); Managing Resources, Leading People, Improving the Unit and Executing the Mission (Secretary of the Air Force, 2012). Each MGA is comprised of a list of mandatory compliance items derived from the documents listed in Appendix A. The AF identified high-risk items within the governing documents and required the MAJCOM/IGs create inspection checklists using these items as the minimum requirement (Secretary of the Air Force, 2012). Figure 1 shows a model of the MGAs and how they form the core of the AFIS. In addition to the IG checklist, HAF or MAJCOM commanders may identify supplementary inspection areas called special interest items (SII).

Figure 1: AFIS Inspection Areas

A MAJCOM/IG inspection, at the wing level or below, is known as a UEI. The UEI serves two purposes. First, an UEI validates and verifies a wing commander's inspection program (CCIP) "for accuracy, adequacy and relevance" (Secretary of the Air Force, 2012). Second, an UEI delivers an independent assessment of the wing leadership and the unit's ability to execute its assigned missions (Secretary of the Air Force, 2012). UEIs are a continual process designed to help Wing/CC's monitor their wing's progression over time (Secretary of the Air Force, 2012). An UEI starts with the selfidentification of deficiencies and areas of risk by a Wing/CC's compliance team. The IG periodically samples a wing's progression to mitigate or correct findings through no notice inspections or Management Internal Control Toolset (MICT) reviews. The cycle repeats every 24 to 30 months, coinciding with normal two-year assignment cycle for wing commanders, and culminating each time in a capstone event. The capstone event includes onsite interviews, exercises, and inspections by MAJCOM/IG personnel. At the conclusion of a cycle, the MAJCOM/IG authors a report noting a unit's areas of non-compliance and assigns a score. The report is a reflection of leadership, readiness, and a wing's ability to perform its mission(s). Wing and MAJCOM CCs receive final copies of the report.

The AFIS gives the IG a tool to analyze MAJCOM trends through the examination of multiple unit inspections. A database of final reports provides MAJCOM leadership insight into the health and readiness of assigned forces.

The previous version of AFI 90-201 determined the health and capability of AF wings to meet their peacetime and contingency operational requirements through two types of inspections:

1) Unit Compliance Inspections (UCI) focused on a wing's capability to support home station operations and abide by mandatory laws (Secretary of the Air Force, 2012).

2) Operational Readiness Inspections (ORI) focused on a wing's capability to support contingency operations. Phase 1 ORIs examined a wing's ability to posture their personnel and equipment in preparation for supporting contingency operations. Phase 2 ORIs inspected a wing's capability to execute and sustain combat operations

(Secretary of the Air Force, 2012). Phase 2 ORIs simulated a wartime environment and tested a wing's capability to operate under the adverse conditions (chemical environment, base attacks, jamming, limited resources, high ops tempo, etc).

The new AFI 90-201 does not mandate ORIs, but still levees similar requirements. The shift reflects the change in AFI 90-201 to focus on leadership, reduce inspection time/duration, and saving money. IG personnel now pre-identify areas to inspect prior to arrival by monitoring the unit's self-inspection program and tracking the unit's progress on resolving prior deficiencies. The new 90-201 provides the Wing/CC the opportunity to determine additional areas he/she deems important and build an inspection system around his/her priorities. Through the development of the CCIP, the Wing/CC builds his/her own inspection program using ACC/IG provided checklists as a minimum standard. The role of the AFIS now focuses more on how well the Wing's IG conducts the CCIP. Documentation from wing inspections is input into the MICT database. The ACC/IG regularly monitors a wing's processes and procedures through MICT. When the ACC/IG shows up for an inspection, they have already pre-identified areas they would like to observe based off on MICT inputs. Conversely, MICT also allows the ACC/IG to identify areas that do not require further inspection. The ACC/IG ensures wings strike a balance between the four major graded areas while also assessing how well the commander's inspection program runs.

In conversations with the ACC/IG personnel, every unit focuses on the MGA labeled "executing the mission" because ultimately at the end of the day that is everyone's foremost duty. However, the IG added that almost any wing can execute the mission if and when necessary, but at a great expense to its personnel and equipment.

According to the IG, the remaining three MGAs (Leading People, Managing Resources, and Improving the Unit) make wings more efficient and effective at executing the mission. The charge of the ACC/IG is to ensure units develop these efficiencies thereby reducing mission risks.

Air Combat Command

ACC is one of eight MAJCOMS in the AF, with over 352 total force (TF) units (active duty, reserve, and guard) and 135,068 military and civilian members (Air Combat Command, 2013) (Hostage, Air Combat Command Key Talking Points, 2014). MAJCOMs organize, train, equip, and maintain combat ready forces prepared to conduct operations on a moment's notice (Air Combat Command, 2013). ACC's status of forces includes 25 different Mission Design Series (MDS) platforms totaling 274 active duty aircraft, making ACC the preponderant owner of combat aircraft in the AF (Hostage, Air Combat Command Key Talking Points, 2014). ACC's list of MDS platforms includes a wide variety of fighter, bomber, Intelligence Surveillance and Reconnaissance (ISR), battle management, Command Control and Communication (C3), signals intelligence aircraft, and Remotely Piloted Aircraft (RPA) (Air Combat Command, 2013).

In addition to its function as a MAJCOM, ACC serves as the primary force provider to Joint Forces Command (JFC). In this capacity, ACC responds "to the combatant commander's request for conventional forces with a mission ready joint solution" (U.S. Joint Forces Command). Additionally, ACC must monitor the health of AF forces to sustain current operational commitments while ensuring future forces are properly trained, equipped, and combat ready (U.S. Joint Forces Command).

ACC also acts as the Core Function Lead Integrator (CFLI) for five of the twelve Service Core Functions (SCFs) assigned by the SECDEF. The twelve core functions encompass the full range of AF capabilities. Sustaining and building the SCFs ensures the AF can provide full combat support to the Joint Force. Table 1 lists the twelve core functions and the responsible CFLI. The CFLI's role is to ensure near term and future planning, development, and sustainment of these capabilities to "help the AF achieve the strategic and operational objectives of the National Defense Strategy" (Barnhart). In this capacity, the CFLI also acts as the AF internal integrator of requirements across the MAJCOMs and is tasked with reducing near and long-range program risk to achieve SECDEF guidance and direction (Barnhart) (Hostage, 2012).

Table 1: Air Force Service Core Functions (Barnhart)

Service Core Functions	Core Function Lead Integrator
Air Superiority	Air Combat Command
Global Precision Attack	Air Combat Command
Global Integrated ISR	Air Combat Command
Command and Control	Air Combat Command
Personal Recovery	Air Combat Command
Building Partnerships	Air Education and Training Command
Nuclear Deterrence Ops	Air Force Global Strike Command
Agile Combat Support	Air Force Material Command
Space Superiority	Air Force Space Command
Cyberspace Superiority	Air Force Space Command
Special Operations	Air Force Special Operations Command
Rapid Global Mobility	Air Mobility Command

Joint Operational Architecture

History of Joint Operations

US joint operations trace their beginning to the Revolutionary War when a small Continental Army and Navy working in conjunction with French naval and ground forces to defeated the British. In the final battle of the Revolutionary War, General Cornwallis surrendered to General George Washington at the port city of Yorktown, Virginia. Simultaneously leveraging the effects of naval and land forces, General Washington surrounded General Cornwallis's army, cutting off resupply and reinforcements. While the small US Navy blocked the channel from British ships and pounded the coast with artillery, the Continental Army enveloped General Cornwallis' forces from the land. This first instance of joint planning and execution highlights the potential force multiplication created by combining two independent systems.

Prior to the Goldwater-Nichols Department of Defense Reorganization Act, the US military operated as three separate branches. Peacetime operations of organizing, training, equipping, and planning were conducted independently (Locker, 2001). Military operations were planned and executed separately and operational control of forces remained with each service (Fogarty, 2006). Service CCs often failed to communicate or coordinate efforts. The Korean, Vietnam, and Grenada conflicts highlighted these flaws. Lacking integration, each branch executed the war according to its own objectives and strategies (Fogarty, 2006). Studies of these operations revealed communication issues, uncoordinated tactical operations, failed liaison programs, and separately coordinated operations (Chairman of the Joint Chiefs of Staff, 2013). Goldwater and Nichols also cited the military's lack of integration and inability to profit from economies of scale as major reasons for past failures. Further, separate command structures hindered the development of joint doctrine (Locker, 2001).

The Goldwater-Nichols Act reorganized the military command structure, formalizing the need to deploy and operate as a single unified force. The Goldwater-Nichols Act established operational control of deployed forces under a single combatant commander (Senate Committee on Armed Services, 1985). Service chiefs were cut out of the operational chain of command and assigned the primary role of organizing, training, and equipping forces in support of combatant commander requirements (United States Congress, 1986). The Goldwater Nichols Act created a joint SoS architecture unified under the COCOMs. COCOMs assign a single or multiple JFCCs to lead operations within their geographic area of responsibility. JFCCs continuously modify their joint organization throughout operations to provide the right mixes of forces and equipment to achieve mission success (Joint Chiefs of Staff, 2007). Operation Just Cause, the first Gulf War, Bosnia, Operation Iraqi Freedom (OIF) (also known as Operation New Dawn) and Operation Enduring Freedom (OEF) have tested the JFC construct. According to JP-1 the JFCC's role is to create unity of effort and unified action among participating organizations (Joint Chiefs of Staff, 2013).

Joint Publications

JPs are standing documents, written and approved by the COCOMs, service branches, and Joint Chiefs of Staff (JCS). JPs were created to provide guidance on the employment of joint forces. The primary purpose for creating JPs was to establish unity of command and unity of effort during joint operations (Furr, 1991). Prior to 1986, the development of joint doctrine was hindered by a lack of clear guidance determining who was responsible for creating and enforcing doctrine. In addition, COCOMs were not required to participate and service branches were not obligated to follow joint policy (Furr, 1991). Service components were responsible for developing their own operational doctrine "with provision for coordination between services" (Cushman, 1985). A 1985 Senate Armed Services Committee report identified "poorly developed joint doctrine as one of the major systems of inadequate unified military advice" (Furr, 1991). Further, the report stated, "the joint operational effectiveness of military forces is dependent upon the development of joint doctrine and sufficient joint training to be able to effectively employ it" (Senate Committee on Armed Services, 1985). The Goldwater-Nichols Act empowered the CJCS and assigned the chairman full responsibility for the development and establishment of joint doctrine. The Act required all services to comply with joint publications (Furr, 1991).

In this regard, JP-1 continues to echo the words of the Goldwater-Nichols Act stating "successful joint operations merge capabilities and skill sets of assigned service components. Interoperability and effective integration of service capabilities enhance joint operations to accomplish US Government objective(s)" (Joint Chiefs of Staff, 2013). Today, AFIs provide additional guidance on how AF units will implement JP procedures.

Unit Mission Development

In planning for deployments, wings train and prepare to execute their assigned missions. Wings must also maintain the proper mix of equipment to support necessary to support their assigned missions. A wings's weapon system determines the types of missions it can accomplish (a weapon system can be an aircraft or job function). A Joint Staff supporting a COCOM determines the missions and equipment necessary to achieve the COCOMs goals. The Joint Operational Planning Process and Global Force Management Process are two documents used to link missions to specific wings as well as assign and set time-tables for the movement of forces should they be required.

Mission development is a joint function that begins with the President approving and publishing the *National Security Strategy* (NSS) and *Unified Command Plan* (UCP). These documents provide the US's strategic outlook and establish the responsibilities and roles of the COCOMs respectively (Joint Chiefs of Staff, 2011) (Joint Staff-7, 2011) (Santacrose, 2011). The SECDEF uses the NSS to establish DoD "policy goals and priorities for the development, employment, and sustainment of forces" (Santacrose, 2011). The *National Defense Strategy* (NDS) is the venue through which the SECDEF presents his/her priorities. Further, the SECDEF authors the *Guidance for Employment of* *the Force* (GEF) which “consolidates and integrates five separate guidance documents into a single strategic directive” providing “clearer linkages from strategy to operations/activities” (Chairman of the Joint Chiefs of Staff, 2011) (Santacrose, 2011). Contained within the GEF is guidance on campaign planning, a major part of how units receive their mission (Joint Chiefs of Staff, 2011).

The CJCS outlines the global military strategy and strategic direction in the NMS document, using the NDS, NSS, and GEF as a framework. The NDS, NSS, and GEF “provide ‘the what,’ and the NMS provides the ‘how’ in aligning ends, ways, means, and risk to accomplish the missions called for in support of U.S. national interests and objectives” (Chairman of the Joint Chiefs of Staff, 2008). In addition, the CJCS helps author the UCP. The UCP contains the Joint Strategic Planning System (JSPS). The JSPS tasks the COCOMs to create their Campaign Plans. Campaign Plans establish the COCOMs end state and steady state vision for their area of responsibility. Campaign Plans include force posture, security requirements, alliances, and goals (Chairman of the Joint Chiefs of Staff, 2011) (Santacrose, 2011). Figure 2 depicts a graphical representation detailing the steps required to create a Campaign Plan.

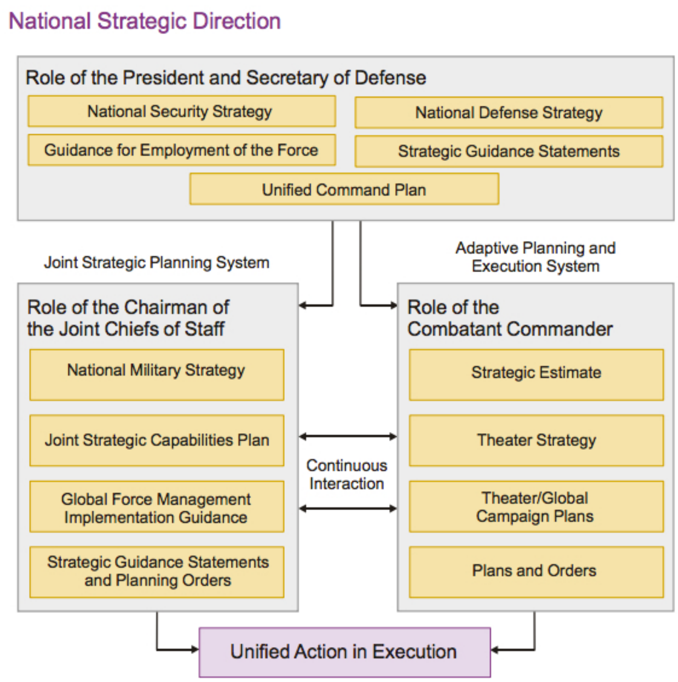

Figure 2: Joint planning and development process (Joint Chiefs of Staff, 2011)

Operational Plans (OPLAN) and Contingency Plans (CONPLAN) are two subsets of the larger Campaign Plan (Joint Chiefs of Staff, 2011). They are pre-developed military plans created to respond to potential threats and regional instability. These plans present COCOMs with quick options for returning to a steady state and are anticipatory in nature. Each OPLAN and CONPLAN contains the COCOM's force and equipment requirements to achieve his or her desired end state. OPLANs and CONPLANs also contain Time Phased Force Deployment Data (TPFDD) (Joint Chiefs of Staff, 2011). The TPFDD includes information on when and where personnel and cargo will begin loading, as well as guidance on the rotation of forces and equipment into and out of theater (Newberry, 2005). Joint planners match service capabilities to these requirements and link specific units, functions, and equipment to each plan.

Units in ACC use their assigned OPLANs and CONPLANs for training and exercise development. OPLANs and CONPLANs list specific mission sets, equipment, personnel required, and deployment and phasing information for each plan. OPLANs and CONPLANs also contain the operational and tactical level objectives and how these objectives will be achieved through the integrated use of all service components (Joint Chiefs of Staff, 2011) (Newberry, 2005).

Air Force Deployment Process

Before 1990, AF units were tasked independent of each other and under multiple commands, causing inconsistent deployment tempos and incomplete force packages (Ross, 2012). In addition, assets deployed under multiple commanders caused competing requirements. The Air and Space Expeditionary Force (AEF) concept, created in the 1990s, logically organized AF assets into 10 force packages (McCullough, 2012). Force packages paired component capabilities together, ensuring the effective utilization and blend of assets required to complete the assigned mission. The AEF concept also provided a stable and predictable deployment tempo for airmen (Secretary of the Air Force, 2012). The 10 force packages deployed under the Air and Space Expeditionary Task Force (AETF) construct. The "AETF presents a JFCC with a task-organized, integrated package with the appropriate balance of force, sustainment, control, and force protection," scalable to meet changing COCOM requirements and mission sets (United

States Air Force, 2011). Equipment and personnel were assigned a unit type code (UTC) which designated a specific capability. Force packages are comprised of UTCs depending on the capabilities required[3]. Two force packages were always postured to deploy while the remaining eight packages were in other stages of equipping/revitalizing, training, preparing, or returning from deployment. Figure 3 shows the cycle of training, preparing, deploying, and reintegration every force package went through. Prior to OIF and OEF, the AEF concept fit well with the joint vision of rapid deployment and integration.

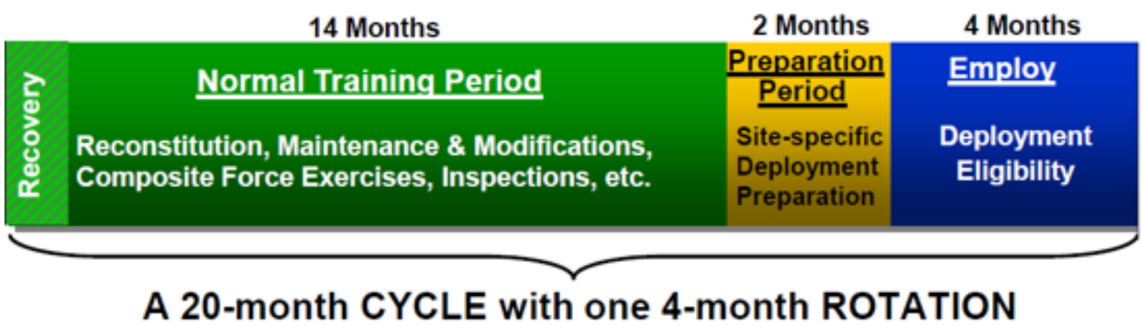

Figure 3: AEF concept prior to surges in OEF and OIF

The wars in Iraq and Afghanistan however, stressed the AEF construct. The original AEF concept was not designed to provide a long-term surge capability. To quickly adapt, the AF converted to a tempo band system and dissolved the force package

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[3] Force packages are often referred to as "Buckets". Two force packages filled one of five buckets.

concept. The tempo band system placed UTCs into one of five active duty tempo bands[4]. The five tempo bands each had a different deploy-to-dwell ratio "based on the combatant commander's requirements" for that specific function (McCullough, 2012). Since UTCs are capability based, the tempo band system created a situation where a single airman could deploy. Individual augmentees often deployed in support of joint or coalition units, filling a specific function (Ross, 2012).

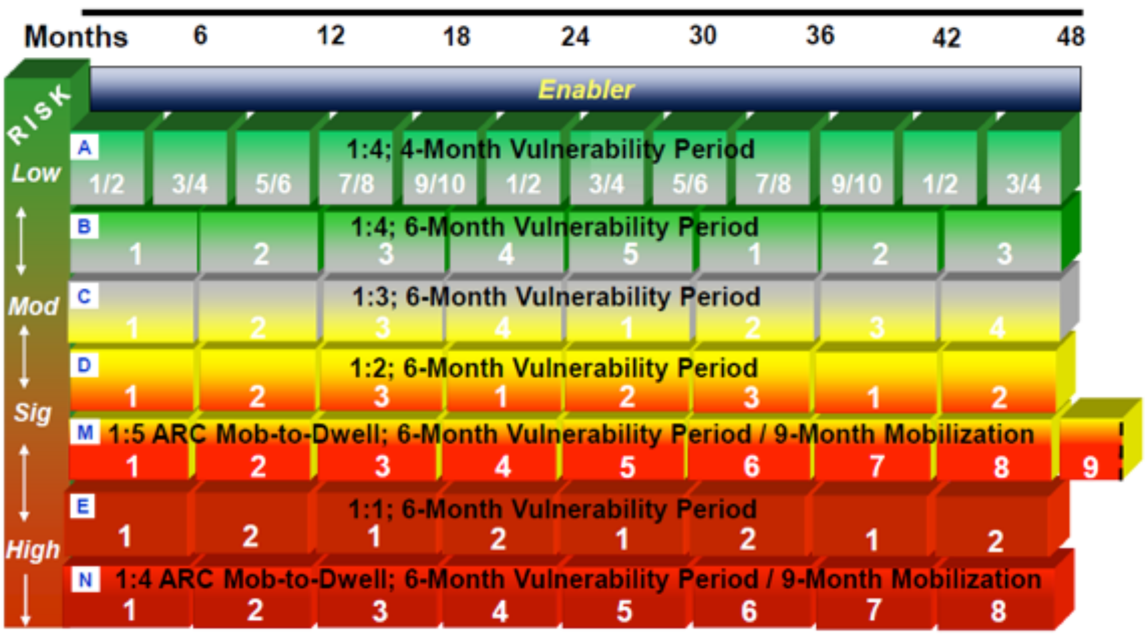

Figure 4: AEF Tempo Band Construct

The next evolution of the AF deployment process is called AEF Next. It rebuilds the old AEF process while addressing issues concerning surge capability, force

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[4] Reserve and Guard units follow their own specific tempo band construct due to differences in Title 10 and Title 32 authorities (Figure 4) (Kapp & Torreon, 2013).

packaging, teaming, and synchronization with Guard and Reserve forces. AEF Next creates six air power teams based on the AF core functions. Each team includes all the required units to satisfy that AF core function. Air power teams will be similar to Brigade Combat Teams (BCT) or Marine Expeditionary Units (MEU) and thus easier to present to JFCCs (Ross, 2012). Team integration is a big part of AEF Next and is designed to allow air power teams to train and exercise together (McCullough, 2012) (Williams, 2013). Wings will now deploy as a complete package instead of a collection of individual augmentees.

Summary

Chapter 2 presented the contextual information relevant to framing the main hypothesis. Chapter 2 identified how the current AFIS system works and defined its main goals: ensuring mission readiness and reducing risk. It also presented a logical case for defining joint operations as a SoS and demonstrated how the AF already operates within the SoS. Further, chapter 2 showed how the AF mission is focused on the success of joint operations and ensuring integration and interoperability within the Joint SoS. It presented several documents showing on the military's evolution and how current strategic level planning documents depict a future joint force more integrated and reliant upon each other. Interoperability and flexibility will be attributes of this future force. These conclusions carry forward into Chapters 3 and 4 helping provide background data supporting the Units of Analysis (UOA) and solidifying the thesis position of overlaying a joint SoS within the AFIS.

III. Methodology

Chapter Overview

This chapter focuses on the methodology used to answer the research question:

How should the AFIS be improved to account for the integrated nature of military warfare reflective of a System-of-Systems architecture?

This question is answered in the following sections using a case study method. Three embedded units of analysis help answer the main research question. UOA one focuses on the integrative nature of military assets during combat operations and the risks associated with joint operations. UOA two examines potential SoS metrics/attributes for assessing joint readiness and how these can be applied within the current AFIS. UOA three presents limitations or counter arguments to implementing joint SoS attributes into the AFIS.

Figure 5 shows a representative diagram of the project's design layout. The dotted line represents the blurred boundary between context and the case study. This distinction highlights the important role context plays in framing the case study. Case studies focus on the operational links between events by connecting empirical and contextual data to the main study question. The three UOAs and the main research question embedded within the larger context box depicts this relationship.

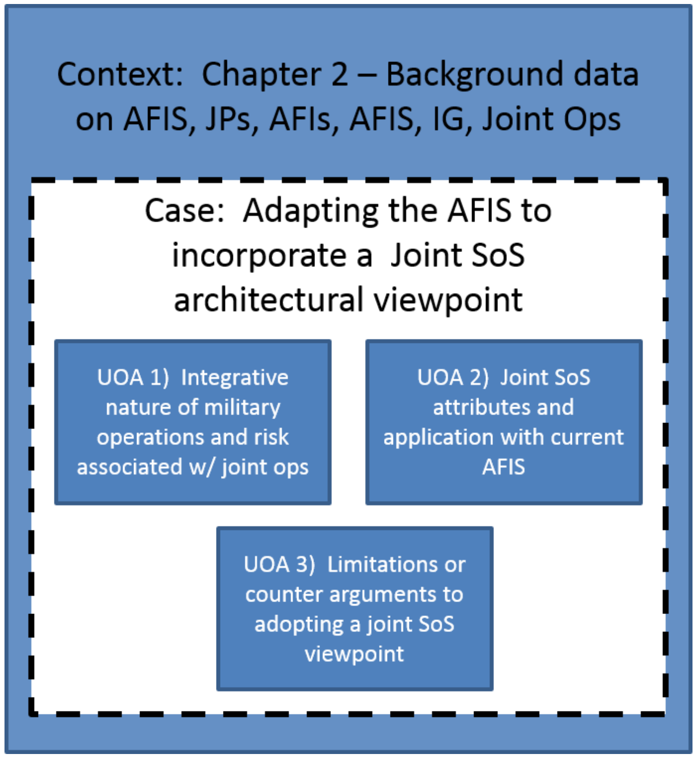

Figure 5: Case Study Design

Research Method Selection

According to Robert Yin, there are five methods from which to choose from when conducting research (2012). Selecting the appropriate method aids in the development of a research plan (Yin, 2009). Table 2 shows three conditions helpful in determining which method to select.

Table 2: Relevant Situations for Different Research Methods (Yin, 2009)

Method \ Condition	Form of Research Question	Requires Control of Behavioral Events	Focuses on Contemporary Events
Experiment	How, why	Yes	Yes
Survey	Who, What, Where, How many, How much	No	Yes
Archival Analysis	Who, What, Where, How many, How much	No	Yes/No
History	How, Why	No	No
Case Study	How, Why	No	Yes

A case study research paper presents the strongest method for three reasons. First, the main research and investigative questions are "how" and "why" questions. Second, the author cannot control the behavior of the AFIS. Third, the thesis focuses on current events. Another reason for using the case study research method is when the links between supporting data and the main study questions are too complex to capture in surveys or controlled experiments. Robert Yin explains, "You use the case study method because you wanted to understand a real-life phenomenon in depth, but such understanding encompassed important contextual conditions – because they were highly pertinent to your phenomenon of study" (2009).

Unit of Analysis Examination

This thesis has three embedded UOAs as depicted in Figure 5. Each UOA is its own case study and thus may use any or a combination of the five research methods presented in Table 2 (Yin, 2012). This is a key principle of case study research, helping create a larger pool of corroborative data, collected from multiple sources, converging on ideas or facts that directly support the main hypothesis (Yin, 2009). A large triangulating pool of data helps solidify the research, validates the hypothesis, and dispels one of the leading prejudices against case study research; lack of academic rigor (Yin, 2009). Figure 6 provides a pictorial diagram of convergent data and also reflects how each UOA acts as its own case study.

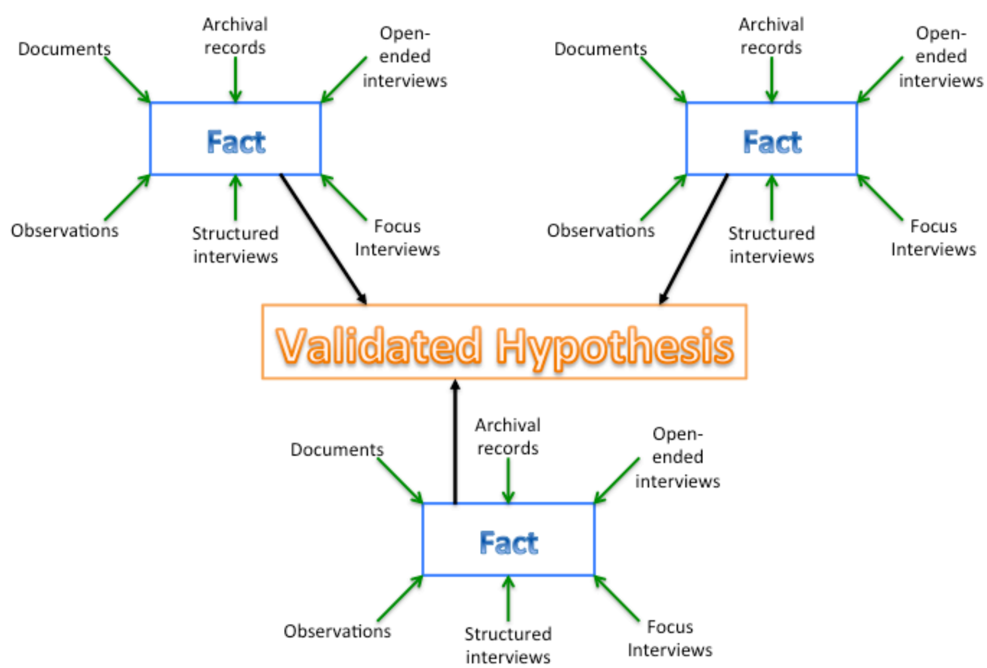

Figure 6: Convergent analysis validates research hypothesis

Unit of Analysis 1 – Integrative Nature of Joint Military Systems

UOA 1: *The integrative nature of military assets during combat operations and the risks associated with joint operations.*

UOA 1 focuses on four of the investigative questions:

1. *How does the Air Force align/posture forces for joint operations?*
2. *What is the focus of the current ACC/IG Inspection system?*
3. *How does the current inspection system account for the integrated nature of military assets during operations?*
4. *What system-of-systems examples or incidents exist that have a direct relation to an operational readiness inspection?*

Chapter 4 presents observations from joint operations and large force exercises. These observations, along with context from joint planning documents, will frame US military operations as joint in nature, reliant on the synergistic effects of the service branches to wage and win wars. High-level strategic documents also emphasize the need for joint operations to become even more integrated in the future. The trend toward further integration creates areas of additional risk. These areas must be addressed now in preparation for the future. Current AFIS evaluations should frame inspections within the joint SoS in order to identify and reduce integration-associated risks. This UOA will blend case study and archival methods.

Unit of Analysis 2 – Joint Readiness Assessment and Metrics

UOA 2: *Potential system of systems metrics/attributes for assessing joint readiness and how these can be applied within the context of the AFIS.*

UOA 2 focuses on analyzing two of five investigative questions:

1. *What system-of-systems examples or incidents exist that have a direct relation to an operational readiness inspection?*
2. *What system-of-systems metrics or attributes can be used to evaluate and determine the status and health of ACC units?*

This UOA examines ways to apply the AFIS to preexisting resources and environments better representative of the Joint SoS. UOA 2 also studies several metrics/attributes inherent in joint operations, which should be added to the AFIS checklists. Primarily a case study, UOA 2 addresses how and why these additions/ modifications are necessary and what they provide. This UOA demonstrates how realigning the AFIS provides better evidence of a unit's combat readiness.

Unit of Analysis 3 – Limitation of the SoS approach

UOA 3: *Limitations or counter arguments to implementing joint SoS attributes into the AFIS.*

This UOA focuses on identifying areas of concern regarding implementing a joint SoS architecture. As such, UOA 3 helps answer three of the investigative questions.

1. *What is the focus of the current ACC/IG Inspection system?*
2. *How does the current inspection system account for the integrated nature of military assets during operations?*
3. *What system-of-systems examples or incidents exist that have a direct relation to an operational readiness inspection?*

According to Yin, identifying and acknowledging weaknesses or differencing opinions are an essential part of case study research, providing the author an opportunity to refute each case. Counter arguments for each of these concerns are also addressed in UOA 3.

Sources

The concept of applying a joint SoS architecture to the AFIS finds support in academia, national strategy documents, and the DoD. However, to fully support the academic resources and defend the hypothesis required input and feedback from Subject Matter Experts (SMEs). Their insights provided further areas to research as well as provided critical analysis on the applicability and necessity for implementing a change gained over their AF careers. SMEs ranged from personnel on the ACC staff, primarily within the A2 and A3 directorates, with over 20 years of experience including assignments as group and wing CCs. Deputy Directors, SESs, division chiefs, branch chiefs, and other staff personnel with direct experience interacting with wing personnel as well as past assignments at wing, group, and squadron levels also contributed inputs. Members of the ACC/IG also reviewed and provided thoughts and comments on this work. Several members of the ACC staff had past joint experiences, either from staff assignments or deployments. Wing/CC's from multiple bases contributed thoughts and ideas as well. Engagements with O-3s to O-5s, from multiple Air Force Specialty Codes (AFSC), across ACC, Air Force Material Command (AFMC), Air Mobility Command (AMC), AF Special Operations Command (AFSOC), and US AF Europe (USAFE), added perspectives from those currently implementing the AFIS and CCIPs. This diverse field of SMEs totaling approximately 100 personnel lends credibility to this research.

Summary

Chapter 3 presented a road map for answering the hypothesis using a case study methodology. It described the techniques for analyzing each UOA and what methodology will be used. Chapter 4 presents the analysis and results of these three UOAs.

IV. Analysis and Results

Chapter Overview

Chapter 4 explores each UOA in greater depth providing examples and dialogue to support the hypothesis. Chapter 4 is divided into three sections based on the UOAs. Section one describes critical weaknesses in how the AFIS evaluates wing readiness in a joint context. Section two investigates ways to enhance the AFIS using joint characteristics. Section two also covers current resources available to help implement a joint SoS within the AFIS. Section three addresses opposing viewpoints or flaws in implementing a joint SoS inspection.

Findings: Unit of Analysis 1 – Integrative Nature of Joint Military Systems

Since the colonial campaigns of 1776 leading up to 1986, all US military operations attempted to achieve a successful joint force. In 1986, as a result of failed military operations from 1950 to 1983, Congress ordered sweeping organizational and climate changes across the DoD. The Goldwater Nichols Act transformed the DoD, acknowledging that successful operations required the synchronized and combined effects of all military departments working as single force. The acts two primary changes established the IG as an independent evaluator and organized the war fighting chain of command under a single unified CC.

JP 1-02 defines interoperability as "the ability to operate in synergy in the execution of assigned tasks" (Joint Chiefs of Staff, 2014). In 2008, JP 1-02 defined interoperability as "the ability of systems, units, or forces to provide services to and accept services from other systems, units, or forces and to use the services so exchanged to enable them to operate effectively together" (Joint Chiefs of Staff, 2008). This later definition more precisely defines interoperability as an exchange between entities to increase efficiencies and implies a level of integration. General Martin Dempsey recently stated US armed forces continue to make substantial improvements in their ability to conduct joint operations; however, he noted two areas of concerns. First, he stated US forces must continue to work together to advance joint capabilities, as future conflicts will require further integration to achieve success. Second, "each [speaking of Operations Desert Storm, OEF, and OIF] has further highlighted requirements for a system to effectively measure, assess, and report readiness from a joint perspective" (Chairman of the Joint Chiefs of Staff, 2013). General Dempsey's words reemphasize the hypothesis; specifically, that combat readiness should be assessed inside the joint SoS architecture.

Air Combat Command Staff Perspectives

Figure 7 depicts an illustrative joint operations OV-1 diagram. The picture shows the integrated and reliant nature of service components in an operational environment. It displays multiple levels of interoperability creating the synergistic effects referred to by the CJCS. Discussions with ACC staff personnel[5] helped identify key differences between joint warfare, as depicted in Figure 7 and a single wing inspection system.

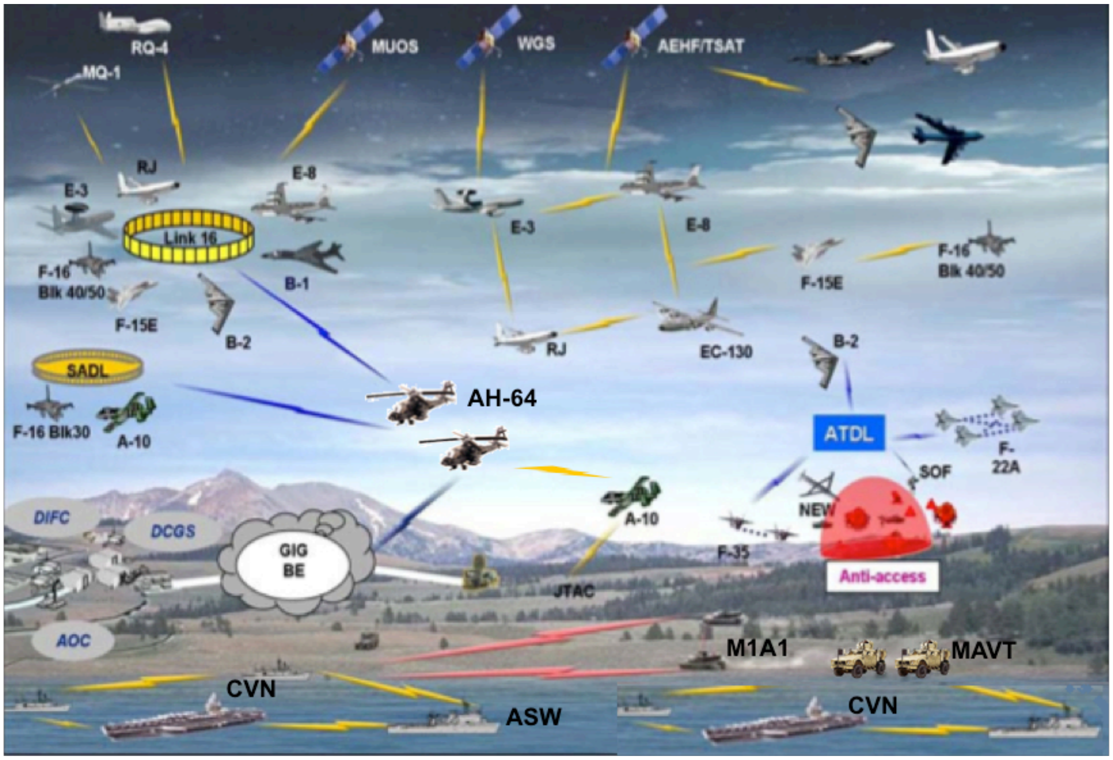

Figure 7: Operation view of the joint environment (SAF/CIO A6, 2010)

A primary aspect unique to joint operations is the sharing of information across platforms and services. This crucial element of modern warfare helps find, locate, and exploit enemy weaknesses. Information sharing drives the development of future operational and tactical level missions and decision planning as well as builds a common

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[5] ACC Staff personnel refers to member of the ACC/A2 and A3 staffs, including Branch Chiefs, Division Chiefs, SESs, and Directors of Operations.

operating picture for all users and enhances situational awareness. Additionally, information sharing requires three primary elements.

1) The gathering equipment must be able to send the data.
2) The receiving equipment must be able to accept and process the information.
3) The users on both ends must know what to do with the information.

Missing any one of these elements degrades the utility of the information. In joint operations, information is everywhere. Finding the right information and passing it along to the correct user(s) are important functions of all deployed personnel.

The characteristics of joint leadership, timing, and weapon system relationships are also demonstrated in Figure 7. Based on the number of connections between platforms, leaders must understand their role in the grand scheme as well as other responsibilities they may assume. Leaders must also be aware of which organizations are depending on them to successful complete their assigned mission. According to ACC staff, the diagram also reveals the amount of risk leaders assume when it comes to implementing the mission and assigning personnel and equipment. They must constantly balance the safety and security of their personnel and equipment versus the requirements to complete the mission. Leadership characteristics at this level are difficult to assess outside the joint SoS.

ACC staff personnel commented that organization provides a level of structure by establishing a chain of command. Creating a well-organized operation ensures information flows smoothly and helps personnel build and maintain situational awareness. Joint operations, because of the mix of services, coalition partners, and outside agencies, present a larger organizational problem. CCs must decipher these larger often overlapping organizational rings within joint operations to ensure the timely dissemination of information to the right personnel. Conversely, the organizational structure within most ACC wings is simpler in size, scope, and geography.

The relationship between weapon systems deals with the role of supporting versus supported. In joint operations personnel must know not only their platform's capabilities and limitations but also those of other platforms involved. The relationship between platforms explains who is leading the operation and the operation's primary goal. Understanding these connections contributes to mission success.

All these elements (information sharing, leadership, organization, and weapon system relationships) are linked together in the joint environment and their effects are often compounded by distance. In a joint environment a Wing/CC must juggle all these elements simultaneously. It is difficult to evaluate these elements during single wing inspection as they are often mitigated, simulated, or not applied.

ACC staff members pointed out there is no standard for joint preparation or joint integration. While joint publications and AFIs provide guidance and direction, there remains room for interpretation. There is a lack of clear guidance on what joint means at the wing level and who monitors adherence to JPs. They readily identified a lack of joint training opportunities, command level guidance, and oversight to help mitigate this problem. Compounding this issue, staff members mentioned every Wing/CC organizes and trains his/her unit based on past experiences. These unique career experiences create different interpretations of already loosely defined regulations directing affecting how wings practice, prepare, and equip. Compounded just across AF wings, these differences create integration issues during joint operations.

The ACC staff provided several notable differences in how a single wing OV-1 looks versus the joint operational OV-1 depicted in Figure 7. A wing level inspection under evaluates, or neglects several of the previously mentioned joint characteristics. Wing level inspections are introspective, focusing on areas within the Wing/CC's purview. Wing exercises and inspections often simulate outside relationships. Communication and information flow is much shorter and does not feed a larger organization. The negative implications of missed communications, actions, or plans do not ripple outward. Further, there is not a leadership role to practice mitigating these implications. During wing evaluations, distance also does not become factor. Everything necessary to complete their mission, the wing has at their disposal. There are limited ways to test interoperability and integration during wing exercises. Reliance on others is reduced and thus the pressures to perform, act, or accept risks are not present.

Risk Analysis: The Diamond Model

The previous discussions with ACC staff members highlights several differences between joint operations and single wing inspections. These differences present known levels of risks. Modifying an approach designed to assess project management risk provides insight into the differences between joint operations and single wing inspections. The diamond model approach created by Shenhar and Dvir helps managers scope their project and select the appropriate managerial techniques to maximize benefits and reduce risk (2007). Analysis occurs using a radar chart with four dimensions. Linking the plotted values from each dimension creates a graphical representation of the uncertainty and risk inherent in a project. See Figure 8 through Figure 10 for examples.

The four dimensions are listed in Table 3 along with abbreviated definitions (Shenhar & Dvir, 2007). Appendix B provides additional information on the diamond technique.

Table 3: Diamond Method dimensions and definitions

Dimension	Novelty	Technology	Complexity	Pace
Definition	How new is the product, familiarity with the product. Represents the uncertainty of the projects goal	Technology and task uncertainty. The level of technology needed or used in the project	Scope. Project organization. What is the project task	Urgency, impacts autonomy, decision making, and management involvement. Affects planning

While not specifically designed to identify risks associated with military operations, Shenhar and Dvir's approach to analyzing project management risk is applicable to this study. In fact, military operations contain similar attributes to projects. In addition, military operations are planned and coordinated in a comparable fashion to tangible project development. A JFC acts as the project lead, assembling the required parts, pieces, and people to complete the mission. The JFC balances requirements, time, sizing, costs, and integration like any project manager. In this analogy, the operation is the project. Once complete, the JFC is tasked with another project. Operations, like projects, can affect, influence, or run in parallel with other operations and require additional oversight to resolve disputes and set priorities. In the case of military operations, the COCOM, SECDEF, and POTUS act as chief executive officers delineating responsibilities and managing the oversight of all operations. The DoD's use of the terminology "systems of systems" in reference to the military implies a project like structure (ODUSD(A&T)SSE, 2008). Similar to integration and interoperability issues during joint operations hinders mission success, Shenhar and Dvir write that a "complex system does not simply function as a collection of subsystems…even when all subsystems function perfectly and each one fully meets specifications, when they are put together they rarely work as a system the first time. Ignoring this reality may cause delays and surprises to project managers" (2007). The similarities between military operations management and project management allow the application of Shenhar and Dvir's diamond approach to military operations.

The next paragraphs provide further discussion on the four dimensions listed in Table 3 and offer examples to illustrate each one.

Novelty relates to the type of military operation as defined by JP 3-0. This dimension also includes geographical location and level of warfare, with the later referring to the type of environment faced by our forces. This includes permissive, non-permissive, anti-access, aerial denial, and chemical environments. These factors change the operations novelty as they represent environments US forces do not routinely prepare for. The Counter Insurgency (COIN) operations of OEF and OIF, for example, would represent a breakthrough level of novelty form of warfare for US forces. Prior to OEF and OIF, the US military had not participated in or practiced a "hearts and minds" approach to COIN operations. This new COIN approach emphasized winning over the population as a way to drive out terrorist and reduce insurgent activity.

Table 4: Types of Military Operations (Joint Chiefs of Staff, 2011)

Examples of Military Operations			
Stability operations	Recovery	Combating weapons of mass destruction	Counterdrug operations

Civil support	Noncombatant evacuation	Chemical, biological, radiological, and nuclear consequence management	Combating terrorism
Foreign humanitarian assistance	Peace Operations	Foreign internal defense	Homeland defense

Technology relates to the type of equipment being used in support of the operation. This dimension includes the communication, space, and cyber architecture as well as conventional equipment (planes, tanks, bombs). The OV-1 diagram depicted in Figure 7 shows the complex technology required to ensure all forces can communicate and complete their assigned missions. A surgical SEAL operation however, may use less technology to control emissions and allow for speed, security, and stealth (Carney & Schemmer, 2002).

Complexity focuses on the operations size, strategy, scope, and command architecture. It also includes components of distance and logistical support. Coalition warfare increases the level of complexity.

Pace refers to speed and duration and is driven by the type of operation. Most military operations require timely movements in order to meet TPFDD deployment timelines or execute a new Air Tasking Order (ATO) cycle. A humanitarian operation may require the rapid deployment of forces, whereas the buildup for Operation Desert Storm was deliberate and occurred over a six-month span. The unit’s primary mission capability also dictates pace. Personnel recovery (PR) units may exercise at a blitz pace in order to save lives. Fighter operations however, may fall more in the fast/competitive lane for regular ATO execution but spike to time critical or blitz if called to support a Troops-in-Contact (TIC) or PR event.

The subsequent paragraphs apply the diamond approach to single wing exercises and joint operations. According to the AFI 90-201, inspection readiness reflects mission readiness. If true, the wing and joint diamonds should be relatively similar in size. Shenhar and Dvir state inaccurately sizing a project's diamond indicates a lack of project understanding/analysis. This causes waste, if sized too large, or increased risk, delays, and cost, if undersized (Shenhar & Dvir, 2007). The diamond's area reflects the project's overall risk and complexity (Shenhar & Dvir, 2007). The difference in area between the wing and joint diamonds reflects the additional complexity inherent in joint operations, not captured in wing level exercises. The size difference translates to additional risk wings may face when deploying in support of joint operations. The resulting diamonds were sized by the author using his military experiences as a project manager for acquisition programs, multiple deployments as an intelligence officer and civil engineer, time in wing level intelligence organizations, and the flight commander for ACC's Staff Assistance Visit (SAV) program. In addition, the experiences and knowledge of ACC personnel, listed in the Sources section, contributed to how to plot each diamond.

Application of the Diamond Model to a Wing Exercise

Figure 8 depicts the risk associated with a wing level inspection or exercise. Since the majority of wing level exercises are internally focused, the novelty can be considered derivative in nature. Wing level exercises are often derivatives of prior exercises with updated intelligence, geopolitical, and TTP information. Completely new exercises scenarios are rarely generated at the wing level. Given the number of base organizations involved in these exercises the complexity level fits the description of a system. Routinely scenarios become focused on specific functions within the wing, limiting base involvement to as few units as necessary. This minimization, along with the repetitive use of similar scenarios, limits the size of the complexity and novelty dimensions. Technology risk remains at the low to medium level.

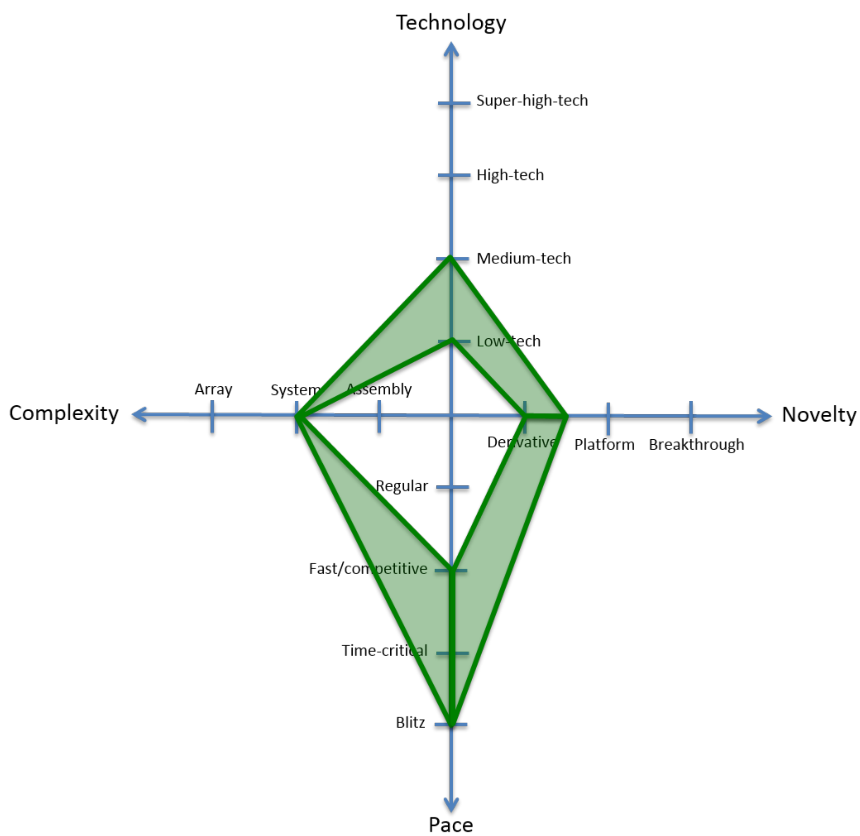

Figure 8: Wing level risk assessment

While several wing organizations work together creating a larger pool of technology required to synchronize communications and share data, there is rarely new technology integrated into wing scenarios. Wing scenarios look to refine already existing capabilities and identify inefficiencies. However, it is possible for newer technology to be incorporated to correct past deficiencies, which is captured in the slight increase towards medium technology. In addition, the platform itself affects the size of the technology dimension. ISR platforms, for example, often require larger communications networks. Wing exercises often limit the network requirement though, simulating communication and information sharing with outside organizations. Pace is the only dimension identical between wing and joint operations.

Application of the Diamond Model to joint operations

Figure 9 shows a diamond model assessment of a joint operation or exercise. Joint operations stretch outward in three of the four dimensions compared to a single wing inspection. Figure 10 in the next section shows a comparison of the single wing versus joint diamonds, overlaying the one over top the other.

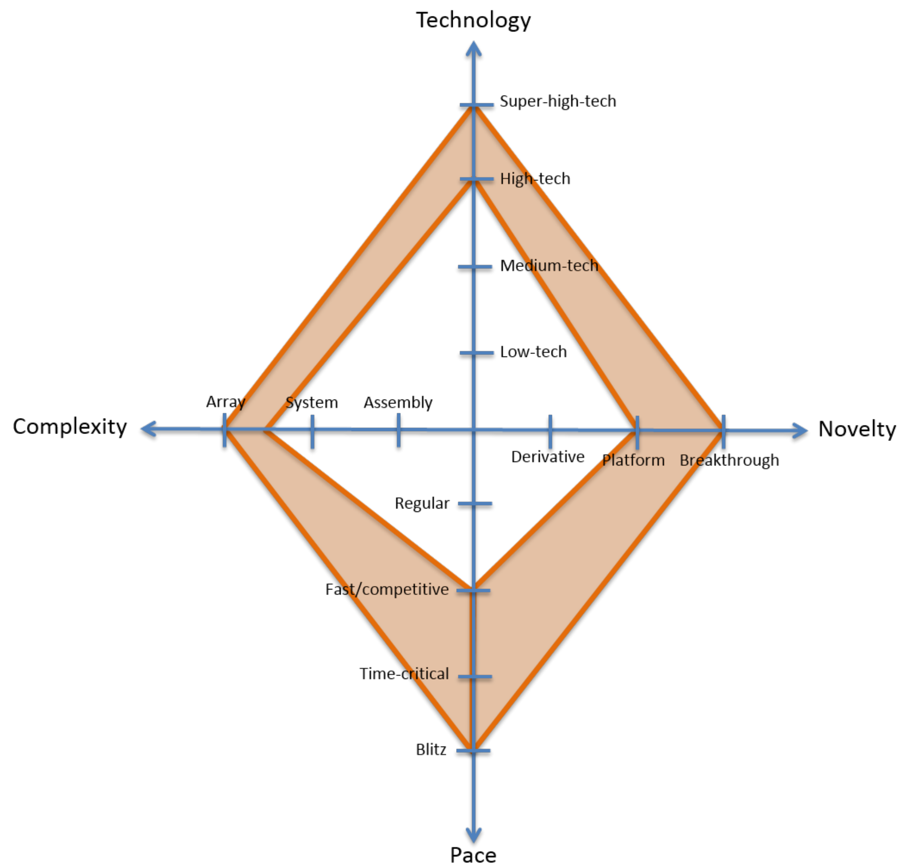

Figure 9: Joint risk assessment

Analyzing the novelty dimension for joint operations creates an area between platform and breakthrough. At a minimum, joint operations start at the platform level. As discussed in chapter two, JFCs build and tailor forces to meet current operational needs. Each JFC acts as a new platform. However, the changing global environment, rising global powers, the rapid proliferation of technology, advanced Surface to Air Missiles (SAMs) and jammers, and the increasing number of terrorist organizations, creates an endless number of scenarios joint forces must be prepared to handle. Future operations will challenge US forces in new ways. The unknown nature of the next conflict extends the novelty dimension out to breakthrough. Joint exercises are often conducted at the platform level, expanding upon already used exercises to incorporate new weapon systems or expand the focus of the exercise to incorporate new threat environments.

The technology risk associated with joint operations ranges from high tech to super high tech. The integration of service and/or coalition technology resembles the definition of high tech and sets the minimum level of risk. The "fog and friction" of warfare accounts for the increase from high to super-high-tech. Integration and interoperability issues may drive the development of new technology or require the quick adaptation of existing technology. In addition, warfare is the struggle between adversaries to achieve conflicting goals. The struggle to gain and maintain momentum, exploit an opponent's weaknesses, and defend ones gains, spurs the development of new technology and TTPs in order to gain a slight advantage. The rapid development of networked and layered sensor and communication systems transformed OEF and OIF into super high tech wars.

The complexity risk associated with joint operations primarily resides at the array level. Shenhar and Dvir define an array as a SoS or "a widely dispersed collection of systems that function together to achieve a common purpose" (2007). This definition is exactly how joint and coalition forces operate. The challenge of merging and organizing several command structures under one unified CC poses a large risk. Several other factors affect complexity risk. Ensuring all services work to achieve a single goal, balancing various Rules of Engagements (ROEs), understanding the strengths and limitations of each service or coalition partner, and managing a global logistics chain are a few examples.

Comparison of Wing and Joint risks

Figure 10 shows the joint and wing diamonds plotted on the same graph. Joint operations incorporate a larger amount of risk in three of the four dimensions. Only the pace dimension is the same for joint and wing operations. The added area of the joint diamond represents shortfalls and unidentified risks in single wing inspections. The smaller wing diamond explains the "start-up pains" and additional issues several ACC staff and wing personnel mentioned earlier. A puzzle analogy works well to describe the differences. The POTUS has a vision, which the SECDEF in turn creates into a picture. The COCOMs cuts up the puzzle as they see fit with a single piece representing a wing. People only put puzzles together when they want to. No one counts the pieces or sorts them before starting. It's halfway through the puzzle when someone realizes pieces are missing, finds pieces from another puzzle, or notices the pieces don't fit together anymore. The combined effect of all the pieces is a perfect recreation of the POTUS's vision. Missing just one-piece flaws the entire image.

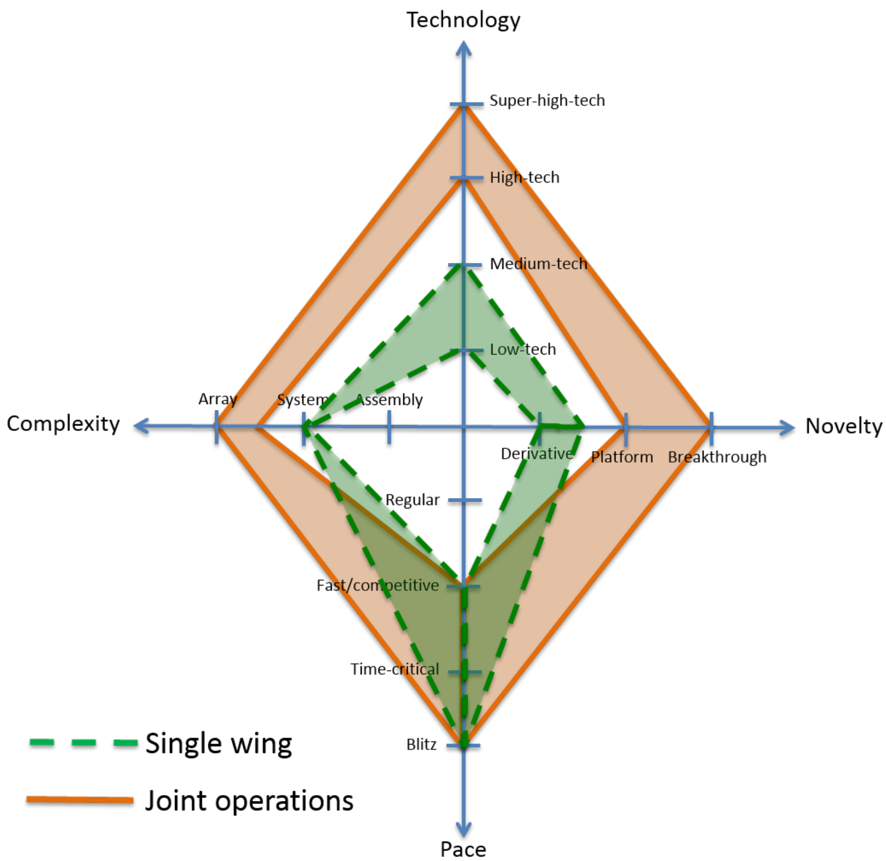

Figure 10: Overlay of Joint and Single Wing risk assessment models

ACC staff also equated the size difference between the joint and single wing diamonds to the introverted nature of wings. When at home station, wings tend to focus on improving internal functions and procedures. Their training focuses on the specific tasks assigned in their OPLANs and CONPLANS. In today's fiscally constrained environment ACC staff does not see wing commands spending funds on large force exercises or joint training when money may not even be available to sustain current flying operations or maintenance costs. All agreed the smaller defense budget has the potential to make the differences in joint and wing diamonds larger as Wing/CCs prioritize necessities first.

Some argued the new AFIS will also create a larger difference between joint and wing operations. Since the new AFIS evaluates the CC's ability to lead and manage his own inspection program, they felt CCs would concentrate more on internal issues verses external connections. This inward looking perspective further separates wings from the larger joint SoS as commanders put all their resources towards correcting internal issues while ignoring areas with cross wing or service implications.

Operational Wing Personnel Perspectives

Discussions with unit personnel concurred with the ACC staff perspectives of joint versus AFIS realities. Conversations included pilots, maintainers, and intelligence personnel from the following platforms: RC-135, JSTARS, Global Hawk, Predator/Reaper, ASOS, F-16, C-130, AWACS, and F-15E. All personnel agreed that large-scale exercises provided better evaluations of combat readiness. Wing personnel concurred with ACC staff members that wing exercises[6] often simulate key operational components. Further, personnel noted wing exercises do not provide opportunities to conduct operations with other service air or ground assets. Lacking these elements makes it difficult to correctly assess wing readiness or adequately prepare for joint operations. Examples provided included synchronizing timing with other units, joint mission planning and rehearsal, and direct interaction with ground control, airborne control, and

[6] Wing exercises are often referred to as operational readiness exercises (ORE) or ORIs

ISR platforms. Other differences noted included lack of realistic scenarios and the inability to test equipment across networks. Most personnel stated they experienced varying degrees of interoperability issues throughout their deployment. Initial integration issues were identified as a large problem. Overtime, personnel noted issues became smaller; however, the dynamic nature of operations sometimes caused new issues or further complicated others.

An example from several ISR wing inspections, under the current and old AFIS, provides insight into the limitations of single wing inspections. During wing exercises and inspections, personnel revealed ISR aircraft often do not conduct live or simulated operations. The aircraft take off in order to demonstrate the capability to generate sorties however, there is often no mission to test/demonstrate the platform's ISR capability. Personnel cited time, money, Federal Aviation Administration (FAA) restrictions, planning constraints, and leadership as reasons why this occurs. In addition, personnel stated simulators (which can be linked to live or virtual exercises) are outdated and do not provide the same fidelity as actual missions. Simulator availability was also identified as an issue. Some wings have noted these deficiencies using the new CCIP; however, others did not. When asked why, several personnel stated the higher deployment tempo for ISR platforms keeps personnel well trained. This statement independently validates the hypothesis. Units are using real operations as training environments, relying on the larger SoS to provide the necessary realism.

Many aircrew and intelligence personnel stated Large Force Exercises (LFE) provided better feedback on wing readiness. LFEs place an emphasis on successful integration in order to achieve mission objectives. LFEs act as a venue for testing and refining TTPs or Concept of Operations (CONOP), reducing integration risk by identifying areas of concern prior to deployment. LFEs mirror combat operations by generating scenarios that require units to interact and integrate in order to achieve mission success. Combat operations place importance on synchronizing effects to ensure mission completion. In contrast, internal wing inspections often place the emphasis on procedures. JP 1-02's definition of interoperability, given earlier, reiterates this point. LFEs provide a platform to resolve cross service issues at the lowest level. However, several personnel mentioned issues such as conflicting TTPs, network/communications problems, and logistics/planning differences regularly emerge during LFEs (or during joint deployments). Sometimes, these issues transcend the wing level and permeate throughout the AF and other services. In these situations, an IG focused and trained to understand the larger SoS could use its position to benefit all branches. As an independent evaluator, the IG's access to higher-level CCs would allow the quick resolution of interoperability issues.

ACC staff members and personnel were asked to identify reasons why the current AFIS conducts single wing inspections and what benefits exist to this method. The primary reason identified for single wing inspections was simplicity. Single wing inspections reduce the required number of inspectors. Inspecting multiple wings simultaneously requires additional resources to ensure the availability of enough inspectors for each location. In addition, a single wing inspection provides a simple method for identifying the source of problems and assigning responsibility. In addition, most wings identify themselves as having a unique mission, making it impossible to equally compare results. Inspecting a single wing allows the IG to tailor its needs and checklists for each wing to accommodate the variety of unit missions. During conversations with the IG, they agreed with all these points. They added single wing inspections also make trend analysis easy, allowing quick publication of corrective guidance.

Collaborating Field Research and Data

A 2011 survey of active duty intelligence units in ACC supports the staff and wing personnel's thoughts on the lack of joint training opportunities. Among other questions, the survey asked units to report on pre-deployment training specific to the wing's deployed function and theater specific spin up training. Findings revealed that on average only two percent of wing intelligence personnel were funded to attend focused pre-deployment training (15th Intel Squadron, 2011). Thirty five percent of wings said spin up training was adequate at best (fifty five percent had no comment). Only forty one percent felt their units were prepared to accomplish the deployed mission. The report noted that at one time ACC offered a pre-deployment/theater spin up course that provided units with specific training on current TTPs employed down range (15th Intel Squadron, 2011). The course used a feedback loop to ensure units had the latest information before leaving the US. The report did not mention when and why the course was canceled however, it did mention the course stopped prior to this survey (15th Intel Squadron, 2011).

Government Accountability Office (GAO) reports over the past two decades support ACC's findings, identifying the lack of joint training opportunities as a primary cause for integration and interoperability issues (1992) (1998) (2005). In 2009, the DoD published DoD Directive 1322.18, requiring all training be built around "an open, net centric, interoperable standard" focused on meeting COCOM requirements (Department of Defense, 2009). The Air Force Scientific Advisory Board echoed the GAO findings in a 2005 report stating the lack of joint SoS planning, preparation, and training created situations in which "the unanticipated need for system to system interactions too often require clever ad hoc work-arounds" (2005). Further, the 2005 report listed four battlefield consequences created by a lack of joint SoS planning: "1) JFCs cannot take full advantage of assets, 2) capabilities are 'late to the need', 3) unanticipated CONOPS 'work-arounds' developed on the fly, and 4) users had to compensate for weak interoperability designs" (United States Air Force Scientific Advisory Board).

While training and LFEs can help correct deficiencies in interoperability and integration, an inspection system must be in place to enforce standards. Training programs require evaluations to provide feedback on the program's quality and accuracy. In addition, evaluations ensure personnel are proficient at their assigned tasks. AFIs 11-202 and 14-202 (aircrew and intelligence regulations respectively) each contain three volumes. Volume one of each series is dedicated to training. Volume two is dedicated to standardization and evaluation and ensuring the training program meets all expectations. The IG is ACC's evaluator and is responsible for identifying and addressing these larger issues of interoperability and integration.

Research in the area of battlefield fratricide shows a direct connection between the causes of fratricide and service branches failing to acknowledge the larger joint context during training, exercises, and planning. This failure leads to increased risk which could be mitigated through a joint SoS approach to inspections. A study by Hewitt and Webb from the United States Army Aeromedical Research Laboratory (USAARL) linked fratricide to several of the factors identified by ACC staff members and personnel. Their research shows an increase in the percentage of fratricide events since WWI. The cases they analyzed involved several cross service incidents (example: AF pilots fire on Army personnel). The level and complexity of warfare, and a heavy reliance on technology, were identified as two underlying forces attributing to the increased fratricide rate, but not the sole reasons (Hewett & Webb, 2010). The most common causes of fratricide were related to three categories. First, misidentification which included three related findings: "combat identification measures, the actions of the target, and the physical features of the target" (Hewett & Webb, 2010). Categories two and three were teamwork and procedures respectively. Training was identified as a common factor related to these three categories. In their conclusion, Hewett and Webb recommended military leaders "should stress the importance of training, education, and leadership," in order to combat fratricide (2010). They further noted the heavy dependence on technology created an air of overconfidence in abilities. This overconfidence often prevented soldiers from "double checking plans," and reduced information sharing (Hewett & Webb, 2010).

A separate study conducted by Gadsden and Outteridge came to similar conclusions. Their root cause analysis identified the top four reasons as communication and information flow, Command and Control (C2), procedures, and misidentification (Gadsden & Outteridge, 2006). Reliance on technology was identified as a minor contributing factor. Gadsden and Outteridge concluded there is never a single reason for a fratricide event. Instead, the compilation of several factors resulting in a loss of situational awareness is the most likely cause (Gadsden & Outteridge, 2006). The compilation of factors equates to the compounding effect of risks. Gadsden and Outteridge did not specify ways to resolve these issues; however, since the results are similar to Hewett and Webb's work, better training and preparation are potential solutions.

Major Russell Hart in 2004 and Commander Robert Rasmussen in 2007 published similar qualitative studies on the increasing percentage of fratricide cases. Their articles share similar thoughts on the rapid pace of modern conflict and its impact on human factors and the reliance of forces on technology (Hart, 2004) (Rasmussen, 2007). According to Hart and Rasmussen, the dynamic nature of modern warfare creates situations where "the mission that forces may be tasked to accomplish and the manner in which they may be employed may not necessarily coincide with the dedicated mission the specific unit or asset was intended to perform" (Hart, 2004). Maj Hart provides the example of B-52's conducting Close Air Support (CAS) in the early stages of OEF and OIF, a role "strategic bombers had not played since Vietnam (Hart, 2004)." Several of these non-traditional combat roles resulted in fratricide or near missing. New TTPs and safety regulations were written after such events occurred (Rasmussen, 2007). Army and Air Force top officials immediately pushed for implementing these new TTPs and regulations into joint training and exercises. Both authors state they feel more joint exercises and training would have the greatest effect on reducing fratricide. Exercises and training events highlight areas of incompatibility and allow the development and writing of TTPs and regulations prior to combat operations (Hart, 2004) (Rasmussen, 2007). Further, both cite the high ops tempo forcing soldiers to rely more heavily on technology to build Situational Awareness (SA). Hart and Rasmussen pointed to the lack of compatibility between several identify friend or foe and blue force tracking systems currently in use, citing soldiers heavily relied on this technology to be true at all times (Hart, 2004) (Rasmussen, 2007). Miss-identification was cited as a primary reason for fratricide in both reports as well as being identified in Gadsden and Outteridge's and Hewitt and Webb's works (although not a prime reason in either case). Hart's and Rasmussen's stories on the overuse of technology also relates to Hewett and Webb's overconfidence factor. An incomplete picture of the battlefield compounds the problems created by a lack of joint awareness/training.

The qualitative and quantitative examples of the previous paragraphs show the need for early integration of forces at the lowest levels in order to help reduce combat risk. Factors identified in these studies on fratricide complement discussion with ACC staff and personnel and explain the larger joint operational risk diamond. Joint training, operations, and exercises demonstrate levels of increased risk due to the added complexity and pace of warfare. Joint forces rely on each other to provide specific capabilities to accomplish strategic, operational, and tactical level operations. Inherent in that trust is the mutual understanding of TTPs, guidance, regulations, and a refined practice. A major component of the UEI though is to assess and identify wing level risks which could impede combat readiness with the goal of shrinking the difference between combat and inspection ready. A SoS perspective layered over the AFIS should identify additional joint risks prior to deployments, allowing for the development and implementation of risk mitigation strategies/plans.

Deployment Findings

A recent deployment supporting MC-12 operations in Southeast Asia reiterates several of the points identified by staff and wing personnel.

In the Central Command (CENTCOM) theater of operations, the Reconnaissance, Surveillance, Targeting and Acquisition (RSTA) annex to the ATO lists all the ISR sensors' taskings for a specific day. The process to develop the RSTA and the information it contains highlights the integrated nature of modern warfare. To request ISR support for upcoming operations, units submit requests through collection managers. Collection managers translate requests into requirements. These requirements are input into a database where the Joint Collection Management Board (JCMB) sorts and prioritizes the requirements. The JCMB provides the prioritized list to the Combined Air Operations Center (CAOC) where a team assigns an ISR sensor to fulfill the requirement. The RSTA provides baseline information for who, what, when, where, and how each sensor will support operations. Units use the RSTA to gather additional mission details through direct contact with supported users and other agencies. This decentralized execution allows assigned platforms flexibility to properly support its customer at the right time and place.

Interoperability issues often arise as a result of the RSTA. This process normally assigns an AF platform to support a non-AF unit. A lack of understanding in capabilities, TTPs, and responsibilities between the two users impedes mission success. The MC-12 MULTI-INT aircraft is a prime example. The majority of MC-12 missions fly in support of US Army or Marine ground forces. Ground CCs were often not familiar with the MC-12 platform or its capabilities. Lacking this knowledge, many ground units under or incorrectly utilized the MC-12. In addition, AF pilots lacked the required training to read ground schemes of maneuver, making permission planning and coordination difficult. The MC-12 wing started a liaison program to educate ground forces on the platform's capabilities. This along with post mission debriefs with supported users helped mitigate integration issues.

Further, MC-12 aircrews were authorized to provide air warden duties for large ground operations. This role required MC-12 crewmembers to manage and direct all aircraft supporting an operation. Mission CCs cross-talked with all participating air assets, relaying commands from ground force and vice versa. Only mission CCs holding current air warden certifications were authorized to perform this duty. Home station training; however, lacked the resources to provide this certification before a mission commander deployed. The home station training program did not have a robust enough scenario to accomplish this task. Once deployed, mission CCs received training "on the fly" during actual missions in order to receive their air warden certification.

The MC-12 also provided buddying lasing for strike aircraft to fire guided munitions. Similar to air warden certification, MC-12 operators received training down range during actual combat missions. Never trained in munitions planning, the lack of knowledge on weapons effects hindered operations. MC-12 personnel were not familiar with important considerations to ensure successful target engagement. Details concerning run in headings and release angles to mitigate Collateral Damage Estimates (CDE) or provide the strike platform a better visual on the target were new subjects for MC-12 operators. Joint exercises on military ranges in theater established the buddying lasing TTPs and certification requirements.

Another adjunct role provided by the MC-12 was medical evacuation relay. Ground forces encountering communications issues due to distance, equipment failure, frequency differences, or jamming sometimes could not communicate their requirement for medical support. Or once in route, ground forces would not know the callsign and frequency on which to communicate the medical platform. MC-12 aircrew became radio relay assets during these situations, passing 9 line information as well as situational updates and possible threats to inbound rescue platforms. During TTP development (again conducted in the deployed environment), ground personnel explained that during homestation exercises, air lift is simulated and all the callsign and frequency information is provided beforehand. In addition, many ground units never simulated or practiced procedures to mitigate jamming or work around other communication issues.

Inspecting MC-12 mission capability requires testing aircrew proficiency in all mission areas. Many of these situations are difficult to test or capture in a single wing inspection. The only way to assess mission capability in today's joint environment is to evaluate a system within the joint SoS architecture.

Further research revealed two similar integration issues. Air to ground fighter units often deploy with an embedded Army Ground Liaison Officer (GLO). This position, as well as those at Distributed Common Ground System (DCGS) sites, was intended to increase interoperability and reduce operational risks between services. Coordination and communication issues between AF and Army personnel resulting in impaired operations highlighted the need to provide inter-service liaisons (i.e. translate Army talk to AF language and vice versa). Army liaisons facilitate cross talk between aircrew, Joint Terminal Attack Controllers (JTAC), and ground forces CCs, interpret

CONOPS/Scheme of Manuevers (SoM), support mission planning, and provide awareness training to AF personnel. The DCGS utilizes Naval Intelligence personnel for the same reason. These issues and their solutions were identified and tested during LFEs or combat operations.

Findings: Unit of Analysis 2 – Joint Readiness Assessment and Metrics

Integrating a joint SoS architecture into the current AFIS does not require a completely new system. The framework shown in Figure 1 provides a good foundation while already existing capabilities can be leveraged to make integration smoother and quicker. Implementing a joint SoS in the AFIS provides a means for breaking down barriers related to interoperability and expanding upon the IG's current function of identifying risk and ensuring combat readiness. The IG as an independent organization can reach across services to identify root causes impacting joint operations and driving change. Further, expanding the AFIS aperture to include the joint SoS creates an organization capturing lessons learned and studying growing trends to potentially identify areas of future risk.   General Hostage, ACC/CC, summarized the importance of joint interoperability stating, "Partnerships improve operational effectiveness and increase integration of air force, joint, allied, and coalition capabilities in advanced threat environments" (Hostage, 2014).

Joint Characteristics

This section collects and expands upon the joint characteristics mentioned throughout this work. It should be acknowledged that these are not "new" characteristics by any means but have been pulled from joint and AF regulations as well as from articles by other government agencies/think tanks and non-government organizations from as early as 1987. While some of these documents contained additional characteristics, all stated the need for a more integrated and interoperable, rapidly deployed and tailored forces, which can easily "plug and play" (Joint Chiefs of Staff, 2003). Discussions with the personnel listed in the Sources section helped limit this list to four characteristics: 1) Rapid integration, 2) Rapid interoperability, 3) Joint training, 4) Flexibility/adaptability. Additional characteristics mentioned where: 1) Rapid mobility, 2) Net-centric, 3) Tailored, and 4) Joint awareness. Rapid mobility and net-centric were combined with the definitions for rapid integration and interoperability while joint awareness was combined with joint training. Tailored was eliminated from the list since it is the JFCC's job to decide which forces he/she requires to complete the mission.

In addition to implementing these characteristics within the IG checklist, the joint SoS architecture requires a mindset change in ACC wings. Personnel must begin to acknowledge the relationship between units and the joint SoS and the affects each component has on the other. The mindset shift affects wing TTPs, decision-making, and planning; however, adopting the joint SoS architecture aligns with the intended focus of the UEI and the force with combat readiness.

Adapting Figure 1, Figure 11 shows how the joint architecture would integrate with the current UEI MGAs. Adding the characteristics does not require changing the UEI rating system, which assigns each MGA an equal apportionment (25%). The large orange box represents the joint SoS mindset while the smaller green boxes identify areas where joint SoS characteristics could be added to the UEI checklist.

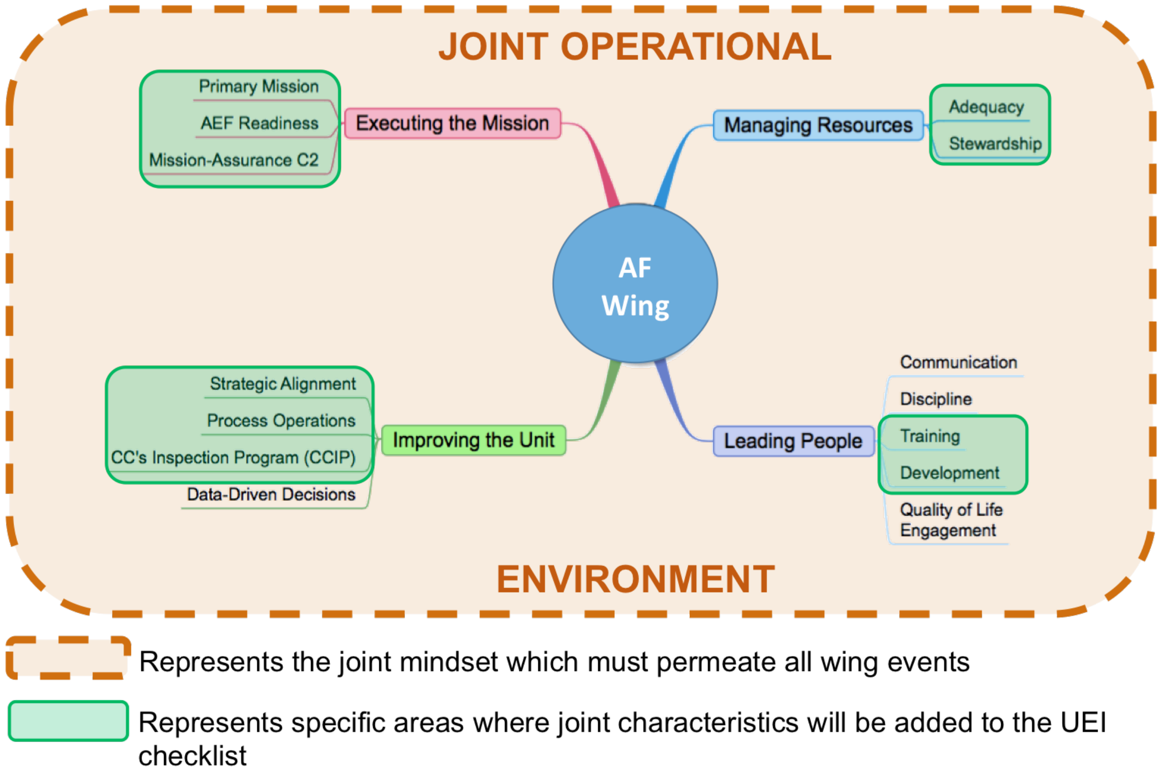

Figure 11: New AFIS UEI with focus on the joint SoS

- Rapid integration – Defines a wing's ability to quickly assemble with other services and stand up operations in any environment. The characteristic focuses on creating a working and sustainable joint force. Rapid integration occurs on a much quicker time scale than current operations and requires wings to utilize and understand other service equipment. It requires wings to integrate capabilities quickly in order to quickly prosecute assigned mission. Rapid integration exploits time as a weakness and requires the swift integration of forces who can immediately conduct operations on short notice. To achieve this affect, wings must engage with other service components assigned to the same OPLAN/CONPLAN. Training should focus on the capabilities and communication equipment of other service assets and studying the wings role within the larger framework. Services should pre-coordinate necessary equipment to reduce weight and redundancy. Sharing resources saves time and reduces the logistical trail.

- Rapid interoperability – Works hand in hand with rapid integration. This characteristic assesses a wings ability to quickly share information and capabilities to create synergistic effects focused on overwhelming the enemy. Interoperability should be developed prior to deploying, as services should exercise regularly in order to build and refine TTPs, test communication equipment, activate networks, and develop redundant or alternative methods.

- Joint Training – A specific task to ensure Wing/CCs are provided with and in turn are offering joint training opportunities to their personnel. Training should be properly documented upon completion and trainees should share their experience with the rest of the wing. This characteristic looks at how the Wing/CC manages his/her training budget and balances joint requirements against platform requirements. It also looks at how often the wing participates in multi-unit or joint exercises over a year period. Outside a joint exercise, successfully meeting this requirement stipulates wings maintain a robust training program based on assigned OPLANs and CONPLANs. These training programs should contain sections dedicated to friend force capabilities, interoperability issues, assigned responsibilities, and the affects of the wing's role on the larger operation. Finally, the characteristic looks to ensure leadership (W/CC at a minimum) have attended a joint training course. This characteristic looks to reduce risks associated with failing to understand the larger operation and failing to know other service capabilities/limitations.

- Flexibility/Adaptability – This characteristic ties in with integration and interoperability. Flexibility and adaptability look at a wings capability to support other mission outside its primary and assigned missions. The use of B-52 aircraft in a CAS role is an example from OEF/OIF. It examines a leader's ability to identify opportunities and weigh the risks and rewards. It analysis how rapidly and efficiently wings can change missions and how well the wing uses its equipment. Flexibility and adaptability tests a wing's ability to rapidly mission plan, identify other resources available (could be another service), and utilize those resources to successfully conduct the mission.

Leveraging Current Resources

Identifying joint characteristics is a key first step in integrating a joint SoS into the AFIS. However, implementing these characteristics requires the resources and means by which to evaluate them.

Currently there is a plethora of joint, service, and coalition exercises ranging from larger scale operations to mission specific events. These exercises present a logical place to implement a new joint SoS AFIS. Additional areas to explore include geographically related bases hosting regional exercises and the use of simulators for networked exercises. In addition, the new AEF Next model creates a perfect cycle for integrating a LFE for rotational forces. This work does not contain an all-inclusive list. It does; however, provide examples of how to implement a joint SoS within these exercises and why exercises provide a perfect fit.

Operation Angel Thunder, for example, is a joint exercise focusing specifically on personnel recovery. Since its inception in 2006, Operation Angel Thunder continues to grow in size and scope. Over the last several iterations, the exercise organizers have added new scenarios and expanded the depth and breadth of training personnel receive. Recently developed scenarios focus on rescue operations in jungle environments and at extended ranges to account for aerial denial situations. Several ISR platforms and coalition partners have also joined in, demonstrating/providing new capabilities and producing new TTPs for integrated operations. The MC-12, for example, initially developed its PR TTPs at Operations Angel Thunder. Once downrange, the wing refined its PR TTPs, becoming a valuable communications relay asset for PR and aeromedical evacuation assets[7].

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[7] Personnel recovery and aeromedical evacuation are not taught at the MC-12 school house nor have they been tested in wing exercises. These TTPs and capabilities were only discovered through joint exercises

In addition, many of these joint scenarios/exercises continue to grow, involving cyber, space, RPAs, and coalition partners. Red Flag, the AF's premier training event, recently integrated all these facets into its 2014 exercise deck. These four areas represent areas of interest to the joint chiefs and service secretaries. Red Flag was specifically designed to provide cross platform and cross service training in a simulated real operational environment. The exercises force services to operate together, learn each others TTPs, and rely upon each other to exploit the enemy's weaknesses through combined affects (99th Air Base Wing Public Affairs, 2012).

Red Flag 14-1 saw more than 125 aircraft from the US AF, Navy, and Marine Corp attend the exercise, as well as aircraft and personnel from the Royal Australian Air Force and Royal Air Force of the United Kingdom. According to General Hostage, soldiers, sailors, and airmen "participated in advanced training, improving integration and interoperability amongst our joint and allied partners" (Hostage, 2014). Events like Red Flag develop those synergistic effects, which translate into future mission success.

The AFIS could also adopt a geographical approach to inspections. Exercise Razor Talon is an east coast exercise hosted by Seymour Johnson AFB. Started as a way to augment Red Flag and provide additional training for deploying units, Razor Talon has expanded into a large joint force event. Unlike Red Flag, participating units prepare, plan, and fly from their own bases. Exercise coordination and planning takes place over teleconferences, Video Teleconferencing (VTC), or Defense Connect Online (DCO) Chat functions. Wings alternate acting as the CAOC, directing and leading exercise operations. Scenarios range from CAS, offensive counter air, to strike escort and

Suppression of Enemy Air Defenses (SEAD). In addition, access to ranges with simulated threats increases the exercises' complexity.

The exercise has emerged as a popular venue due to its integrated nature with other service and international partners. The exercise provides a rare opportunity to interact with and fully understand the capabilities and limitations of the various assets. "For example, Air Force pilots have opportunities to hear ship communications over the radio" or fly and communicate with British and French forces (Boland, 2013).

In addition, the complexities of running such a large exercise, as well as hosting coalition partners, create multiple interoperability and communication challenges. Personnel improvise solutions on the go, learning valuable lessons about joint operations. From its inception, the goal of Razor Talon was to "train like forces fight, and in the field, the various nations are going to stand side by side" (Boland, 2013). Planners wanted to provide as much realistic training as possible to help services and coalition partners understand the challenges combine operations can create. Col Birch, 4th OSS/CC stated (Boland, 2013):

> "Through the exercises, decision makers have realized that they remain unfamiliar with what real joint domain command and control is. For example, the Air Force is still working out how to put surface vessels on its network, a task integral to the Air-Sea Battle Concept."

On a smaller scale, the AFIS could organize joint inspections around states or areas with larger concentration of military bases. Virginia's Hampton Roads area is a perfect example with Naval, Army, and AF bases all within 40 miles of each other. Alaska, California, Georgia, New Mexico, and Texas also have multiple service bases near each other.

The capability exits to link actual AF, Navy, and Army assets participating in live exercises with simulators and virtual trainers. Live Virtual Environment (LVE) and Live Virtual Constructive (LVC) training/exercises are two commonly used terms synonymous with these network link exercises. These two terms will be used interchangeably throughout this work. The ability to join live missions with simulators increasing the number of participants, the diversity of assets, and the level of realism. LVEs gives planners the ability to shape the battlefield environment, providing control of the weather, allowing injects to simulate the “fog and friction” of war, as well as replicating threat systems, ranging from jamming, Weapons of Mass Destruction (WMD), and air threats, to name a few. The three services share similar future plans for LVE training, all budgeting for newer more realistic simulators, expanded network capabilities and nodes, increased data rates, upgrades to existing simulators, and software solutions to include more assets (Catanzano, 2011). The three services are also pursuing LVE capabilities, which will allow coalition partners to participate (Blacklock & Zalcman, 2010).

In a recent article Colonel John T. Janiszewski, Director of the Army’s National Simulation Center (NSC), stated virtual training “replicates the difficulties and complications of the operational environment, enabling leaders and units to gain the experience, confidence and skills required to execute decisive action” (Janiszewski, 2014). Further (and more relevant to current fiscal constraints), Col Janiszewski sees an increased need and reliance on virtual training as augmenting or replacing live training. Col Janiszewski stated virtual training is “effective, low-cost individual and collective training for soldiers and leaders" posing a viable alternative to expensive large force exercises (Janiszewski, 2014).

ACC currently owns and operates the Distributed Mission Operations Center (DMOC) located at Kirtland AFB, NM. The DMOC allows strategic, operational, and tactical level virtual training allowing simulation across the range of military operations. In addition, the DMOC "provides network connectivity to joint and coalition players around the world" (Kirtland AFB Public Affairs Office, 2014). The DMOC hosts ACC's Virtual Flag (VF), "a CJCS sponsored, large force exercise designed to increase combat capability across the Theater Air Control System and its elements" (Horne, 2013). In addition to VF, the DMOC hosts other LVEs for specific assets. The DMOC can replicate threat environments/systems and simulate attacks, forcing personnel to cooperate and interact as they would in real life. Brigadier General Bradford J. Shwedo, former Director of Intelligence ACC, stated in a policy memo to the field, "VF is an excellent opportunity for the Air Force intelligence community to 'train like we fight' and to identify any shortfalls in our current training plans" (Shwedo, 2013).

The AEF Next concept explained in Chapter 2 creates an easy launching point for CCs and the IG to implement the new AFIS. AEF Next packages units into air power teams focused around core missions. Since the AEF Next concept centers on a teaming concept, air power teams will always deploy with the same units and personnel. The IG could implement LFEs around these air power teams capturing the units' ability to work amongst other teams. At any given time, the new AEF Next cycle has one team returning, one team deployed, and one team preparing. The returning team and the preparing teams could engage in a LFE for increased knowledge and experience dissemination. The returning team would act as a "red" team. Having just returned, their knowledge of the enemy and emerging TTPs would provide a sound foundation for assessing readiness. While intra-service, this system would still open the training aperture ensuring wings interoperate and integrate at the AF level.

On a larger scale, further work could investigate if the AEF Next system aligns with other service deployment cycles. In the same fashion, a joint LFE could be conducted with returning and preparing forces. If it does not, research could be conducted to determine how difficult it would be to adapt the AEF Next cycle to synchronize with other services.

Findings: Unit of Analysis 3 – Limitations of the SoS Approach

IG Perspective

Discussions with ACC/IG personnel regarding integrating a joint SoS architecture into the AFIS provide insight into their current philosophy. The AF core values represent and reflect the joint nature of today's military. The joint competencies were developed by the services and the AF embodies these competencies in its doctrine, philosophy, and values. The number of shared weapon systems, TTPs, and communications equipment used today, by all the services, continues to grow, and the AF led the procurement of several of these systems. "Jointness" is percolating down to the wings and units through the philosophical changes at the headquarters level and exemplified in the AF core competencies: Developing Airmen, technology to war fighting and integrating operations (Air Combat Command, 2013). Units share resources, lessons learned, and

TTPs more often these days providing a continuous cycle of growth at the wing level and below.

The AFIS places an emphasis on the Wing/CC's ability to lead and develop his/her wing as he/she feels necessary. In creating a Wing/IG role, the new AFIS is attempting to create "buy in" from wing personnel. It is attempting to break away from the old philosophy where units prepared for IG inspections then redid everything in preparation for deploying. The Wing/CC creates his/her own inspection program, identifying their areas of concern, improvement, and/or strengths. Since the Wing/CCs create the checklists, the AFIS found a way to capture the unique functions of every unit. The Wing/CCs drives how "joint" capable the wing is through his/her CCIP, based on the wing's assigned OPLAN/CONPLANS, its unique qualities/missions, vision, and goal. These changes to the AFIS were developed to create the mission ready attitude and focus mentioned earlier.

The role of the MAJCOM/IG is to observe and audit how well the Wing/IG program articulates the CC's vision and goal and inspects, documents, and follows up on wing deficiencies. In areas where the MAJCOM/IG does not feel the CCIP is properly identifying and capturing risks, the MAJCOM/IG can step in and correct or ask to observe operations. Unless directed from above, the MAJCOM/IG does not enforce an agenda. The ACC/IG philosophy is that individual wing inspections identify enough risk that integration into the larger SoS is minimal. The governing regulations which form the basis for MAJCOM and wing IG programs are developed in accordance with AF core competencies and thus capture the joint criteria necessary for integration. The ACC/IG believes the Wing/CC is the optimal person to decide the wing's priorities and the necessary joint priorities. In addition, the AFIS allows Wing/CCs to use exercises, training, and deployment results to highlight wing performance and complete/validate inspection items as long as results are documented and verified by the wing/IG (Secretary of the Air Force, 2012). Further, per 90-201 the MAJCOM/IG still reserves the right to conduct no or little notice inspections or mandate wings conduct "ORI" like events to validate CCIP findings. Bottom line, ACC/IG's philosophy maintains that AF core competencies are based on joint requirements. Wings will practice their roles as defined in their OPLAN/CONPLANS and execute those roles in combat. The IG grades the individual wings and hopes the pieces, when put together during joint operations, integrate and interoperate based on prior practice.

According to IG personnel, there has never been a joint inspection or meeting of service IG programs to discuss joint operations. Further, within ACC, there has never been a multi-wing inspection, nor have ACC/IG personnel attended LFEs with the intent of inspecting units. Whenever possible, the ACC/IG Gatekeeper, who organizes and schedules all inspections levied on ACC units, ensures inspections are TF. TF refers to wings that have an associated guard or reserve squadron. In these cases all units are inspected at once. In addition, all ACC/IG inspections include a red air component to help simulate adversary tactics. Anti-Access/Aerial Denial (A2/AD) and contested/degraded operations where added to ACC/IG inspections in late 2011 and quickly become more common.

LFE Resource Burdon

The ACC/IG provided details defending a single wing inspection construct. The four reasons provided closely match those given by ACC staff and wing personnel

1) funding

2) a small cadre of inspectors

3) synchronization

4) identify unique wing functions.

When inspecting multiple systems interacting at once, it becomes difficult to see the minor details occurring behind the larger operation. The MAJCOM/IG looks to increase wing efficiency and identify areas of risk. While primary operations may look good, subsurface operations may be weak. During LFEs, MAJCOM/IG personnel may miss subtle details due to the added commotion. Compounding this issue is the need for additional inspectors to cover the additional wings participating in the joint exercise. Also, geographically separated wings create communication challenges for MAJCOM/IG personnel. The strength of a single wing inspection is having all inspectors at one location. Inspectors can hold impromptu meetings to quick deliberate and share information. These meetings are a critical part of the inspection process, keeping all inspectors informed of findings. Adding other service organizations adds to these issues. The coordination efforts required to synchronize a joint exercise, inspectors, and communication from each of the service components imposes significant manpower and time requirements. Funding is really a by-product of the three previously mentioned reasons but is necessary to hire additional inspectors and offset the added costs for planning and coordinating LFEs.

LFEs as a training Environment

Allowing inspectors access to LFEs could distract from the exercise's intended purpose. Most units use LFEs as opportunities to focus on integration issues, refining proficiency skills, and developing new TTPs. A pilot referred to LFEs as lower stress events meant to improve personal skills and work out the bugs, whereas inspections are high stress events focusing on the minute details. Authorizing MAJCOM/IG personnel to monitor LFEs shifts the focus away from personal growth to meeting inspection criteria. LFEs are venues for units to fail without repercussions. With inspectors on sight, units may not be willing to take "learning" risks.

In order to counter this philosophy, MAJCOM/IG personnel must evaluate a wing's performance in light of the LFE's intended purpose. The AFIS's structure, if adhered to, compensates for this dilemma. The MAJCOM/IG's focus should be on monitoring the wing/IG and the Wing/CC's leadership capability. If the wing's IG is going to evaluate the unit during the LFE, the MAJCOM/IG should also be authorized. This separates out LFEs designed for training and development versus LFEs for mission compliance.

LFEs; however, provide pertinent insight into a wings ability to adapt and flex to changing mission conditions, two of the recommended joint characteristics. Several wing personnel pointed out LFEs are often free flowing and a little disorganized which presents a challenge to overcome communication issues or unclear guidance. These are two issues units often face during joint operations. In addition, wing personnel noted LFEs (and deployments) sometimes uncover problems that cannot be resolved at the wing level. Personnel noted communication/systems integration issues or conflicting guidance/standards between service organizations as two examples. These issues go above wing levels and are outside the scope of a Wing/CC to solve. Identifying these issues prior to deploying greatly reduces risk; however, discovery of these types of integration issues is impossible during single wing inspections. The MAJCOM/IG is in a position to address these issues with other service organizations or at higher AF levels. Adopting a joint SoS architecture and attributes compels wings to look at, address, and raise these concerns prior to deploying.

IG and wing personnel also noted that LFEs do not test every aspect of a wings mission/capability. LFEs often focus on one mission or operational aspect and only include the required wing functions or organizations. In this light, the joint SoS provides less insight than a regular wing inspection. There are two ways to correct this shortfall. One is to create larger LFEs which engage all organizations. The second is to send IG personnel to more focused exercises (like Angel Thunder) to ensure all components are evaluated. Both corrections require additional funds and time.

Competing Systems

The Defense Readiness Reporting System (DRRS) is a CJCS program designed to provide JFCs and COCOMs a more efficient and effective tool for quickly identifying the readiness status of forces down to the unit level (for the AF, squadron level). DRRS also synthesizes "unit and joint force readiness to describe the ability of the armed forces as a whole to fight and meet the demands of the National Military Strategy," and can reflect the current readiness of all COCOMS (Trunkey, 2013). DRRS pulls unit manpower, equipment, training, and readiness information from the AF's AEF UTC Reporting Tool (ART) and DoDs Status of Resources and Training System (SORTS) databases. In addition, DRRS allows commanders to input supplementary information which may impact readiness like morale and unit confidence. DRRS also asks CCs to rate a "unit against its actual assigned mission, anticipated mission, and core mission" (Trunkey, 2013). The assigned mission comes from the unit's Designed Operational Capability (DOC) statement and the core mission comes from what the weapon system was designed to do. The capability of DRRS to capture qualitative and quantitative information makes it a valuable tool for CCs to identify deficiencies.

DRRS is not fully implemented across the services but is expected to become fully operational in 2014 (Trunkey, 2013). Overall, DRRS does show promise as a way to capture unit readiness information as well as larger COCOM readiness. However, it lacks a way to identify risks associated with interoperability or integration. To assess COCOM readiness, DRRS tabulates scores from multiple units and provides an overall score. The DRRS score does represent risk, based on the numerical difference between all units reporting 100% readiness and actual readiness values. In addition, DRRS does not independently verify and validate CCs' inputs. ACC/IG and Staff members, who currently work with DRRS, ART, and SORTs, stated it is easy to "cover up" wing issues in these programs as they are computer entries and authorized inputs are not always clear. CCs do not want to look bad on paper and often inflate scores to appear healthier than they actually are.

Investigative Questions Answered

Chapter 4 provided answers to all five investigative questions found in Chapter 1. Question one though was primarily answered in Chapter 2.

1. *How does the Air Force align/posture forces for joint operations?*
2. *What is the focus of the current ACC/IG Inspection system?*

3. *How does the current system account for the integrated nature of military assets during operations?*

4. *What system-of-systems examples or incidents exist that have a direct relation to an operational readiness inspection?*

5. *What system-of-systems metrics or attributes can be used to evaluate and determine the status and health of ACC units?*

Summary

Chapter 4 presented supporting data to defend the hypothesis through validation of three UOAs. UOA 1 explained key differences between the AFIS single wing inspection system and joint operations. A risk analysis identified how these differences translate into increased risk when wings operate in a joint environment. Conversations with AF personnel, fratricide statistics, and deployment experiences provided additional facts and explanations supporting the risk analysis results. UOA 2 explored several joint characteristics which should be added to the UEI checklist to help incorporate a joint SoS approach into the current AFIS. UOA 2 further examined how adopting a joint SoS architecture requires a mentality shift where mission readiness means joint readiness. This mentality shift leverages the new UEI joint characteristics to help refocus wings. Last, UOA 2 provides example exercises or existing capabilities (simulators) which allow the IG to implement a new joint SoS AFIS in short order. UOA 3 provided counter arguments to adopting a joint SoS and included discussion and comments from ACC/IG personnel.

Chapter 4 clearly showed there is a need to approach the AFIS from a SoS approach. There currently exists large amounts of risk between wing and joint operations. If not addressed, the level of risk will continue to increase as the military moves towards a smaller more integrated force. This change requires a paradigm shift in how ACC defines unit readiness and its willingness to lead the change where mission ready is joint ready

V. Conclusions and Recommendations

Chapter Overview

Chapter 5 provides a short synopsis of the previous four chapters highlighting the significance of the research as well as recommended actions. Chapter 5 also contains information on future research areas which could affect this work's conclusions

Conclusions of Research

This work identified a source of unknown risk and offered a viable solution. The study showed there is a disparity between wing and joint operations, which the AFIS does not fully account for. The AFIS should assess units within the joint operation environment to provide a better analysis of wing readiness

Significance of Research

Assessing a wing within the joint SoS has many benefits. First, risks associated with integration and interoperability will be reduced. Second, overall wing readiness will improve. Third, ACC/CC, COCOMs, SECDEF, and JCS will have a way to validate DRRS information. These benefits are significant because the development of a more closely aligned and capable force prior to the beginning of hostilities allows CCs to immediately exploit the synergistic effects of the services without the normal delays or failures systems integration has historically had. In addition, implementing a joint inspection system may reduce fratricide rates by allowing the early detection of the leading causes attributing to friendly force incidents.

Not implementing the changes recommended in chapter 4 creates an area of growing risk. In the short term units will continue to struggle with integration and interoperability. However, in the long run, as the services become more integrated the amount of unchecked risk could lead to failed operations and higher fratricide rates.

Recommendations for Action

Recommendations based on this work include three actions necessary to adopt a joint SoS architectural viewpoint into today's AFIS. The first recommendation is to implement the joint characteristics mentioned in Chapter 4, UOA 2. To due so, ACC/CC should issue a Memorandum for Record (MFR) to the field making "jointness" a SII within ACC. Further, the AFIS checklist, MGAs, and AFIs will need to be republished to incorporate joint operations and interoperability as key items for wings to practice during home station preparation, exercise planning, training, and equipment procurement.

Recommendation two enhances the first action. ACC should take lead on developing and sustaining additional joint training courses or exercises for all ranks and AFSCs. Within ACC, standardize the definition of joint operations and create a mandatory course for all Wing/CCs. This reduces risks created by the diverse backgrounds of wing commanders, which fuels the current inconsistent understanding of joint operations. In addition, ACC should prepare a staff assistance team knowledgeable in joint operations to provide support and training to wings as they begin shifting to a joint SoS viewpoint.

The third recommendation involves starting joint inspections. This recommendation should not occur until recommendations two and three are complete. In the beginning, ACC should implement the joint inspections at a manageable level and develop the capability further through trials (similar to spiral development). Inspections should begin in the AF with multi-wing inspections. Use air power teams as a way to select wings. As inspectors and wings become more comfortable and TTPs are refined, integrate other service IG members into AF inspections. Allow these outside inspector the opportunity to participate and add their service viewpoint to inspection results. From here, develop an inter-service inspection working group to define what joint inspections are and how they will be handled, graded, reported, etc.

Recommendation three will require the most work as ACC cannot act unilaterally at that point. It is within ACC's power to issue an SII on joint operations and conduct multi wing inspections of ACC units. However this only provides a limited view of the larger joint SoS. The services are all pursuing "jointness" but no one is on the same page. Without buy in from other organizations, this plan becomes just another "joint" effort without a "joint" understanding.

Recommendations for Future Research

Four areas for further examination were identified while conducting research in support of this thesis. Area one pertains to defining the type of SoS architecture reflective of joint operations. This is a System of Systems Engineering (SoSE) question that directly impacts how joint operations interact and influence the multiple systems, which form the larger SoS. It is equally important to analyze and determine the different types of SoS architectures each service uses. What is the risk associated with applying the wrong SoSE approach? The DoD SoSE guide currently recognizes virtual and acknowledged architectures as the two prominent SoS architectures. However, the guide is specifically written to address acknowledged SoSs. It does not address how different SoS architectures influence each other or the influences between systems and SoSs. It also does not address what architecture joint operations resemble and how to handle constantly changing SoSs. The relationship between a system and its parent organization (service branch) versus its joint organization may change how the characteristics listed in Chapter 4 are implemented. Further research into this area will produce significant information on how joint operations should be formed as well as how joint requirements should be integrated into service acquisition programs.

As stated in Chapter 1, the scope of this project does not include a cost analysis for joint versus single inspections. Shrinking defense budgets require prudent use of limited funds. Further research into costs will have to account for manpower hours to plan and coordinate joint and wing exercises as well as travel and equipment costs. Analysis of costs should be paired with the third purposed research area, effects of joint metrics/inspections on readiness.

The recommendations of work include adding joint attributes to the AFIS inspection checklist as well as current exercises for implementing a joint SoS inspection architecture. If implemented, further research should quantify the effects of joint metrics/inspections on readiness. If possible, a potential "test" case of select wings and other services units could be used as a sample set. Implement the new AFIS over this small sample set to determine feasibility and outcome (beneficial or not, to what extent, and at what cost).

Summary

The ACC/IG is responsible for determining the readiness of ACC forces. Through the use of the AFIS, the IG reports the efficiency, effectiveness and combat readiness of units to the ACC/CC. Through the use of checklists, interviews, and observation, the IG determines a unit's ability to fulfill its wartime mission requirements.

Today's wars however, are waged as a Joint Force, where the COCOM leverages the resources available to achieve a strategic outcome. Objectives are met through the coordination and combination of military capabilities provided by the Army, Navy, and Air Force. Battles are no longer fought by a single service or single weapons system, but as a collective one. The joint force is a complex SoS, where the success of the whole relies on each individual component to fulfill their role within the structure. This integration allows CCs to harness the synergistic effects of his/her forces to bring decisive firepower to the battlefield and exploit the enemy's weakness.

Currently the AFIS inspects a single wing at a time to determine combat effectiveness. The AFIS does not directly acknowledging the joint SoS architecture and the relationship between the SoS and subsystems. The combat effectiveness of a wing is largely based on how well it operates within this larger SoS. Given the ever-growing joint nature of the US military, the AFIS should assess units through a larger SoS framework. Adapting this approach reduces integration risk prior to deployment and provides a better assessment of wing readiness.

Appendix A: 90-201 Checklist References

The AFIS uses the following list of references to create the IG inspection checklist and evaluate unit readiness.

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3. AFI 10-206, *Operational Reporting*, 6 Sep 11 AFI 10-207, *Command Posts*, 1 Feb 12
4. AFI 10-208, Air Force Continuity of Operations (COOP) Program, 15 Dec 11
5. AFI 10-210, Prime Base Engineer Emergency Force (BEEF) Program, 6 Sep 12
6. AFI 10-245, Antiterrorism (AT), 21 Sep 12 AFI 10-250, Individual Medical Readiness, 9 Mar 07
7. AFI 10-301, Responsibilities of Air Reserve Component (ARC) Forces, 16 Aug 06
8. AFI 10-404, Base Support and Expeditionary (BAS&E) Site Planning, 11 Oct 11
9. AFI 10-701, Operations Security (OPSEC), 8 Jun 11
10. AFI 10-702, Military Information Support Operations (MISO), 7 Jun 11
11. AFI 10-704, Military Deception Program, 30 Aug 05
12. AFI 10-2501, Air Force Emergency Management (EM) Program Planning and Operations, 24 Jan 07
13. AFI 10-2603, Emergency Health Powers on Air Force Installations, 13 Oct 10
14. AFI 10-2604, Disease Containment Planning (FOUO), 3 Sep 10
15. AFI 11-2(MDS) Volume 1, Aircrew Training (Note: Published by MDS as applicable)
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19. AFI 11-202, Volume 2, Aircrew Standardization/Evaluation Program, 13 Sep 10

20. AFI 11-202 Volume 3, General Flight Rules, 22 Oct 10

21. AFI 11-230, Instrument Procedures, 30 Mar 10

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30. AFI 13-216, Evaluation of Air Traffic Control and Landing Systems, 05 May 2005

31. AFI 13-503, Nuclear-Capable Unit Certification, Decertification and Restriction Program, 2 Oct 12

32. AFI 14-104, Oversight of Intelligence Activities, 23 Apr 12

33. AFI 14-202V1, Intelligence Training, 10 Mar 08

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35. AFI 14-202V3, General Intelligence Rules, 10 Mar 08

36. AFI 16-701, Special Access Programs, 1 Nov 95

37. AFI 16-1301, Survival, Evasion, Resistance, and Escape (SERE) Program, 6 Sep 06

38. AFI 21-204, Nuclear Weapons Maintenance Procedures, 30 Nov 09

39. AFI 31-101, Integrated Defense (FOUO), 8 Oct 09

40. AFI 31-401, Information Security Program Management, 1 Nov 05

41. AFI 31-501, Personnel Security Program Management, 27 Jan 05

42. AFI 31-601, Industrial Security Program Management, 29 Jun 05

43. AFI 32-7001, Environmental Management, 4 Nov 11

44. AFI 33-150, Management of Cyberspace Support Activities, 30 Nov 11

45. AFI 33-360, Publications and Forms Management, 7 Feb 13

46. AFI 34-219, Alcoholic Beverage Program, 17 Oct 07

47. AFI 35-101, Public Affairs Responsibilities and Management, 18 Aug 10

48. AFI 35-102, Security and Policy Review Process, 20 Oct 09

49. AFI 35-103, Public Affairs Travel, 26 Jan 10

50. AFI 35-104, Media Operations, 22 Jan 10

51. AFI 35-105, Community Relations, 26 Jan 10

52. AFI 35-107, Public Web Communications, 21 Oct 09

53. AFI 35-108, Environmental Public Affairs, 8 Mar 10 AFI 35-109, Visual Information, 12 Mar 10

54. AFI 35-110, U.S. Air Force Band Program, 22 Jan 10

55. AFI 35-111, Public Affairs Contingency Operations and Wartime Readiness, 28 Oct 09

56. AFI 35-113, Internal Information, 11 Mar 10

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59. AFI 36-2640, Executing Total Force Development, 16 Dec 08

60. AFI 36-3009, Airman and Family Readiness Centers, 7 May 13

61. AFI 36-3107, Voting Assistance Program, 10 Sep 03

62. AFI 36-6001, Sexual Assault Prevention and Response (SAPR) Program, 29 Sep 08

63. AFI 41-106, Medical Readiness Program Management, 1 Jul 11

64. AFI 63-125, Nuclear Certification Program, 8 Aug 12

65. AFI 64-117, Air Force Government-Wide Purchase Card (GPC) Program, 20 Sep 11

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67. AFI 90-201 ANGSUP 1, Inspector General Activities, 2 Mar 10

68. AFI 90-301, Inspector General Complaints Resolution, 23 Aug 11

69. AFI 90-501, Community Action Information Board and Integrated Delivery System, 31 Aug 06

70. AFI 90-505, Suicide Prevention Program, 10 Aug 12

71. AFI 90-803, Environmental, Safety, and Occupational Health Compliance Assessment and Management Program, 24 Mar 10

72. AFI 90-1001, Responsibilities for Total Force Integration, 29 May 07 AFI 91-101, Air Force Nuclear Weapons Surety Program, 13 Oct 10

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77. AFI 91-302, Air Force Occupational and Environmental Safety, Fire Protection, and Health (AFOSH) Standards, 18 Apr 94

78. AFJI 11-204, Operational Procedures for Aircraft Carrying Hazardous Materials, 11 Nov 94

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84. AFMAN 15-129V1, Air and Space Weather Operations – Characterization, 6 Dec 11

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86. AFMAN 15-129V2, Air and Space Weather Operations—Exploitation, 07 Dec 11

87. AFMAN 33-363, Management of Records, 1 Mar 08

88. AFMAN 65-506, Economic Analysis, 29 Aug 11

89. AFMAN 91-201, Explosives Safety Standards, 12 Jan 11

90. AFPD 10-7, Information Operations, 6 Sep 06

91. AFPD 10-24, Air Force Critical Infrastructure Program (CIP), 28 Apr 06

92. AFPD 10-25, Emergency Management, 26 Sep 07

93. AFPD 14-1, Intelligence Surveillance, and Reconnaissance (ISR) Planning, Resources, and Operations, 2 Apr 04

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156. Department Of Defense Initial Guidance for BRAC 2005 Joint Base Implementation, 22 January 08

157. Fire Emergency Services Assessment Program (FESAP) Law of Armed Conflict (LOAC)

Appendix B: Risk Diamond Approach

Exerts from Professors Shenhar and Dvir's book *Reinventing Project Management*. The below paragraphs provide Shenhar and Dvir's definitions for the four dimensions and there different levels.

Table 5: NTCP dimensions and levels

NTCP Model				
Levels \ Dimensions	Novelty	Technology	Complexity	Pace
1	Derivative	Low-tech	Assembly	Regular
2	Platform	Medium-tech	System	Fast/Competitive
3	Breakthrough	High-tech	Array	Time-critical
4		Super-high-tech		Blitz

Novelty: Product novelty is defined by how new the product is to its markets and potential users. This dimension represents the extent to which customers are familiar with this kind of product, the way to use it, and its benefits. It also represents the uncertainty of your project goal – that is, how clearly you can define the requirements and customer needs up front.

- Derivative products are extensions and improvements of existing products
- Platform products are new generations of existing product lines. Such products replace previous products in a well-established market sector. A typical example is a new car model.

- Breakthrough products are new-to-the-world products. They transform a new concept or a new idea into a new product that customers have never seen before. The first Sony Walkman and the first 3M Post-it notes are typical examples

Technology: The major source of task uncertainty is technological uncertainty. Technological uncertainty has an impact on, among other things, design and testing, communication and interaction, the timing of design freeze, and the needed number of design cycles. It also affects the technical competence needed by the project manager and project team members.

- Low-tech projects rely on existing and well-established technologies. The most typical examples are construction projects.

- Medium-tech projects use mainly existing or base technologies but incorporate a new technology or a new feature that did not exist in previous products. Examples include products in stable industries, such as appliances, automobiles, or heavy equipment

- High-tech projects represent situations in which most of the technologies employed are new to the firm but already exist and are available at project initiation. Most computer and defense development projects belong to this category

- Super-high-tech projects are based on new technologies that do not exist at project initiation. Although the mission is clear, the solution is not, and new technologies must be developed during the project. A good example is the moon-landing program

Complexity: Project complexity is directly related to system scope and affects project organization and the formality of project management. Three typical levels of complexity are used to distinguish among project management practices. A lower scope level can be seen as a subsystem of the next higher level.

- Assembly projects involve creating a collection of elements, components, and modules combined into a single unit or entity that performs a single function.

Assembly projects may produce a simple stand-alone product (such as a CD player or a coffee machine) or build a subsystem of a larger system (such as an automobile transmission). They may also involve building a new organization that is responsible for a single function (such as payroll).

- System projects involve a complex collection of interactive elements and subsystems, jointly performing multiple functions to meet a specific operational need. System projects may build products such as cars, computers, or buildings, or they may deal with the creation of entire new businesses that include several functions.

- Array projects deal with a large, widely dispersed collection of systems that function together to achieve a common purpose (sometimes they are called "systems of systems" or "super systems"). Examples of arrays include national communications networks, a mass transit infrastructure, or regional power distribution networks, as well as entire corporations.

Pace: On this scale, projects differ by urgency (or how much time is available) and by what happens if time goals are not met. Pace impacts the autonomy of project teams, the bureaucracy, the speed of decision making, and the intensity of top management involvement.

- Regular projects are those efforts where time is not critical to immediate organizational success.

- Fast/competitive projects are the most common projects carried out by industrial and profit-driven organizations. They are typically conceived to address market opportunities, create a strategic positioning, or form new business lines.

- Time-critical projects must be completed by a specific date, which is constrained by a definite event or a window of opportunity. Missing the deadline means project failure. Examples might be the launch of a space vehicle based on a specific cosmic constellation, or the Y2K project.

- Blitz projects are the most urgent, most time-critical. These are crisis projects. Solving the crisis as fast as possible is the criterion for success.

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The Air Combat Command (ACC) Inspector General (IG) assesses the operational readiness and combat effectiveness of units by evaluating individual wings. Today's conflicts; however, are waged as a joint force. The Joint Forces Commander (JFC) leverages the resources of the entire military complex to achieve strategic objectives. The synergistic effects, created by the integration of individual weapon systems, produce greater results than the individual components. Evaluating wings outside the joint System of Systems (SoS) architecture does not provide a true assessment of combat readiness. Using a case study method, this research examines the idea of integrating a joint SoS architecture with the ACC/IG inspection system. First, this study assesses the current nature of military operations and the risks associated with joint operations. Next, it defines several joint attributes to enhance the ACC/IG inspection checklist. Further, it outlines several joint exercises as areas for implement a joint inspection system. Finally, this study explores limitations and counter arguments to adopting a joint SoS into the inspection system. Based on this analysis, the ACC/IG should assess units through a larger system-of-system framework, which offers the possibility to reduce integration risks prior to deployment, and provide a better assessment of wing readiness

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