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WEATHER PLAY IN EXERCISES: MOVING FROM CONTROLLING TO ENABLING DECISION MAKING

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“Never, never, never believe any war will be smooth and easy, or that anyone who embarks on the strange voyage can measure the tides and hurricanes he will encounter. The statesman who yields to war fever must realize that once the signal is given, he is no longer the master of policy but the slave of unforeseeable and uncontrollable events.”

Sir Winston Churchill
British politician (1874 - 1965)

Funny how Sir Winston referred to weather terms (i.e., tides and hurricanes) when describing the uncertainties in war. Then again, maybe not. Nothing can change the pace of war faster than weather. It directly affects five of the principles of war—mass, offensive, surprise, economy of force, and maneuver. Yet, it can't be controlled or perfectly predicted. Thus, military leaders can certainly become slaves to it. On the other hand, these leaders should be trained to account for the effects of weather—to devise ways to mitigate its effects and to exploit opportunities presented by the weather. In fact, that's just what today's exercises and experiments are doing. Past training events employed weather as a way to control pace. Now weather works to enhance training objectives. The outcome—superior decision makers and more effective war fighting.

“Imagination is more important than knowledge.”

Albert Einstein
US (German-born) physicist (1879 - 1955)

“Leadership and learning are indispensable to each other.”

John F. Kennedy, speech prepared for delivery in Dallas the day of his assassination, November 22, 1963
35th president of US 1961-1963 (1917 - 1963)

The Air & Space Natural Environment Modeling and Simulation Executive Agent (ASNE MSEA)* office recently applied their premier tool, Environmental Scenario Generator (ESG)**, to support exercises in an innovative way. They used it to find realistic weather patterns that matched exercise coordinators' objectives to stress theater operations centers, facilitating flexibility and rapid decisions.

The exercise AUSTERE CHALLENGE 06 tests US Air Force, Europe's (USAFE) capability to be a warfighting headquarters. However, the prelude to the Chairman, Joint Chiefs of Staff evaluation is more than a rehearsal. It includes a series of workups to prepare participants to handle a variety of situations so they can work out processes, develop teamwork, and look for novel ways to attack the challenges presented by the "fog of war". ASNE MSEA personnel identified a sequence in history across the area of interest that complicated the generation of the Air Tasking Order (ATO), causing Air Operations Center (AOC) planners to look for inventive ways to bring about necessary effects. The Operational Weather Squadron (OWS) also provided actual weather products to increase realism. On top of that, the ESG data set directly affected individual mission success via another ASNE technology, Environmental Hypercube. More lifelike and credible results tremendously advanced learning.

"Be not ashamed of mistakes and thus make them crimes."

Confucius

Chinese philosopher & reformer (551 BC - 479 BC)

"The future ain't what it used to be."

Yogi Berra

US baseball player, coach, & manager (1925 -)

Experimentation presents another way for DoD to develop superior decision makers. Decision making is a daunting responsibility, but a very difficult skill to grow. The number of perturbations leaders face regarding possible conditions and responses can choke a computer, let alone confound the human brain. Thus, leaders must be allowed to test out various decisions to determine what works and what doesn't in general situations. In other words, failure is an option in an experiment.

The US Joint Forces Command exercise URBAN RESOLVE 2015 (UR 2015) employs this concept of experimentation. It concentrates on the joint force's ability to "isolate an irregular adversary and control a large urban environment" in the 2015 timeframe. The ASNE MSEA used ESG to identify environmental conditions that lie in the realm of the possible, capturing "typical" conditions for the exercise timeframe. ESG data sets will feed directly into a data server. The data will then be ingested by several exercise models to help decision makers visualize the consequences of chemical, biological, or nuclear attacks. While some very plausible responses take place, the UR 2015 experiment stimulates creativity. However, weather constrains the scope of creativity to a real world by generating real world effects, thus facilitating learning and better decision making processes.

"Knowledge and timber shouldn't be much used till they are seasoned."

Oliver Wendell Holmes, The Autocrat of the Breakfast-Table, 1858

US author & physician (1809 - 1894)

Participants in these two exercises understood that weather wasn't just a nuisance that could be ignored. The effects of weather must be considered early in decision making rather than as an afterthought. Even more important, the exercises demonstrated the importance of exposing future leaders to the dynamics of decision making. After all, what's more dynamic than weather.

The power of ESG made weather play simple and realistic. The capabilities of the tool have captured the attention of other warfighting commands. As a result, expect more exercises to integrate decision making based on realistic weather effects.

* The ASNE MSEA Office resides within the Air Force Combat Climatology Center in Asheville, NC

** ESG was developed by Defense Modeling and Simulation Office (DMSO)/ASNE/MSEA. It is employed by ASNE MSEA to generate environmental data sets for DoD models and simulations. It searches environmental databases (currently National Centers for Environmental Prediction (NCEP)/National Center for Atmospheric Research (NCAR) Reanalysis and Mesoscale Atmospheric Simulation System (MASS)

modeled data) to find user-defined scenarios. It then generates a data set in user-defined formats (i.e., GRIB (gridded binary), SEDRIS, text). It attained initial operational capability (IOC) in April 2006 and is in transition to the Air Force Combat Climatology Center. Resource databases will expand to include Weather Research and Forecast (WRF) models and a 33-year space weather analysis among others. Search features will also increase to meet the growing demand for including environmental effects in modeling and simulation.

**THE NATIONAL SPACE SECURITY INSTITUTE SPACE POWER LABORATORY,
APPLYING SIMULATION TO EDUCATE AND TRAIN THE WARFIGHTER**

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ABSTRACT: *The National Space Security Institute (NSSI) has the mission to provide instruction of space systems knowledge, operational concepts and tactics required to prepare warfighters for joint military operations. To help accomplish this mission, the NSSI has developed the Space Power Laboratory (SPL). The SPL augments the student's education in the formal classroom and prepares space professionals to augment Air and Space Operations Centers (AOCs) during exercise and real-world contingencies. The SPL consists of an integrated wrap-around simulation system, communications system, A/V system and the command and control applications typically found in an AOC. This facility serves as a multi-media classroom, software application-training laboratory and simulated operations center. This paper will discuss requirements of the SPL, the architecture of the SPL, how the NSSI has adapted its instruction to take advantage of the SPL and the impact on the NSSI's mission.*

Background

As military dependence on space grows, the Department of Defense (DoD) must meet the challenge of developing the critical personnel needed to acquire, operate and employ military space capabilities. These space professionals are an indispensable component of the national security space force.

This challenge was documented in the Report of the Commission to Assess United States National Security Space Management and Organization on January 11, 2001. The Commission noted, "The DoD is not yet on course to develop the space cadre the nation needs." These professionals "will have to master highly complex technology; develop new doctrine and concepts of operations for space launch, offensive and defensive space operations, power projection in, from and through space... and operate some of the most complex systems ever built and deployed." This conclusion led the Commission to call for initiatives to "create and sustain a cadre of Space Professionals" and to "create a stronger military space culture through focused career development, education, and training within which the space leaders for the future can be developed."

Two years and two conflicts (Operation Enduring Freedom and Operation Iraqi Freedom) after the Space Commission report was published, DoD Directive Number 5101.2, dated June 3, 2003, recognized the Air Force as the DoD Executive Agent for Space. The Air Force emphasized the need for a new and innovative space professional development construct – the Air Force Space Command (AFSPC) Space Professional Strategy. The goal of this strategy is to build a team skilled and knowledgeable in the development, employment and integration of space systems, concepts and doctrine to achieve national security objectives. Consistent with the Executive Agent for Space role, the AFSPC Space Professional Strategy includes the responsibility for developing a space cadre and advocating education and training programs for space professionals. AFSPC gave the responsibility to execute the education and training portion to the NSSI.

To support the AFSPC Space Professional Strategy, the NSSI was required to develop an education and training program for Space Professionals throughout the DoD. The Space Professional courses consist of Space 100 (taught by Air Education and Training Command), Space 200, Space 300 and various Advanced Space Training courses. The requirement for a world-class modeling and simulation facility was a logical conclusion to support the Space Professional courses, as well as legacy courses conducted at the NSSI.

Training the Warfighter at NSSI

The NSSI is the DoD Center of Excellence for space education and training throughout the National Security Space community. Nine of the thirteen formal space courses (see Figure 1.0) conducted at the NSSI have a current and/or future wargame exercise as the capstone event with the goal of solidifying the course learning objectives. Two of these courses, the Space in the Air and Space Operations Center Course (SAOCC) and the Director of Space Forces Course train students to augment AOCs during exercise and real-world contingencies. To be prepared, these graduates need scenario-based hands-on training on applications and checklists they will use in theater. In FY05, 30 SAOCC graduates received orders to deploy to various AOCs worldwide within 180 days of finishing the course.

The SPL gives the NSSI the in-house capability to plan and execute wargames using actual AOC-baseline system applications and checklists. The SPL serves as the centerpiece for meeting the NSSI's education and training goals in the following manner:

- Space Air Expeditionary Forces (AEF) augmentees get hands-on training with the various space software applications and checklists they will use in the AOC
- Students are able to participate in high-fidelity current and future wargame exercises which will reinforce the concepts taught during formal classroom sessions
- Students gain an appreciation for the complexity of war planning, the dynamics involved in executing these plans and the overall integration of space capabilities
- Students and instructors are able to test and validate the development of operational tactics, techniques and procedures (TTP)

AOC Courses

Space in the Air and Space Operations Center Course (SAOCC)
Director of Space Forces (DS4)

Space Professional Courses

Space 200 (SP200)
Space 300 (SP300) - under development
Navigational Operations Advanced Space Training (ASTNO)
Missile Warning Advanced Space Training (ASTMW) - under development

NSSI Legacy Courses

Space Operations Course (SOC)
Space Operations Course Mobile (SOC-M) -Road show
Space Operations Course Executive Level (SOC-E)
Space Fundamentals Course (SFC)
Space Support Course (SSC)
Weapons School Preparation Course (WSPC)
Counterspace Planning and Integration Course (CPIC)

Note: Courses using the SPL are bolded. See www.TheNSSI.com for a more detailed description of all the NSSI courses.

Figure 1.0: Courses Taught at the NSSI

Old Training Methodology

The SPL Team focused their efforts on enhancing the education and training conducted at the NSSI. Traditional methods of instruction included: classroom lecture, limited application training and tabletop wargame exercises.

The challenge of the SPL Team was to improve the training processes at the NSSI; specifically to develop a scenario-based interactive modeling and simulation environment that stresses creative thinking and collaborative problem solving.

The Space Applications and Integration Facility (SPAIF) is an experimentation center used by the Space Warfare Center located at Schriever AFB, CO to evaluate new systems and tactics. The NSSI had limited access to the SPAIF to conduct space application training and wargame exercises, however, this facility is not designed as a structured education and training environment. The deficiencies noted in using tabletop wargame exercises and the SPAIF were as follows:

- The tabletop wargame exercises lacked realism and were marginal in reinforcing the learning objectives taught in the classroom
- The lack of support to collaborative problem solving
- No ability to support dynamic response to stimuli using scripted events
- The SPAIF has inadequate similarity to the AOC environment--software/data limitations preventing training on essential AOC functions
- The SPAIF is too small to accommodate the number of students per course
- The SPAIF had a limited number of workstations, which limited the hands-on time for students
- There was no control over scheduling the SPAIF to support NSSI courses
- The SPAIF is located 30 miles away from the NSSI

The SPL Team conducted a cost benefit analysis and a feasibility study to determine if building an in-house modeling and simulation environment was viable. The cost benefit analysis showed the upfront costs would be high to build such a facility, but the long-term intangible benefits would greatly outweigh these costs. The feasibility study focused mostly on the technical ability to integrate all of the required space software applications. There was a high risk factor because an integration effort of this magnitude had never been done before; however, the technical analysis showed it was possible, given that the necessary system architecture was developed.

General Lance Lord (AFSPC/CC) was keenly interested in the efforts of the SPL Team because of past feedback he received from Combatant Commanders. Specifically, the Combatant Commanders noted that Space AEF augmentees were not being properly prepared to perform their operational functions upon arrival in theater.

The Space AEF augmentees being deployed were highly competent personnel, but they lacked the requisite education and training on the various space applications being used in theater. As a result, Space AEF augmentees were required to become proficient in their duties via on-the-job training.

The initial requirements for developing the SPL centered on the feedback from subject matter experts including the Space Weapon School graduates deployed in theater. Requirements were gathered from CENTCOM, PACOM and EUCOM. One of the biggest challenges in education and training of personnel to deploy to an AOC is that each AOC uses the baseline applications differently to achieve their objectives. The SPL Team needed to create a system that was robust enough to handle the majority of the space operational requirements no matter what particular theater a Space AEF augmentee might be deployed.

Besides the Space AEF augmentees, the other primary users of the SPL are students from the National Security Space community. Though these students are not being deployed, they need to have an

appreciation for the complexity of war planning, the dynamics involved in executing these plans and the overall integration of space capabilities.

Impact on NSSI Mission

From a space operations perspective, there is no other facility like this in the world. The SPL is a two thousand square foot facility that can accommodate 35 students and provide an interactive training environment via a classified internal network. The SPL can easily be arranged into a variety of configurations based upon desired student-instructor interaction including the ability to partition off the facility and run two separate training environments as required by the course objectives and student load. The SPL integrates 17 mission planning applications and situational awareness tools (see Figure 2.0) to give students virtual training on every aspect of their AOC duties. The applications give students exposure to:

- Theater Missile Warning
- Global Command and Control
- Theater Common Operating Picture
- Theater Planning Tools
- Combat Search and Rescue (CSAR)
- Global Positioning System Interference and Analysis
- AOC Collaboration Tools
- Orbital Analysis and
- Exploitation of Intelligence Data

Event/Requirement	Software Application	SAOCC	DS4	SP200	SP300	ASTNO	ASTMW	SOC	SFC	SSC
Theater Missile Warning	PDS-M GALE-LITE	X	X	X			X	X	X	X
IR Special Events	PDS-M GALE-LITE	X	X	X			X	X	X	X
CSAR	GALE-LITE HAVE CSAR	X	X	X		X		X	X	X
GPS Predicts	GIANT SBMCS	X	X	X		X		X	X	X
Time Sensitive Target (TST)	ADOCS	X	X	X				X	X	X
Common Operating Picture (COP)	GCCS-J C2PC ADOCS	X	X	X	X	X	X	X	X	X
Global Command and Control	GCCS-J	X	X	X	X	X	X	X	X	X
Imagery	FALCON VIEW C2PC ADOCS	X	X	X				X	X	X
AOC Collaboration Tools	IWS	X	X	X	X	X	X	X	X	X
Simulation Tools	AJCOM JCATS ASSET JSAF	X	X	X	X	X	X	X	X	X
Interactive Learning	SYNCHRON EYES	X	X	X	X	X	X	X	X	X
Orbital Analysis	SCOPES STK	X	X	X	X	X	X	X	X	X

Figure 2.0: Matrix of Events, Applications and Courses in SPL

The result is that Combatant Commanders now receive highly competent Space AEF augmentees who are prepared to provide valuable real-world operational contributions upon arrival in theater - thus minimizing in-theater training requirements. The hands-on training capability created by the SPL Team reinforces classroom. In addition, wargame exercises are currently being developed for execution in the SPL to reinforce the learning objectives of the Space Professional courses and legacy NSSI courses.

The following are the intangible benefits associated with the SPL:

- Space AEF augmentees are trained on the actual systems and checklists they will be using in theater – increased from 20 hours of limited application training (in the SPAIF) to 40 hours of hands-on training for every student.
- Space AEF augmentees have the availability of required refresher training to increase skill retention.
- Broader range of skills for Space Professionals with the potential for fewer deployed personnel (smaller footprint), which will reduce the cost for the Global War on Terrorism.
- Self-sufficient NSSI provides quality hands-on training without being impeded by the constraints in using the SPAIF
- Moving from a tabletop wargame exercise to scenario-based high-fidelity wargame exercise gives students an appreciation for the complexity of war planning, the dynamics involved with executing these plans and the integration of space capabilities
- AFSPC has a training facility to conduct training. Before the SPL was built, there was no such facility to support this type of MAJCOM training
- Critical thinking and collaborative problem solving are emphasized and the overall technical knowledge of the Space Professional is increased. Space is a highly technical discipline with some of the most complex systems ever built and deployed. Learning is achieved in many ways, but hands-on training is a powerful tool to reinforcing these complex topics
- Potential to develop and validate operational TTP improves planning and execution effectiveness.

Impact on USAF Mission

The mission of the United States Air Force is to defend the United States and protect its interests through air and space power. To achieve that mission, the Air Force has a vision of Global Vigilance, Reach and Power. This vision orbits around three core competencies: Developing Airmen, Technology-to-Warfighting and Integrating Operations.

Through their innovative vision and problem solving expertise, the SPL Team provides the NSSI faculty access to training processes perfectly suited to the needs of their students. In this way, the SPL Team contributed to meeting all three of these Air Force Core Competencies:

- Developing Airmen – The NSSI has the education and training mission to create and sustain a cadre of credentialed Space Professionals. The SPL is an enabler for fulfilling this mission.
- Technology-to-Warfighting – The complexity of war planning, the dynamics involved with executing these plans and the integration of space capabilities is a daunting task. The SPL integrates the space application tools the space warfighter will use in theater and encourages creative thinking.
- Integrating Operations – General Jumper said, “In the fast-paced combat environment of the 21st century, victory belongs to those who can most quickly collect intelligence, communicate information and bring capabilities to bear against targets around the globe. Executing these complex tasks with accuracy, speed and power requires the seamless integration of systems, activities and expertise across all manned, unmanned and space capabilities.” From a space operations perspective, this is precisely what the SPL is designed to achieve.

Directly related to these competencies are the space professional pillars of providing a breadth of knowledge, integrating space power in modern warfare and improving space systems acquisitions. The SPL provides training processes where warfighters are immersed in a realistic environment allowing them to learn

how to operate as they would in theater. In this virtual environment, the conditions are replicated where all students learn the skills and thought processes that would be expected of them in theater.

SPL Architecture

Operational Architecture

The NSSI's approach to educate Space Professionals is expose them to the capabilities, limitations, vulnerabilities, applications and employment considerations of the numerous space systems and explain how these systems are integrated into joint military operations. From the formal classroom, students are taken into the SPL where they have the opportunity to put this knowledge to practice in fully immersive exercises. This training opportunity necessitated an easily reconfigurable system that provides a maximum amount of flexibility while minimizing the impact on the instructional staff.

The environment developed to fulfill the NSSI's requirements was to provide a wrap-around simulation environment for the students to operate with the tactical space application tools while under the watchful eyes of the instructional staff. Figure 3.0 shows that the students have the full suite of tactical tools at their fingertips for use during application training or wargame exercises. These tools are provided with data from simulations to allow full use of all their functionality. The computer based simulation suite stimulates the tactical applications with the data they need to operate in the context of these exercises.

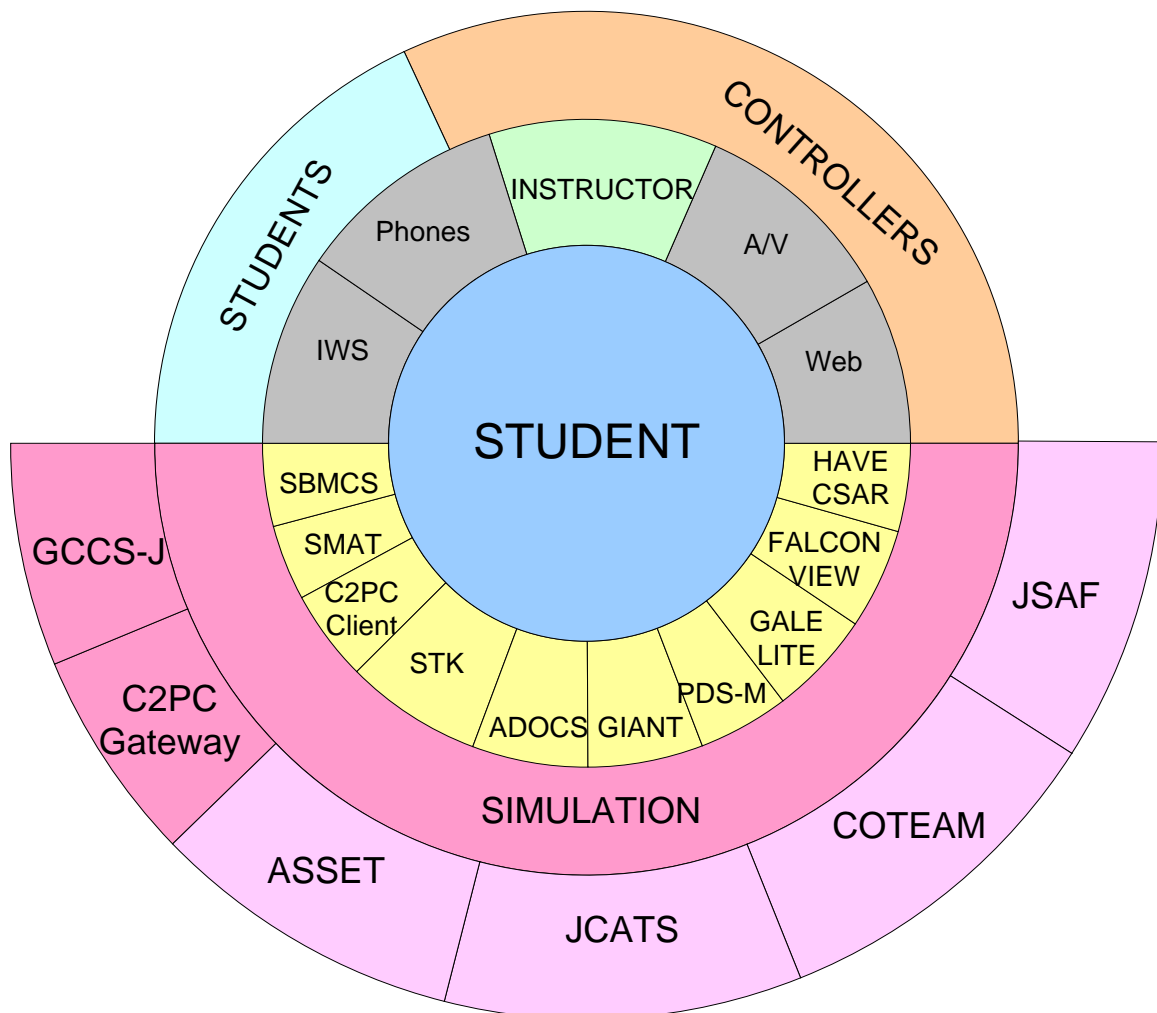


Figure 3.0 – SPL Operational Architecture

The environment is enhanced by providing the students with realistic communications tools, as they would have in an AOC. To provide this, a phone system, network-based conferencing system and SIPRNET emulation are available. Furthermore, the instructors have a complete A/V system for lecture materials, demonstrations, simulated video feeds and VTC into the classroom. A staff of full-time controllers is available to the NSSI instructors to provide for operations and maintenance of the SPL equipment and systems, support during lessons and as role-players to augment the exercises as simulation controllers.

Functional Architecture

The SPL is broken down into six basic modules. At the core of the system are the network infrastructure and services. Plugged into this are the instructor/controller/student workstations, a phone system, simulation suite and an A/V system. Each of these segments provides a special set of services to the SPL as a whole.

The network infrastructure (see Figure 4.0) provides the communications media between all of the other components plus access and storage for all the data used in the SPL. The network handles all of the data and control needs for the applications, the phone system, the simulation suite, systems administration/management and a significant portion of the A/V suite’s data. Data stores have also been provided for the saving of instructional materials, exercise data and student data.

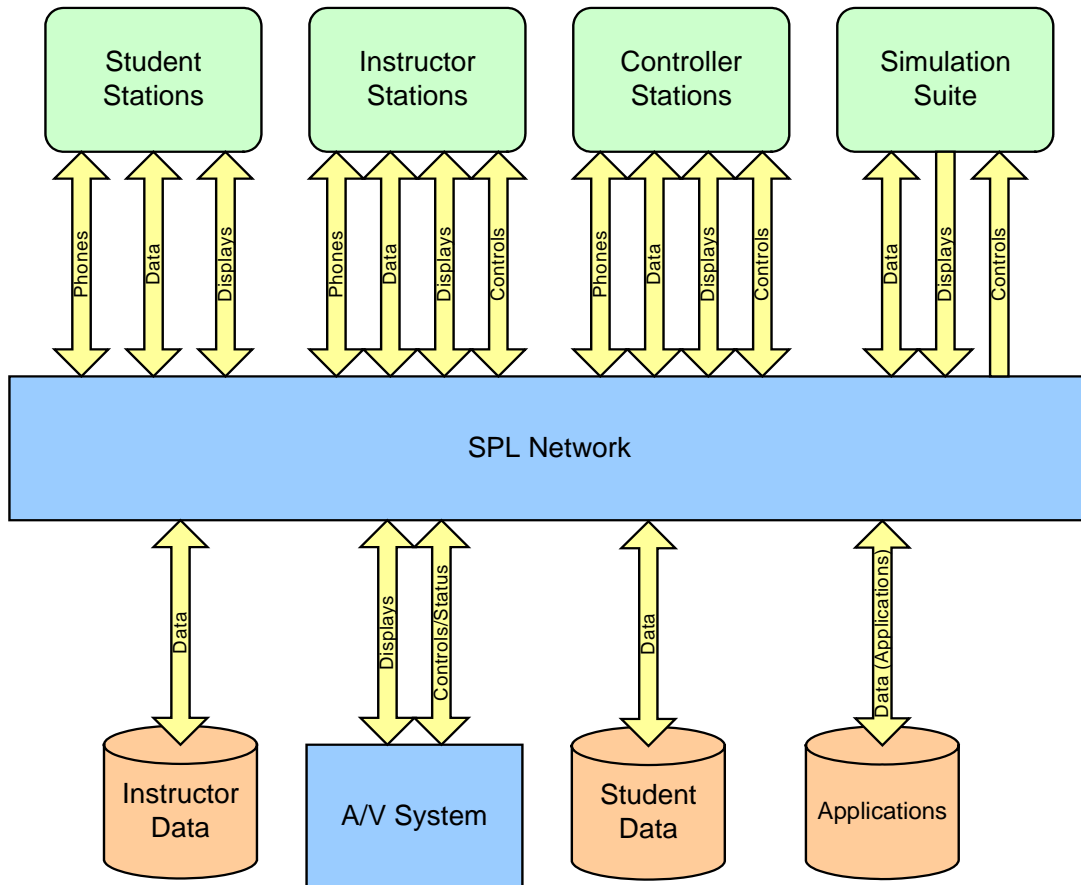


Figure 4.0 – SPL Functional Architecture

Three classes of workstations were developed for the SPL. These are for the students, exercise controllers, and the instructors. Their configurations are:

- The student stations run most of the tactical applications provide display and voice chat resources and digital telephony.
- The instructor stations have the same core capabilities as the student stations with enhanced A/V capabilities and instructional tools.
- The controller stations have the same core capabilities as the student stations with enhanced A/V capabilities, some of the same instructional tools as the instructor stations and enhanced telephony capability. Additionally, they are the host for the simulation suite.
- The simulation suite consists of a partially integrated set of simulation applications injecting message traffic into a C4I suite that drives the tactical applications.
- The A/V system provides the instructor and the controllers with the ability to effectively take any video or audio source in the SPL and route it to any other display surface in the SPL. The sources for the video can be the primary video output from any workstation, camera, or video player (DVD, VCR). The display surfaces can be any workstations' primary display, large screen display, or TV monitor in the SPL. The A/V system and the room lighting can be controlled from almost any computer and the control room.

Physical Architecture

Two of the more challenging requirements of the laboratory design were the necessity to reconfigure the classroom on a regular basis and the desire to separate the classroom into two separate classrooms. These two requirements drove the design of the student workstations, the network topology and the A/V system.

The classroom is designed to support up to 35 student stations, two instructor stations and five controller stations (See Figure 5.0). The controller stations, servers and Sun workstation(s) are not expected to be moved and were installed in the control room and the controllers' offices. The student and instructor stations are designed to be self-contained systems with a minimal number of connections to the SPL's infrastructure to facilitate reconfiguring the room for different sized classes, dual room operations and different exercise and lecture configurations. Since the room came with a raised floor, the power, network and A/V outlets were provided beneath the floor to provide the maximum flexibility for room arrangement.

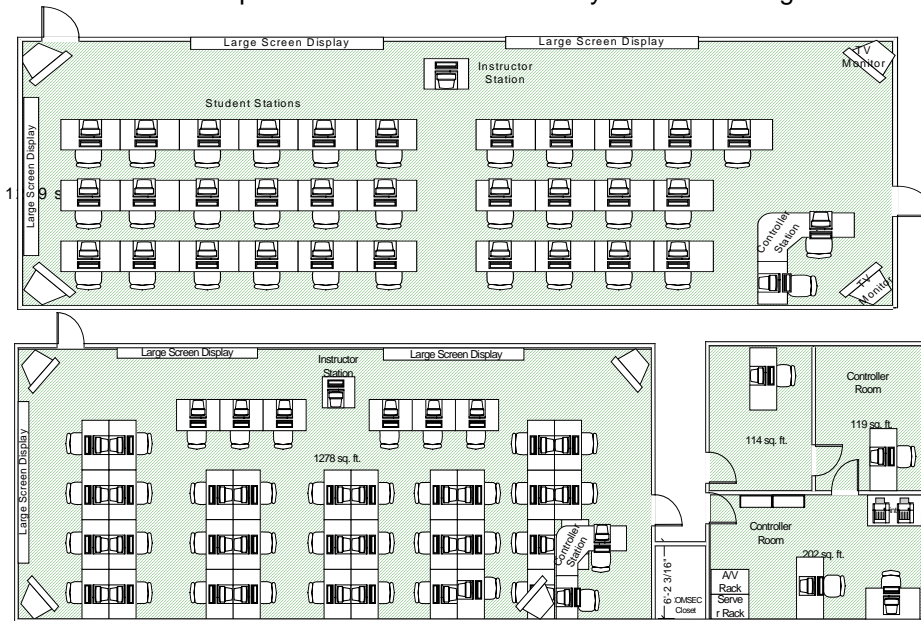


Figure 5.0 – SPL Physical Architecture

The SPL design has two network feeds to each desktop, a gigabit channel for data and a 100 MB channel for the VOIP phone system. The original design had only one GB Ethernet feed for each desktop that would support both the voice and data traffic. Many of the tactical applications used by the students have the requirement to pull map and chart data from the file server. These data files can be very large and with the potential of several students pulling data simultaneously, collisions between the VOIP and chart traffic may occur. As digital voice traffic has a low tolerance for lost or out-of-order delivery of packets, to avoid the risk of packet collision during high traffic times, the VOIP phones were placed on a separate branch of the network. Since the VOIP network didn't require full GB bandwidth, 100 MB switches for the voice traffic and 1 GB switches for the data were used with managed QOS. GB switches could have been used all around, however since they are triple the cost of 100 MB switches the lower cost option was chosen to save money for other features in the lab.

The entire SPL is wired with Cat-6 for future growth if needed. Each workstation requires 2 network connections (1 voice, 1 data) plus a power supply. We reduced the number of cables that had to go through the floor by mounting 5-port switches mounted on 9 of the student station desks. This allows the student stations to be plugged into the desk-mounted switches or into the network outlets under the floor. It is usually easier to reconfigure the room by placing the "super stations" (with the switches) near a network outlet and a floor port and it allowed reduced the number of managed GB switches required. Furthermore, only 18 network jacks of each type were provided for the 35 student and 2 instructor workstations to share (more would have required larger, or more backbone switches with a negligible increase in performance).

Integrating the simulation suite has been the largest challenge and is an ongoing effort. This suite consists of JSAF, JCATS, COTEAM and ASSET, GCCS-J and C2PC; an HLA native simulation (COTEAM), a DIS simulation (ASSET) and dual protocol capable simulations (JSAF & JCATS). The initial design concept was for COTEAM, a theater-level constructive model to drive the overall tactical picture and use ASSET to provide ELINT, SIGINT and Sensor traffic to C2PC and GCCS for distribution to all the other applications. At our preliminary design review, ASSET was not DIS compatible. Because it was unknown whether COTEAM would provide all of the levels of detail that the school would require, we planned on adding JCATS to the simulation suite (See Figure 6.0).

At the very end of September, the National Reconnaissance Office (NRO) released a beta version of ASSET that had a DIS interface. The SPL development site was used by NRO as their beta test site. During testing, ASSET and JCATS successfully exchanged DIS PDUs enabling the injection of sensor data into the SPL C4I systems (See Figure 7.0).

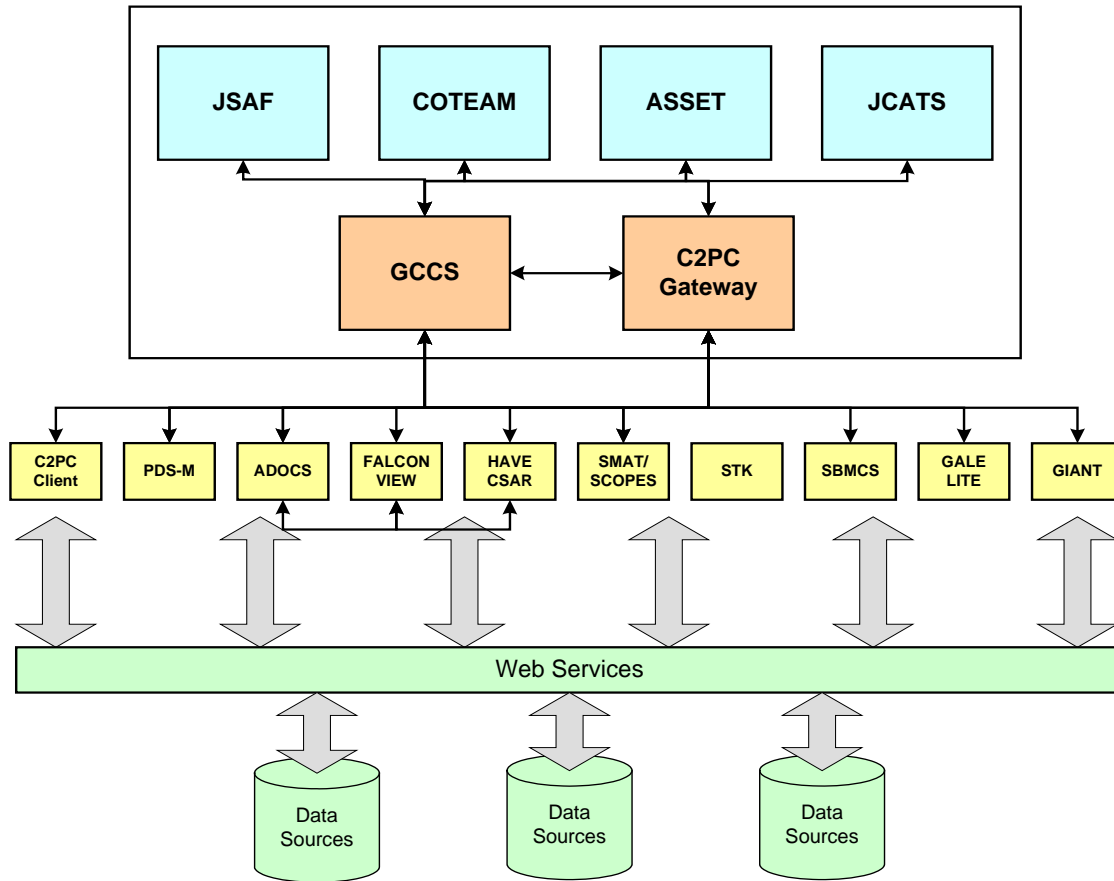


Figure 6.0 – SPL Architecture

Software Application	Purpose
JCATS - Joint Conflict And Tactical Simulation	Exercise scenario tool
ASSET - All-Source Satellite Evaluation Tool	Exercise scenario tool
JSAF - Joint Semi-Automated Forces	Exercise scenario tool
AJCOM - Advanced Joint and Combined Operations Model (previously was COTEAM)	Exercise scenario tool
SYNCHRON EYES	Instruction software used to guide learning and interact with students. Capabilities provided include chat, lock computers, and control computers remotely
IWS - InfoWorkSpace	Secure collaborative environment that allows large groups of dispersed people to collaborate securely
GCCS-J - Global Command and Control System-Joint	Command and control tool joint forces
C2PC - Command and Control Personal Computer	Situational awareness tool
STK - Satellite Tool Kit	Orbital analysis tool
SCOPES - Space Common Operational Picture and Exploitation System	Orbital analysis tool
SBMCS - Space Battle Manager Core System	Hosts the applications for space operations planning and assessment and it is a central source for space information
PDS-M - Processing and Display Subsystem-Migration	Strategic and tactical missile-warning tool used to display launch and threat area information
GIANT - GPS Interference And Navigation Tool	Engagement and mission level simulation tool that calculates the impact of navigation performance.
Falcon View	Flight-planning tool used to display threat information and to provide pre-flight mission familiarization
HAVE CSAR - HAVE Combat Search and Rescue	HH-60 cockpit simulation that allows the display of emergency transmissions from downed aircrew to be reproduced on a PC monitor.
ADOCS - Automated Deep Operations Coordination System	Joint mission management software application used for theater deep attack planning.
GALE Lite - Generic Area Limitation Environment-Lite	Analysis and exploitation of intelligence data

Figure 7.0 – SPL Applications

Conclusions

The SPL has demonstrated that a targeted set of simulations can provide an effective environment for education and training. When bringing a state-of-the-art capability to a traditional education institution such as the NSSI, the bigger challenges are involved in the integration of the facility capabilities with the NSSI's educational processes and coming up with effective new paradigms for the delivery of the course materials and meeting the educational objectives.

The NSSI has made several steps towards integrating M&S and traditional classroom education and is starting to realize the power of a facility like the SPL. The SPL is a facility designed specifically for creating an active learning environment for students that will stimulate, leverage and take advantage of the known benefits of active learning. The facility employs a suite of simulations and related tools to create a "real world"-like environment. The student workstations provide the tools students will need to perform their missions. The instructor podium provides the instructors with all the tools they will need to monitor, control and manage the learning process, while the control room provides SPL technical personnel complete access to all elements needed to facilitate the full range of activities necessary to support the instructors.

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