ABSTRACT
This article introduces and shares a model of a practitioner oriented masters level capstone seminar in Information Assurance. The course is designed to reinforce student knowledge levels and to advance students from an awareness level to a performance level as defined by the NSTISS 4011 standard through problem solving based projects.

Categories and Subject Descriptors
D.3.3 K.6.5 Security and Protection,

General Terms
Security, Information Assurance

Keywords
Information Assurance Education, Capstone Course in Information Assurance

1. INTRODUCTION
INT 891 Capstone Seminar in Information Assurance is a required course designed and taught as a core component of the Master of Liberal Studies (MLS) in Information Assurance[3]. It is a culminating course that studies information assurance through the use of case studies, research, and knowledge application for master’s degree seeking students. Students work very closely with their advisor/instructor on a significant project that will serve as the master’s degree level culminating experience [2].

2. GRADUATE IA PROGRAM COURSE ALIGNMENT
There are four Information Assurance (IA) core courses accompanied by electives in the IA graduate program, offered by Information Networking and Telecommunications (INT) department at Fort Hays State University [4]. To pursue a degree in Information Assurance, students begin with the entry level course INT 684 Foundation of Information Systems Security, which covers a broad knowledge base of Information Assurance and has been certified at the awareness level of NSTISS 4011 and 4013E[6]. The other two required core classes focus on network security. Students may select electives from such classes as computer forensics, network architecture and data communications, operating systems, data base, and cyber law classes. Students conclude their graduate studies with the INT 891 Capstone Seminar in Information Assurance course, in which students conduct research on a project they have designed to demonstrate their academic achievements and enhance their IA capability from the awareness level to the performance level as defined in NSTISS 4011. This course is delivered online through the Virtual College at Fort Hays State University, which provides a flexible way of learning for the students. Students can choose their topic of interest to study within the structure of the class. Different students may study different topics at the same time. This makes the individual one-on-one teaching and research advisement necessary.

3. STUDENT-ORIENTED SEMINAR
All teaching approaches in the IA program are aimed toward one final goal: motivating students to reach the Performance Level. The NSTISSI dictates that Performance Level training “provides the employee with the skill or ability to design, execute, or evaluate agency INFOSEC security procedures and practices. This level of understanding will ensure that employees are able to apply security concepts while performing their tasks” [6]. Learning is not a spectator sport. Students do not learn much just by passively sitting in class listening to instructors, memorizing prepackaged assignments, and providing rote answers. They must talk about what they are learning, write about it, relate it to past experiences, and apply it to their daily lives. They must make what they learn part of themselves [1].

Teaching experience has shown that students will retain the information that they have discovered on their own, more so than information presented in an instructor’s lecture. Students given the opportunity to discover information will fully develop their problem solving skills and understanding of the scientific method,
and develop satisfaction in discovering the information themselves. Attentive faculty can gage the extent of students’ understanding and enhance their understanding and synthesis of theory and practice. Faculty are also able to measure and support the development of students’ capacities of identification, differentiation, application, and production.

Understanding student background knowledge and skills is a key to planning an effective course. The students enrolling in this seminar course have the following characteristics:

1. Though most work in information technology (IT) positions and/or have undergraduate degrees in an IT field, most students lack IA proficiency;
2. Students typically have a strong computer networking and network security background based upon pre-requisites and typically will have some web development and/or programming skills. Based upon pre-requisites, they should have an awareness level of NSTISSI 4011 before they enroll in this seminar;
3. Students need to draw from the knowledge and skills developed during graduate study and to apply those in a manner that demonstrates mastery [2]; and
4. They are exposed to career possibilities that were not visible to them before.

In completing this seminar and hence their masters degree, we expect students will:

1. Enhance their IA performance capability beyond knowing the “big picture” of information security and specific skill based network security classes. This course should move students toward proficiency;
2. Be capable of identifying problems, differentiating risks, creating countermeasures and applying solutions; and
3. Develop their aptitude on a continuing basis in this specialized and continually evolving field.

4. STRUCTURE OF THE SEMINAR
IA Performance Capability refers to “Playing the role of either a system penetrator or a system protector. The student will discover points of exploitation and apply appropriate countermeasures in an instructor-supplied description of an Agency AIS/telecommunications system [6].” To develop IA Performance Capability, the, INT 891 Capstone Seminar in Information Assurance is taught in four stages as listed Table 1.

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<thead>
<tr>
<th>No.</th>
<th>Stage</th>
<th>Evaluation</th>
<th>Content</th>
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<tbody>
<tr>
<td>1</td>
<td>Preparation (six weeks)</td>
<td>30%</td>
<td>Choose material /Read &amp; study material/Unit Test</td>
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4.1 Preparation Stage
The first stage is the preparation stage in which students are doing exercises that include reviewing the key concepts of the awareness level to find their aptitude and interests and laying a solid foundation for carrying out research later in the learning process. The textbook recommended should cover all fundamental knowledge of the IA area in order to lead students to discover their shortcomings and to spark brainstorming for their project. The textbook we selected is Principles of Computer Security Security+ and Beyond [8], which has 24 chapters covering a broad area of Information Assurance.

Students are required to study six IA areas or chapters according to their interests. They may select any six chapters from the textbook, though they are encouraged to cover all chapters within the book. Students must pass exams for those selected areas or chapters. Thanks to the online teaching system, each student can work independently on the six different selected areas or chapters they have chosen concurrently.

4.2 Project Proposal Stage
The second stage is the project proposal stage. Students develop a performance based project proposal covering scenario definitions, a literature review and project plan or design. They must develop a problem-based scenario meeting the following criteria:

1. Easy Identification – students must select an authentic real-life problem;
2. Questions addressed -- They must address an open but challenging question or series of related questions;
3. Effectiveness – the final result can be assessed by a scientific evaluation system, especially by NSTISSI 4011 performance level; and
4. Cost efficiency – are the solution costs to the organization, including policy actions, software, hardware, and firmware affordable and feasible?

The suggested proposal structure should be as shown in Table 2.

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<th>Table 2. Suggested Proposal Structure</th>
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<tr>
<td>Table of Contents</td>
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<tr>
<td>Scenario defined</td>
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The proposal must be approved before a student begins the actual research. We expect the project proposal to be research oriented and a feasible topic that demonstrates mastery that is on or above par with the previous graduate level courses he or she has taken. The project plan is required to cover at least three sub-categories at performance level of NSTISSI 4011. The coverage needs to be explicitly indicated and analyzed in the plan for further evaluation purposes. The project will be graded according to those standards listed under the subcategory.

4.3 Project Implementation Stage
At the project implementation stage, students follow the proposal to conduct the research and implement the project. Projects methodologies may include social science, technology, or business research methods. Research reports need to be between 25 and 150 pages in length in APA style. The time taken in this stage will vary tremendously from student to student. This is the key section for the project outcome. Students will include pages of description, story board, flow charts, screen prints, photos, web links and/or network diagrams based upon the type of project. Assessment of this stage is directly related to the standards listed in the subcategory of performance level standards in NSTISSI 4011 indicated in the proposal. Students should explain how their design, implementation, result, and evaluation will stratify with three to four criteria of performance level standards of NSTISS 4011 “Planning and Management” clause a to d, and “Policies and Procedures” clause a to j.

5. CONCLUSION
The purpose of the culminating project in this capstone seminar is to draw from the knowledge and skills of Awareness Level of NSTISS 4011 and 4013E and of specific networking, server, software, and programming technologies that a student has developed during graduate study and to apply those in a manner that demonstrates mastery of entry level of Performance Level of NSTISS 4011. The culminating projects for students vary considerably based upon a student interests and career aspirations. A student-oriented active Capstone Seminar both enhances and demonstrates the students’ IA performance capability that has been mastered from their study in the IA program.

Table 3. NSTISS Standards

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<td>F. NSTISS PLANNING AND MANAGEMENT</td>
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<td>G. NSTISS POLICIES AND PROCEDURES</td>
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<td>Administrative Security Procedural Controls</td>
<td>13</td>
<td>TEMPEST Security</td>
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At the fourth stage, students present and demonstrate their findings or outcomes resulting from the completed project. Students will respond to challenge questions presented by their instructor, fellow students, and finally faculty committee members in sequential stages of review.

The educational outcome we hope to achieve is that these projects and implementations will meet at least three subcategory level standards of NSTISSI No. 4011 at the performance level. Our belief is that the more freedom we give the students in identifying their areas of focus; the more actively they are encouraged. The students will have the opportunity to develop their aptitude and awareness of their weaknesses and knowledge of their short comings. This does take more time and patience on the faculty member’s part. Part of becoming an effective teacher in this type of seminar setting is learning how much to “tell” and how much to let students discover on their own. This approach can be highly motivating towards the problem-solving process, and has been shown to foster the development of critical thinking, problem-solving, and self-directed learning [5]. It is more meaningful and enjoyable for students based on an understanding of what helps them learn. We expect that some students will struggle in choosing a good project topic and these students will require additional initial guidance.


