COURSE DESCRIPTION:

The purpose of this course is to introduce students from various backgrounds to the major entities involved at the intersection of advanced science and technology research and development for the U.S. national security system. Students will receive an overview of U.S. National Security Research and Development ecosystem elements, key organizational entities, including the National Laboratories, university affiliated research centers and select governmental advisory bodies, and examine the role these entities play in furtherance of achieving short-, mid- and long-term U.S. national security objectives. The Manhattan Project will be used as a vehicle to understand the current foundations of the US national security S&T ecosystem – a vast, interconnected enterprise whose ongoing work is reflective of the international security situation and national security policy dynamics that exist today.

The course content consists of a mixture of lectures and “Socratic” interactive classroom discussions facilitated by the professor. Additionally, students will learn from a cadre of guest speakers who are key practitioners and leaders in the S&T R&D and related policy fields. Students will perform research and provide policy recommendations culminating in the creation of strong professional research and writing samples that will help prepare a master’s student for a career as an analyst. Students will be responsible for integrating and formulating assessments of the course content as part of this process in the context of ongoing current events, national security strategies and concomitant policy debates.
COURSE OBJECTIVES/STUDENT LEARNING OUTCOMES:

1. Familiarity and demonstrable understanding of the U.S. National Security Research and Development ecosystem, supporting advisory organizations and the roles of select Executive Branch elements as presented in the syllabus. We might even discuss Congress.

2. Develop a deep understanding of at least one national security-related research and development organization, mission areas and outputs.

3. Ability to critically analyze and evaluate current/evolving strategies and whole-of-government integration (or lack thereof) for ongoing basic and applied scientific and technological investments as pertains to U.S. national security posture in light of a dynamic threat environment.

4. Arrive at an assessment of what the U.S. must do to maintain its military and competitive technological advantage from a strategic policy, organizational alignment, investment, sustained economic power and human capital perspective.

COURSE REQUIREMENTS:

Books:


Optional Reading List:

Kuhn, Thomas S. The Structure of Scientific Revolutions. Chicago and London (1962). (Recommended as a general principle for all graduate students prior to starting the class)

Additional Readings:

All course materials (unless indicated otherwise), aside from the books recommended for purchase, appear as part of the course schedule below and are available via hyperlink. The
professor will work with students on the pace of the readings given the pace of discussion and instruction in the classroom. Given the dynamic nature of this subject, additional readings may be assigned or substituted for during the semester.

**Attendance Participation and Expectations:**

Attendance at all classes is required. Students are expected to finish the assigned readings before coming to class, be prepared to discuss the preparatory material, and actively participate in discussions. Student participation in class discussions will have a substantive impact on final course grades. Participation will be evaluated in terms of contributions to class discussion. Students are not expected to have an extensive background in advanced science and technology; however, it is expected that by the end of the course each student will have a reasonably deep understanding of their research topic at a graduate level of facility. Students are expected to share their thoughts and insights with the class. *Those students with direct professional and related knowledge of these subjects are especially encouraged to participate actively in discussion.*

**Statement on Special Needs of Students (aka: Reasonable Standard Accommodation Language):**

If you are a student with a disability and need academic accommodations, please see me and contact the Disability Resource Center (DRC) at 993-2474. All academic accommodations must be arranged through the DRC.

**Deliverables:**

1. An Op-Ed, suitable for publication in a national newspaper not to exceed 500 words based on class lectures, reading, independent research and guest speaker inputs. A sign-up sheet will be circulated on the first day of class with topical areas related to an aspect of the Nuclear Security Enterprise, which can be refined in further discussion with the professor after the first class. **Due at the beginning of Class 7 on October 14th. (20%)**

2. 10 page research paper assessing what restructuring and/or governance approach we should consider to optimize the disparate key elements of the U.S. national security science and technology research and development ecosystem to more effectively address capability development to meet the challenges of the international threat environment including national economic instruments of power. **Delivered Class 13. Research and Findings to Be Briefed as part of Action Memo below. (35%)**

3. 2-3 page action memo based on the above. Memo should include relevant recommendations, state of play, delineate advantages and disadvantages of the current system, offer three possible courses of action for consideration by the Administration, including affirmative recommendations for funding and/or legislative changes based on open source analysis of current and out-year budgets. **Delivered and Briefed to Class 13/14/15. (20%)**

4. Class Participation and attendance. **(25%)**
Late Work: The deadlines for the deliverables are strict and extensions will not be permitted in the absence of a genuine emergency or documented illness. A late submission will be penalized a full letter grade (for example, from A to B) for every 24-hour period that it is late. Format and file naming nomenclature for submission will be provided. Deliverables are due no later than 7:20 pm on the day of class as delineated in the syllabus.

Grading:

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Letter grades on assignments are calculated out by weighted percentages as described above to determine final grading for the course with a discretionary adjustment factor as determined by the professor. You will receive more latitude in the calculation of your final grade for tackling complex issues in your research papers and action memos.

Statement on academic integrity:

Faculty in the Schar School have zero tolerance for academic dishonesty and will strictly enforce Mason’s honor code.

COURSE SCHEDULE:

The course will be taught during the Fall 2019 semester running from Monday, August 26, 2019 through December 14th, 2019. Based on availability of guest speakers, reordering of course content may occur.

Class 1: Course Introduction; Overview of the International Threat Environment- What’s Going On Out There? What do we need to do from a National Security Science and Technology Perspective? **August 26, 2019**

LABOR DAY NO CLASS **September 2nd, 2019**

Class 2 Interactive Lecture: Overview of the National Security Science and Technology Ecosystem… Who’s who in the zoo…**September 9, 2019**
**Class 3**  *Making of the Atomic Bomb* lecture and discussion; Nuclear Fuel Cycle.  
*September 16, 2019*

**Class 4** Interactive Lecture: *Making of the Atomic Bomb* … discussion related to current and future implications for national security science and technology research and development.  
*September 23, 2019*

**Class 5** Interactive Lecture and Guest Speaker: Nuclear Security Enterprise Overview; Stockpile Stewardship Management Plan; Dr. Mark Anderson, Director, Research Development Test and Evaluation, Office of Defense of Programs, National Nuclear Security Administration;  
*September 30, 2019*

**FALL BREAK**  
*NO CLASS October 7, 2019*

**Class 6** Lecture and Guest Speaker: (invited) Dr. Dmitri Kusnezov, Department of Energy; Office of Science Open Labs  
*October 14, 2019*

**Class 7** Lecture and Guest Speakers: Mr. Al Grasso, former CEO MITRE and Dr. Ralph Semmel, Director, Johns Hopkins Advanced Physics Laboratory and; FFRDCs and UARCs  
*October 21, 2019  Possibility for alternate class date due to Al’s schedule.*

**Class 8** Lecture and Guest Speaker: DARPA, Reading Discussion; (invited) Dr. Brian Pierce and Mr. Ian Crone  
*October 28, 2019*

**Class 9** Lecture and Guest Speaker: (TBD) Mr. Barry Hermann, White House Office of Science and Technology Policy  
*November 4, 2019*

**Class 10** Lecture and Interactive Discussion: Congress and Oversight  
*November 11, 2019*

**Class 11** Lecture and Guest Speakers - USG Science and Technology Advisory Bodies – Dr. Craig I. Fields, Chairman of the Defense Science Board;  
*November 18, 2019; Special Class being held for available students. Talk and discussion with Dr. Stephen Koonin, Chairman Emeritus of the JASONs November 21, 2019.*

**Class 12** Planning, Programming, Budget and Execution (PPBE) cycle  
*November 25, 2019*

**Class 13** Presentation of Findings and Recommendations from Research;  
*Class Discussion December 2, 2019*

**Class 14** Presentation of Findings and Recommendations from Research;  
*Class Discussion December 9, 2019*
Class 15  FINAL Class  Presentation of Findings and Recommendations from Research  
Course Wrap Up/Class Discussion: Have We Built a Better Mousetrap? What did we miss? What’s next? December 16, 2019

Syllabus and Course Changes: The syllabus is a general plan for the course. Deviations may be necessary and will be announced by the professor. The most likely changes will be to dates on the schedule. This syllabus is not a contract and is subject to change at the sole discretion of the instructor.
## COURSE SCHEDULE

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
<th>Readings</th>
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<tr>
<td></td>
<td><strong>September 2</strong></td>
<td>Labor Day</td>
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<td>2</td>
<td><strong>September 9</strong></td>
<td>Interactive Lecture: Overview of the National Security Science and Technology</td>
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<td><strong>National Nuclear Security Administration Stockpile Stewardship Management Plan 2019</strong></td>
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<tr>
<td>October 7</td>
<td>Fall Break NO CLASS</td>
<td>No readings or lectures this week</td>
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| 6 October 14 | Office of Science Open Labs Lecture  
Dr. Dmitri Kusenov  
Deputy Undersecretary  
Department of Energy, Dr. Stephen Binkley  
Deputy Director for Science Programs, Department of Energy, October 14th, 2019 | The National Strategic Computing Initiative (NSCI) [https://www.nitrd.gov/nsci/](https://www.nitrd.gov/nsci/)  
[https://science.energy.gov/-/MEDIA/ASCR/ASCAC/PDF/REPORTS/EXASCALE_SUBCOMMITTEE_REPORT.PDF](https://science.energy.gov/-/MEDIA/ASCR/ASCAC/PDF/REPORTS/EXASCALE_SUBCOMMITTEE_REPORT.PDF)  
Dimitri Kusnezov, Senior Advisor to the Secretary, Steve Binkley, Senior Advisor, Office of Science, Bill Harrod, Office of Science/ASCR Bob Meisner, Defense Programs/ASC Department of Energy Exascale Initiative (2013)  
[https://fas.org/irp/agency/dod/jason/exascale.pdf](https://fas.org/irp/agency/dod/jason/exascale.pdf)  
Website: [https://www.exascaleproject.org/](https://www.exascaleproject.org/)  
Website: [https://www.exascaleproject.org/exascale-computing-project/](https://www.exascaleproject.org/exascale-computing-project/)  
| **7 October 21** | FFRDCs and UARCs Lecture; Dr. Ralph Semmell and Mr. Alfred Grasso | Federally Funded Research and Development Centers (FFRDCs): Background and Issues for Congress Updated December 1, 2017 [https://crsreports.congress.gov/product/pdf/R/R44629](https://crsreports.congress.gov/product/pdf/R/R44629)


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<tr>
<th>Date</th>
<th>Event Description</th>
<th>Reading/Research Required</th>
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<tr>
<td><strong>October 28</strong></td>
<td>DARPA Lecture, Reading Discussion; Dr. Brian Pierce and Mr. Ian Crone</td>
<td>Read the entirety of The Pentagon's Brain: An Uncensored History of DARPA, America's Top-secret Military Research Agency. Little, Brown, 2015. (Required)</td>
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<td><strong>November 11</strong></td>
<td>Congress and Oversight Lecture</td>
<td>Regarding Congressional role in national security S&amp;T policy: Demise of OTA: <a href="https://issues.org/stalk-5/">https://issues.org/stalk-5/</a> Proposal to replace OTA: <a href="https://www.belfercenter.org/publication/congressional-futures-office">https://www.belfercenter.org/publication/congressional-futures-office</a></td>
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<tr>
<td><strong>December 2</strong></td>
<td>Presentation of Findings and Recommendations from Research;</td>
<td>12 student briefings maximum 10 minutes each</td>
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<tr>
<td>December 9</td>
<td>Presentation of Findings and Recommendations from Research; Class Discussion</td>
<td>12 student briefings maximum 10 minutes each</td>
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<tr>
<td>December 16</td>
<td>Presentation of Findings and Recommendations from Research Course Wrap Up/ Class Discussion: Have We Built a Better Mousetrap? What did we miss? What’s next?</td>
<td>6 student briefings maximum 10 minutes each plus wrap up</td>
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