Proposal for a Summer Course on Training Educators in Nuclear Nonproliferation, Security, and Policy

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Introduction

The need to train the next generation of scientists and policy makers on nuclear nonproliferation, security, and policy is of great importance. For example, recent developments in the nuclear weapons program by the Democratic People's Republic of Korea (DPRK) creates further demand for highly-skilled nuclear scientists. Most recently, on September 9th, 2016 the Comprehensive Test Ban Organization detected seismic activity indicative of a nuclear weapons test. Later, the DPRK announced that it had successfully tested a nuclear weapon, making this the fifth nuclear weapons test it has conducted since 2006 [1]. These nuclear weapons tests demonstrate the DPRK's lack of cooperation with international norms and threaten international security. With about 24% of Nuclear Engineers over the age of 55 [2], training a new generation of skilled nuclear scientists and policy makers to assist in nuclear nonproliferation and safeguards initiatives is imperative to global security, especially US national security.

One of the ways to achieve this goal is to create robust and comprehensive nuclear nonproliferation, security, and policy classes at the University level. To do this, we must identify universities without these classes and then train the educators at these universities to create and administer them. We propose a week long summer training course designed to do this.

Overview of Current Nuclear Science and Engineering Nonproliferation, Security, and Policy Programs

A survey of current nuclear engineering programs was performed in order to understand the full extent of the need for such a summer course. An initial list of 37 nuclear engineering programs was obtained from the Nuclear Science and Engineering Education Sourcebook 2016 [3]. Further searches yielded an additional program for a total of 38 nuclear science and engineering programs in the U.S. and Canada. The university course catalog for each program was examined to determine if, and how many, classes related to nuclear nonproliferation, security, and policy are offered. Of the 38 programs surveyed, 22 programs (58%) did not have any nuclear engineering courses listed or cross-listed pertaining to nonproliferation, security, or policy. However, most of those 22 programs have special topics and seminar courses as place holders for subjects not covered by existing courses. Therefore, it is probable that many of these schools actually do offer classes in nonproliferation, security, or policy as a special topics or seminar course. However, even if these programs do offer such classes, it cannot be assumed that they are taught consistently unless an official course is formed for the course catalog.

Two programs in particular stand out for having robust institutes that support education in nuclear nonproliferation, security, and policy. First, the University of Tennessee Institute for Nuclear Security offers a graduate certificate in nuclear security science and analysis and encourages academic cooperation with other universities through Oak Ridge Associated Universities. Second, the Texas A&M Nuclear Security Science and Policy Institute (NSSPI), a multidisciplinary partnership between the Nuclear Engineering Department and Bush School of

Government and Public Service, also offers a graduate certificate in nuclear security. The NSSPI was the first academic organization to tackle the need for increased for experts in nuclear safeguards and nonproliferation and offers distance education for non-degree seeking students and professionals seeking continuing education credits. The NSSPI has also participated in the development of worldwide nuclear security programs, including with the Moscow Engineering Physics Institute and the Obninsk State Technical University through the NNSA funded Russian Academic Program in Nonproliferation and Security Studies. These institutes serve as examples of successful and robust education programs in nuclear nonproliferation, security, and policy and may provide guidance for this Training Summer Course.

Training Summer Course

Creating a summer school for training nuclear science and engineering professors and educators would expand the number of universities with robust nuclear nonproliferation, security, and policy programs. The Training Summer Course would take place over a week and could be hosted in Washington D.C., at Texas A&M University, or at the University of Tennessee. A breakdown of the pros and cons for hosting the course at each location can be found in Table 1.

	Pros	**Cons**
Washington D.C.	• Easy location for travel. There are many direct flights to Ronald Reagan National Airport and Washington Dulles International Airport. The Baltimore – Washington International Aiport is a 30 minute train ride from D.C. • There are several venues to choose from to host the training course. • Many agencies, embassies, non-profits, organizations, and think tanks nearby. • Many experts on nuclear policy reside in D.C.	• Hotels are potentially prohibitively expensive. Hotels can range from $250 per night. • Arranging transportation for a large group of people would be expensive.
Texas A&M University, College Station, TX	• The NSSPI has experience in developing nuclear security programs so many experts in "training the trainers" are already there. • Would potentially host this training course for very inexpensive or free in exchange for promotion of its Nuclear Science and Engineering Program.	• Inconvenient for travel. Would require flying into a regional airport. • College Station is a small college town with limited resources.
University of Tennessee, Knoxville, TN	• Oak Ridge National Lab is nearby. • Geographically central location. • Would potentially host this training course for very inexpensive or free in exchange for promotion of its Nuclear Science and Engineering Program.	• Fewer local resources than in D.C.

Table 1: Pros and cons of hosting the Training Summer Course at various locations

Washington D.C. would be the ideal location because of its convenient location for travelling, large selection of host venues, and easy access to a wide variety of experts and institutions that support nuclear nonproliferation, security, and policy. For the sake of this proposal, it is assumed that this Training Summer Course shall be held in Washington D.C. Within Washington D.C. there are several possible venues ranging in size, price, and location to host this event and several options are explored in Table 2.

	Relative Price	**Pros**	**Cons**
FAS conference room	Free/Low	• Free for the venue • Fully customizable to FAS preferences	• We must provide all set up and take down • May have to rent additional A/V equipment
George Washington University	Medium	• Local professors in nuclear policy and nonproliferation studies	• Must use University catering
A hotel	High	• Large number of options and locations • We could arrange for participants to stay in the same hotel that the course is held in	• Usually must use hotel catering • Comparatively expensive

Table 2: Breakdown of possible venues for the Training Summer Course

Lecture Topics

The purpose of this course is to teach professors and other educators what they would need to know to create courses on nuclear nonproliferation, security, and policy issues at nuclear science and engineering programs. There is a wide range of courses related to these topics offered at each university. Some universities have no nonproliferation, security, or policy courses; other universities, such as Texas A&M and the University of Tennessee, offer many. For this course, it should be assumed that the educators attending have little or no experience in creating coursework related to these topics. An agenda with proposed lecture topics and tours can be found in Table 2. These lectures and tours can be rearranged, added to, or deleted as necessary.

The first day of the Training Summer Course would focus on technical courses in nuclear nonproliferation and security. This would serve to give the participants a solid technical background in areas such as the nuclear fuel cycle, uranium enrichment, radiation detection for nuclear security, the effects of nuclear weapons, nuclear forensics, etc. Discussion would focus on how to create courses on nuclear nonproliferation and security as well as including these topics in courses already offered at the participants' home university.

The second day would focus on nuclear policies, regulations, treaties, and agreements. Speakers with backgrounds in public policy, international relations, and law would provide participants with a solid political background in these areas. Discussion would focus on how to create courses for engineers on policy, regulations, treaties, and agreements as well as including these topics in courses already offered at the participants' home universities. Time and funding permitting, tours may be arranged to the Department of State (DOS) or the American Advancement for the Association of Science (AAAS) headquarters.

The third day would focus on successfully mentoring students for a career in nuclear nonproliferation, security, and policy. Speakers may include students with backgrounds in nuclear science and engineering who have pursued careers in nuclear nonproliferation and security research and policy. Discussion should concentrate on skills students need to be successful in these careers. Time and funding permitting, tours may be arranged to the Department of Energy (DOE) or the National Nuclear Security Agency (NNSA).

The fourth, and final, day would focus on teaching the participants communication skills. These skills would include how to speak with non-scientists, especially lawmakers, about nuclear science, how to give effective presentations, and how to write policy briefs and memos. These skills should be incorporated into the participant's nuclear nonproliferation, security, and policy courses.

Finally, an optional fifth day for the Training Summer Course could be included for participants interested in meeting with their lawmakers. This would serve to practice the communication skills learned the day previously as well as encourage continued congressional support for nuclear science and engineering education.

Day 1	**Day 2**	**Day 3**	**Day 4**	**Day 5**
Introductions and Welcome	Overview of Nuclear Security Policies, Regulations, Treaties, and Agreements	Mentoring students into a career in nuclear nonproliferation and security research	How to effectively communicate technical information to non-scientists	Meet with congressmen and women (optional)
Overview of Nuclear Nonproliferation		Mentoring students into a career in nuclear policy	How to effectively write policy briefs and memos	
Lunch	Lunch	Lunch	Lunch	
Overview of Nuclear Safeguards and Security	DOS Tour or AAAS Tour	DOE Tour or NNSA Tour	Wrap up	

Table 3: Proposed agenda for the Training Summer Course

Attendees and Speakers

The Training Summer Course would be open to any nuclear science and engineering professor or educator, but would target the 22 universities without classes on nonproliferation, security, and policy in their course catalog. Capping the number of participants at 24 people would keep costs low while allowing every university and national lab interested a chance to participate. It is highly likely that not every institution would have someone attending the Training Summer Course and therefore multiple educators from a single institution could come, or the course could be opened up to international institutions or programs outside of Nuclear Engineering Sciences. For the sake of this proposal, 24 participants are used for estimating costs outlined in Table 5.

Invited speakers could come from universities that already have robust programs in nuclear nonproliferation, security, and policy. A few speakers each from the University of Tennessee and Texas A&M nuclear engineering programs as well as the George Washington University Elliott School of International Affairs. A list of potential speakers is outlined in Table 4; and, for the sake of this proposal, 6 invited speakers are used for estimating costs in Table 5.

University	**Professor**	**Expertise**
University of Tennessee	Howard Hall	Nuclear security applications, including proliferation detection, counterproliferation, detection of and response to radiological/nuclear threats, nuclear forensics, radiochemistry, and applications of nuclear-based methods to other security needs (such as explosives detection)
	Jason Hayward	Radiation instrumentation, especially for nonproliferation technologies and imaging.
	Lawrence Heilbronn	High-energy secondary neutron measurements from heavy-ion reactions, measurements of radiation transport through novel shielding materials, measurements of fission neutron-induced cross sections, benchmark calculations of heavy-ion transport models, measurements of light-ion production that are relevant to radioprotection, studies of the effects of Galactic Cosmic Rays, production of radioisotopes for use in medical, power and nuclear security applications
	Eric Lukosi	Radiation instrumentation and detector development, active and passive interrogation techniques, topics of counterterrorism and nonproliferation, nuclear batteries, and measurement of fundamental nuclear physical quantities.
	Laurence Miller	Particle and radiation transport, diagnostics and surveillance, waste management, health physics, modeling and simulation, instrumentation and control
	Steven Skutnik	Nuclear fuel cycles, nonproliferation and safeguards, proliferation resistance evaluation, nuclear waste management, policy issues pertaining to the nuclear fuel cycle
	John Auxier	Advanced radionuclide separations; nuclear forensics for post-

		detonation analysis; advanced imaging techniques and methodologies for pre-detonation forensic samples
	Joseph Stainback	Security topics including policy, law, and diplomacy; education and training; science and technology; operational and intelligence capabilities; and real world missions
Texas A&M University	David Boyle	Safety & efficiency of plutonium storage, disposition approaches
	Sunil Chirayath	Monte carlo transport methods in reactor physics & radiation shielding, fast breeder reactor (FBR) core physics simulations, safeguards approaches & analysis for FBR fuel cycles
	Craig Marianno	Nuclear counter terrorism, nuclear instrumentation development, exercise development, radiological consequence management, environmental health physics
	Paul Nelson	Transport theory, computational methods, management of nuclear materials
George Washington University	Christopher Cahill	Solid-state and materials chemistry of the f-elements, crystallography, nuclear fuel cycle, science and technology policy, scientific communication/public engagement, curriculum development, nuclear forensics
	Allison Macfarlane	Nuclear waste issues, nuclear energy policy, regulatory issues, international security, and science and technology policy
	Janne Nolan	National and Nuclear Security, US Nuclear Strategy and Proliferation Policy, Congress and the Politics of American Security
	Douglas Shaw	Nuclear terrorism, nonproliferation and arms control; multilateral diplomacy; and U.S. foreign and national security policy process

Table 4: List of potential invited speakers for the Training Summer Course

Venue and Food

The venue, if Washington D.C. is chosen as the host city, could be in the Marvin Center at George Washington University. George Washington University is conveniently located in central Washington D.C. in the Foggy Bottom district close to the national mall. Furthermore, GWU has the Elliott School of International Affairs which is home to several faculty that are experts in international security and nuclear policy. The Marvin Center has a variety of meeting spaces that can accommodate from 18 to 60 people in a classroom style setup depending on the room. Specifically, rooms 402 to 404 can be opened up to create a space that can accommodate up to 48 people in the classroom style set up and includes catering tables in the back. This allows plenty of room for all participants and invited speakers. The layout for rooms 402 to 404 can be found in Appendix 1. The Marvin Center also offers projectors with laptops, podiums, microphones, internet access, video and audio recording, and TV production if desired. Events hosted at George Washington University require in-house catering. Boxed sandwich or salad lunches from Au Bon Pan are included in the in-house catering list, are inexpensive, and offer many options to accommodate dietary restrictions. Price estimates for the venue come from a

phone call with GW Events and Venues. Price estimate for Au Bon Pan come from their online catering menu.

Course Materials

Course materials would include a notepad, pens, a highlighter, and a bag for each participant. The course "textbook" would consist of the PowerPoint slides and any supplementary materials printed out and combined in a 3-ring binder. All slides and supplementary materials would be sent to the Federation of American Scientists ahead of time to allow time for printing. Extra course materials should be purchased in the event more are needed or course materials are lost. Price estimates for course materials can be found in Appendix 2.

Transportation

Transportation via charter bus for tours would be ideal because all course participants would travel directly to the tour sites as a group; however this option is expensive. A price estimate for the charter bus can be found in Appendix 3. Alternative transportation options include taxis, Uber, or Lyft; these options would allow the group to travel directly to the tour sites but be split into several vehicles that may arrive at differing times. Additionally, the Marvin Center is within a close walking distance to Foggy Bottom-GWU and Farragut West metro station; this option would allow the group to travel together, but would take a longer amount of time to get around.

Other Expenses and Budget Limitations

The sample cost breakdown in Table 3 does not include some expenses. Airfare and meal costs (other than lunch) for the Training Summer Course participants are not included. Many of these cost estimates may differ from the final total because they shall not be incurred until a later date.

Description		Number of Units	Price per Unit	Total
Venue	George Washington University Marvin Center Room 402-404 Classroom Style (maximum capacity of 48)	4	$525.00	$2100.00
	Projector with laptop	4	$170.00	$680.00
	Podium	4	$30.00	$120.00
	Microphone	4	$30.00	$120.00
Lunch	Boxed Sandwich or Salad Lunch from Au Bon Pan for 30 people	120	$10.75	$1290.00
Venue and Lunch Subtotal				**$4310.00**
Course Material	Office Depot® Brand Perforated Writing Pads, 8 1/2" x 11 3/4", Legal Ruled, 50 Sheets, Canary, Pack Of 12	3	$11.69	$46.76

	Pads			
	BIC® Soft Feel® Retractable Ballpoint Pens, Medium Point, 1.0 mm, Black Barrel, Black Ink, Pack Of 12	3	$9.49	$37.96
	BIC® Brite Liner® Highlighters, Yellow, Box Of 12	3	$7.99	$31.96
	3-Ring Binder with 100 color pages	30	$1287.40	$1287.40
	V Natural Recycled Cotton Grocery Tote	50	$5.51	$275.50
Course Materials Subtotal				**$1679.58**
Transportation	Shofur Bus Reservations 2 day charter bus (capacity of 55) 1:00 pm to 5:15 pm each day	1	$1750.00	**$1750.00**
Hotel	A block rate for a local hotel for 24 people for 5 nights	120	$250	**$30000**
Speaker Honorarium	Estimate for consulting fee, travel, and hotel for visiting professors and speakers.	6	$3000	**$18000**
Grand Total				**$55,739.68**
Cost per person for 24 participants				**$2322.49**

Table 5: Sample cost breakdown for the Training Summer Course

Conclusion

In conclusion, with the current state of international security, the need to train the next generation of scientists and policy makers on nuclear nonproliferation, security, and policy is of great importance. After attending the Summer Course on Training Educators in Nuclear Nonproliferation, Security, and Policy, universities shall have the tools to create more robust and comprehensive coursework and mentor students to pursue careers in these areas. Students will be better prepared to tackle the nonproliferation, security, and policy problems of the future. This will, in turn, strengthen US research capabilities, national security interests, and international relations.

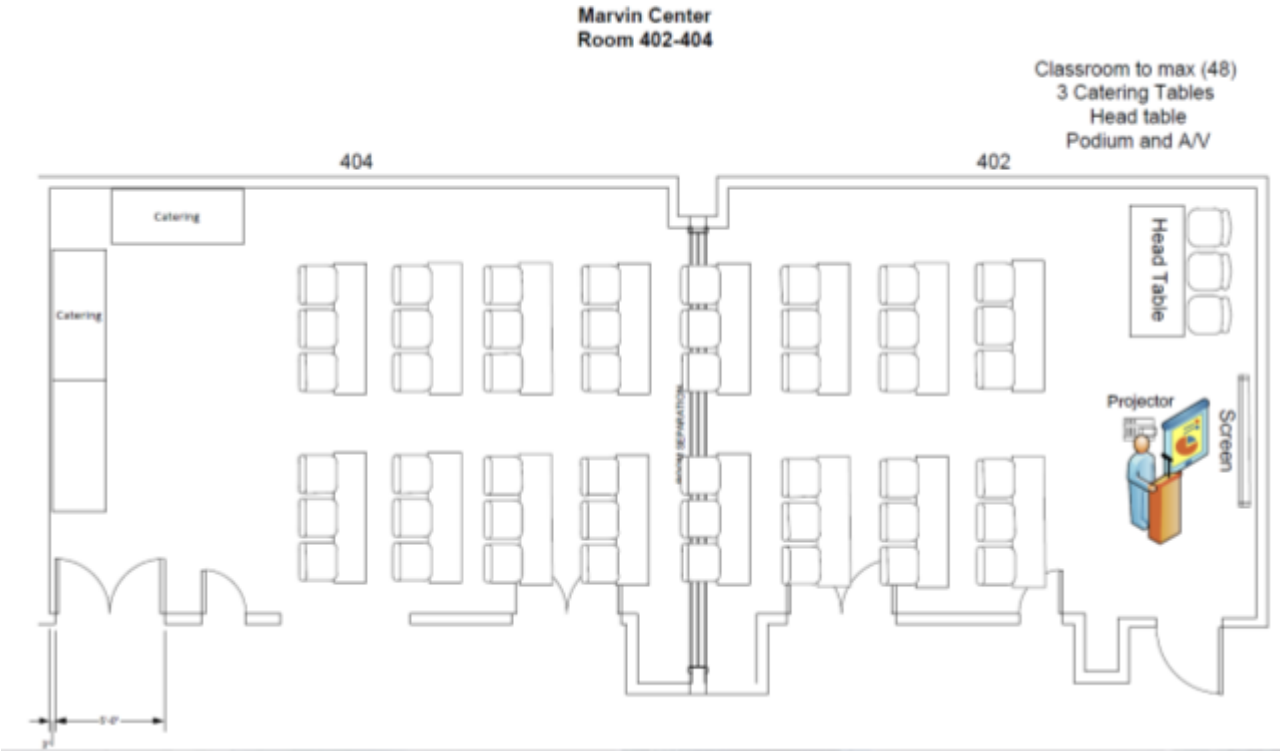
References

[1] “9 September 2016 DPRK Announced Nuclear Test.” CTBTO.org. Comprehensive Test Ban Treaty Organization, Web. 28 May 2017.

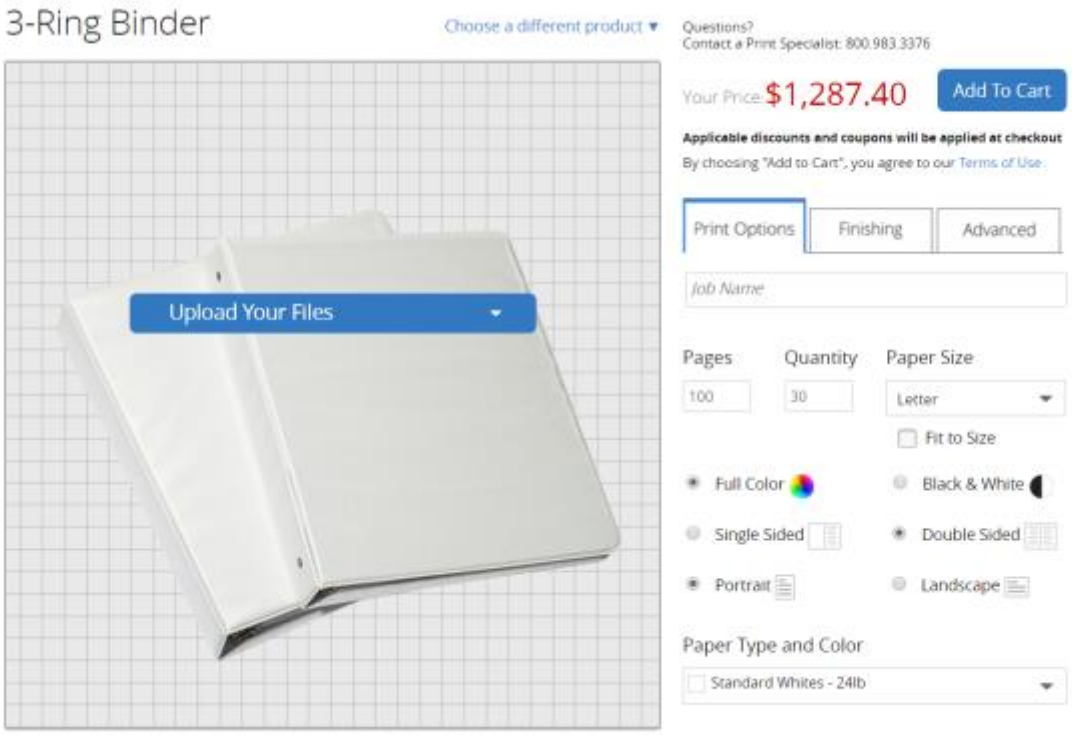
[2] Wright, Joshua. "In-Demand and Aging: A Look at Engineers and Engineering Technicians in the Workforce." Emsi. N.p., 12 Sept. 2014. Web. 28 May 2017.

[3] Gilligan, John, and Sherry Bailey, eds. "Nuclear Science & Engineering Education Sourcebook 2016." 5.16 (2016): n. pag. NEUP. American Nuclear Society Education, Training, and Workforce Division. Web.

Appendix 1: Marvin Center Room 402-404 Layout



Appendix 2: Price estimates for Course Supplie



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Item #106257

V Natural Recycled Cotton Grocery Tote

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average rating 4.6 of 14 ratings

Select Product Color
1 color(s) to choose from!

This item has one color option: Natural

Minimum Quantity	50	100	250	500	1000	2500	5000
Your Price	$5.51	$4.83	$4.52	$4.32	$4.07	$3.39	$2.99

Office DEPOT
OfficeMax
Taking care of business **Shopping Cart**

		Pickup or Delivery	Unit Price	Qty.	Subtotal
	Office Depot® Brand Perforated Writing Pads, 8 1/2" x 11 3/4", Legal Ruled, 50 Sheets, Canary, Pack Of 12 Pads **Item # 305706**	Delivery Estimated arrival Jun 27 To 32601 FREE Store Pickup 2 out of 3 available at your selected store	**$11.69 dozen**	3	$35.07
	BIC® Soft Feel® Retractable Ballpoint Pens, Medium Point, 1.0 mm, Black Barrel, Black Ink, Pack Of 12 **Item # 655266**	Delivery Estimated arrival Jun 27 To 32601 FREE Store Pickup 2 out of 3 available at your selected store	**$9.49 dozen**	3	$28.47
	BIC® Brite Liner® Highlighters, Yellow, Box Of 12 **Item # 375030**	Delivery Estimated arrival Jun 27 To 32601 Store Pickup Not Available	**$7.99 dozen**	3	$23.97

Order summary

Items (9) Subtotal	$87.51
Delivery	FREE
Estimated Total	$87.51

Appendix 3: Price Estimate for Transportation via Charter Bus

Your Information

Trip	1
Vehicle	Charter Bus

Trip Type
Roundtrip

Overtime Rate
$0.00/hr

Pickup Date
July 25th, 2018

Pickup Time
01:00 PM

Pick Up Location
Washington, DC, United States

Drop Off Location
Washington, DC, United States

Return Date:
July 26th, 2018

Return Pickup Time:
05:15 PM

Down Payment
$175.00

Remaining Balance Due
$1,575.00

Remaining Balance Due Date
June 25th, 2018

Base fare	$1,700.00
Processing Fees	$50.00
Tolls	$0.00
Total	$1,750.00
Grand Total	$1,750.00
Amount Due Today	$175.00