

出國報告(出國類別：軍售訓練)

精密試裝班返國報告
TMDE Maintenance Support Specialist

服務機關：陸軍飛彈光電基地勤務廠

姓名職稱：上尉飛彈修護官劉翰詳

派赴國家：美國

出國期間：108年5月21日-109年2月6日

報告日期：109年2月21日

摘要

精密試裝班(TMDE Maintenance Support Specialist)總訓期為 38 週，由 12 週基礎電學課程及 26 週各式儀器校驗專業課程組成。

初期基礎電學課程內容為用電安全、直交流電、類比數位訊號、微處理器及基礎儀器操作等相關基礎課程所組成，主要是讓學員能夠對於電學原理及概念有初步了解及配合儀器操作來觀察電路中訊號，達到理論及實作互相結合，使學員更容易充分理解。

此次受訓過程除了專注於專業課程學習外，國際軍售學生辦公室(International Military Student Office)也會定期舉辦旅遊行程，讓國際學生彼此之間能夠互相交流，增進英文溝通能力，也更了解各國的文化習慣，提升自身的國際觀。

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壹、 目的

人類為了認識世界與改造世界，需不斷對自然界各種現象進行量測與研究，而測量是科學技術、生產及貿易、工程研究以至於生活的各個領域不可或缺的一項工作，測量之目的是確定被測量的值，然而由於測量儀器會因為自然環境因素不同及人員能力的差異而量測出不同的結果，因此這次課程主要就是讓學員了解如何使用儀器進行測量及測試，並學習機儀具校驗流程及專業知識，確保量測之數據無誤，最終能針對儀器故障進行隔離及排除，達到任務所需之要求。

貳、 過程

一、 基礎電學：

基礎電學可以說是瞭解電子訊號意義的根本課程，必須從基礎課程中了解電壓、電流訊號及常用的電子元件，才能夠看得懂電壓或電流在線路圖中的意義，進而運用線路圖研析可能故障的元件，最後完成維修，因此需充分瞭解基礎電學的內容，打好基礎才能更進一步，而美軍主要運用電腦引導式教材(Student Portal)進行教學，依照電腦指示進行學習及實作實驗，可以自行掌握學習進度，當遇到不了解的問題時，則請教官進行說明講解，有效的運用學習時間；



圖 1 Student Portal 基礎電學課程

因本身國、高中甚至是大學都是相關科系，已瞭解課程相關內容，所以在學習的過程中才能比較順利，而不會因為語言的關係，造成自身學習上的窒礙。

二、類比及數位電錶校驗及故障分析(MODULE D)：

電錶是所有儀器中最基礎的儀器，在一般日常生活中也是經常使用到。



圖 2 常見三用電表

課堂中教官向大家介紹類比與數位電錶之差異及操作方式，其中數位電錶除了手動校驗之外又可運用自動校驗程式來進行校驗，自動校驗程式會透過電腦的提示視窗來教導操作者該如何完成儀器間的接線，並自行完成儀器校驗設定，較手動方式方便且快速，最後教官提供了簡易的類比電錶內部線路圖，向學員講解各種故障形成原因及如何故障隔離及排除，在針對類比式電表進行校驗的過程中，需特別注意觀測量測數值時，眼睛必須與指針保持垂直，否則觀測數值將因視角不同而產生誤差。

三、物理量具校驗(MODULE I)：

本堂課主要介紹物理量具操作及校驗，如扭力扳手(Torque wrench)、游標卡尺(Caliper)測微器(Micrometer)、皮托管(PITOT)、張力計(Tensiometer)及溫度計(Thermometer)等。



圖 3 執行皮托管校驗

與電子儀器不同的是，物理量具大部分都需手動校驗，並配合砝碼及塊規等校正器來進行校正，觀察量測值是否位於誤差範圍內，來判斷是否可繼續使用。

四、類比及數位示波器校驗及故障分析(MODULE E)：

示波器是一種能夠顯示電壓訊號動態波型的電子測量儀器，示波器與電錶一樣區分為類比及數位兩種，數位型的示波器除了手動校驗之外一樣可運用自動校驗程式來進行校驗，最後藉由技術書刊內註明的故障種類及檢修步驟來進行故障隔離至最小元件，由於現今數位型的示波器內部卡片大部分都是由程式化元件所組成，關鍵維修技術與韌體受限於製造商未釋出，因此難以進行維修，故本課程主要教授類比型示波器維修作業。



圖 4 執行數位示波器校驗

五、 輻射探測與輻射量測原理(MODULE C)：

本堂課主要是說明各種游離輻射原理及特性，輻射是一種具有能量的波或粒子，如電磁波以及從放射性物質發射出來的微小粒子都可稱為輻射，然而輻射對人體是有危害的，過大的輻射劑量甚至會造成身體病變甚至是死亡，因此瞭解如何運用輻射偵檢器對自然環境內的輻射粒子進行探測及量測是非常重要的事情，且在遭遇輻射暴露時處置的標準作業程序及執行輻射量測時正確的輻射防護措施也是本次課程的主軸，在保護好自身的前提下，才能完美的完成量測任務。

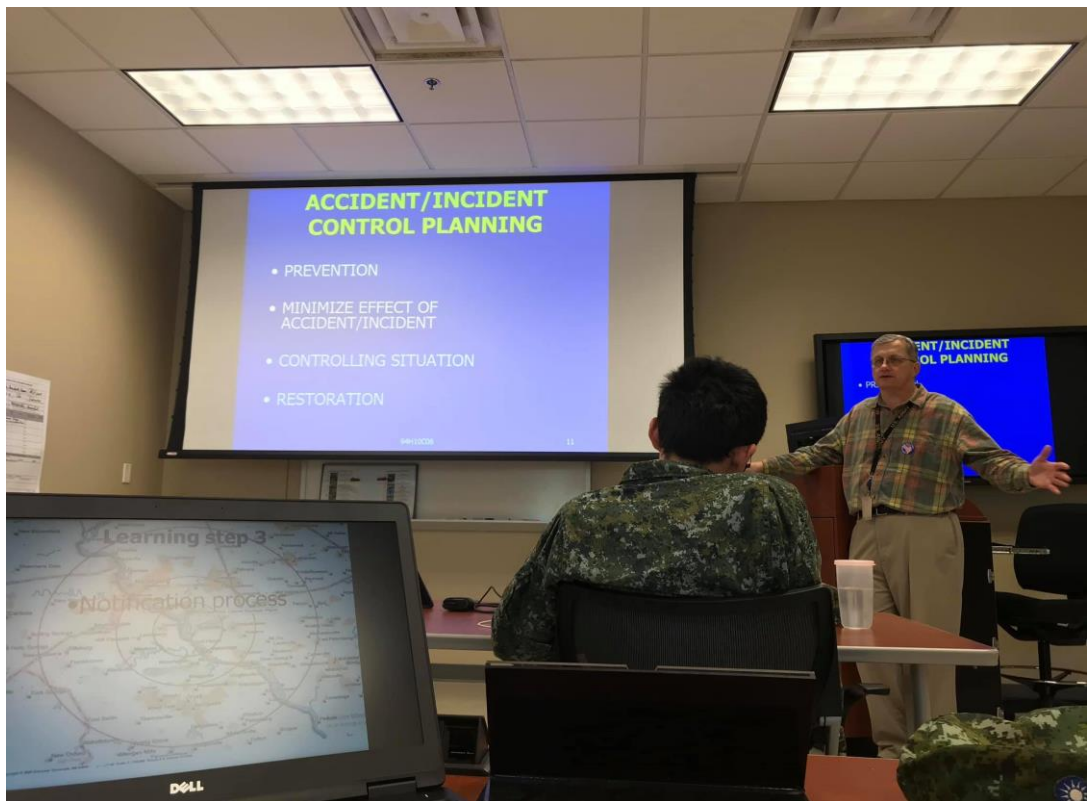


圖 5 輻射防護課程

六、訊號產生器校驗及故障分析(MODULE F):

提到量測訊號時，可能會想到使用示波器或是邏輯分析儀，然而在缺少驅動訊號源的狀況下，勢必無法進行量測，除非由外部來提供訊號，這就是訊號產生器主要的功能，而這堂課是運用型號 PSG2400L 之訊號產生器配合型號 E4448A 頻譜分析儀來進行手動與自動校驗。

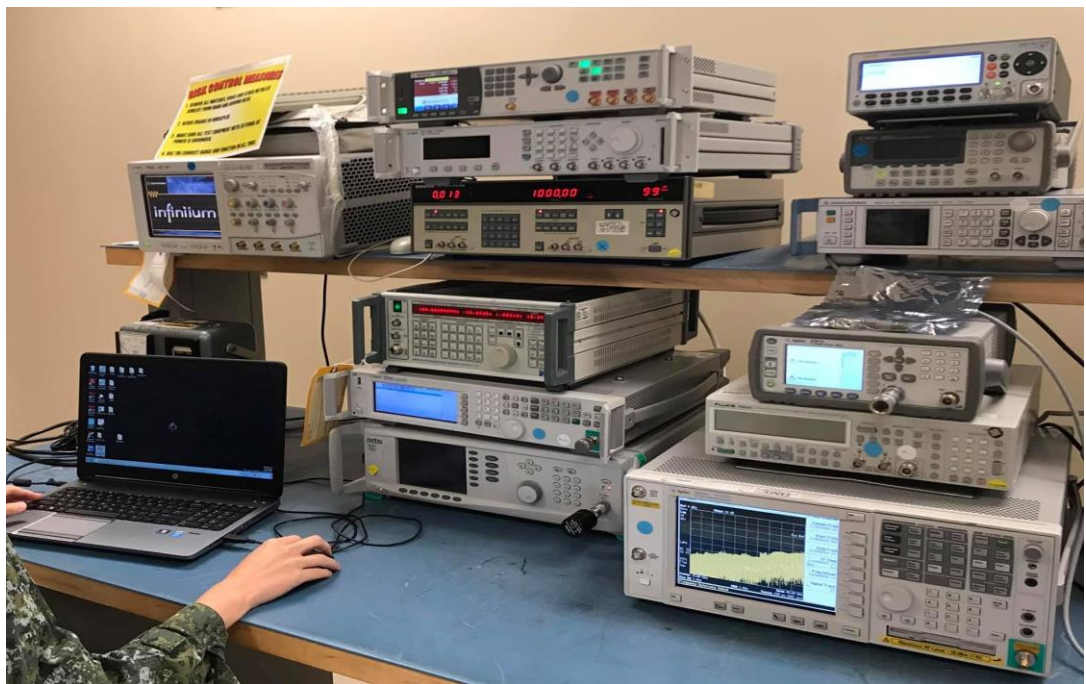


圖 6 訊號產生器校驗

校驗方式與先前電錶及示波器相同，依照技術通報(Technical Bulletin)的手動校驗步驟進行校驗，自動化則是將通報中步驟轉化為程式，也就是自動校驗程式，由電腦自行操作儀器，人員依照電腦提示視窗，進行儀器間接線即可完成校驗，故障分析部分是依據技術手冊(Technical Manual)類似故障情形，配合手冊內容步驟，一步步將故障

進行隔離，判斷出可能故障之板件，在故障分析甚至是排除時，需要非常瞭解儀器操作及分析儀器所顯示各項數據，因此教官在課程中時常會要求學員自行完成儀器校驗前設定，或是將儀器設定成所需之訊號輸出大小及波型，充分讓學員熟悉儀器的操作。

七、射頻電錶及頻譜分析儀校驗與故障分析(MODULE G)：

射頻是指頻率位於 3kHz 至 300GHz 這個頻率範圍內的電磁波，在雷達上發射機及接收機內常由射頻元件所組成，將訊號發射至空間中，並接收反射回來的訊號來判斷目標位置，這就是雷達的功能，所以需針對內部的射頻元件進行量測，同時也需校驗這些量測射頻訊號的儀器，才能讓雷達發揮正常的功用，而這次的課程主要是讓大家了解各種訊號調變，如相位調變(Phase modulation)、頻率調變(Frequency modulation)及振幅調變(Pulse modulation)，而調變主要的作用就是將低頻訊號結合載波，處理成高頻的訊號，因低頻的訊號在傳遞過程中損耗較大，若將訊號轉換成高頻，就可讓訊號傳遞至較遠的地方。

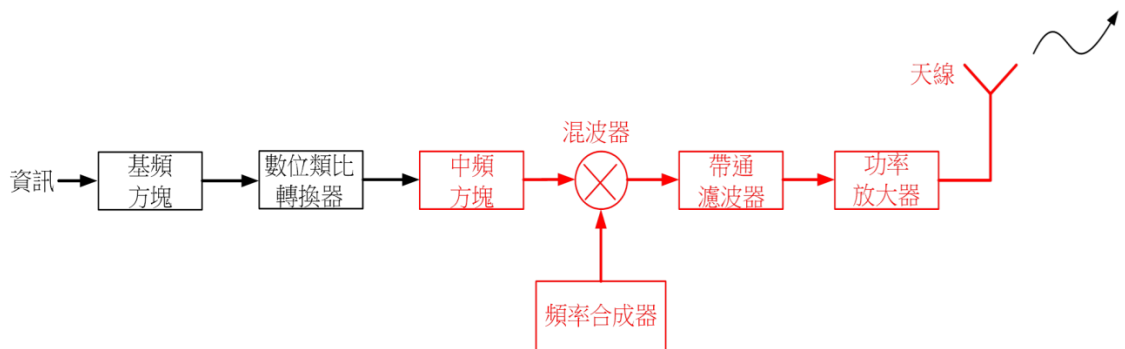


圖 7 由基頻轉換為高頻流程方塊圖

同時課程還有介紹 E4407B 頻譜分析儀及舊型類比式的射頻電表的操作及校驗，類比式射頻電表的部分因為型式老舊，僅可使用手動方式進行校驗，幾乎已經無人使用，而 E4407B 頻譜分析儀則可配合自動校驗程式來進行校驗，在故障分析的部分教官也是針對可能遇到的問題配合技術手冊(Technical Manual)的故障隔離部分進行教學及實作。

八、無線電測試儀校驗(MODULE H)：

無線電，又稱為射頻，是指環境中傳遞的電磁波，波長長於紅外線光，頻率範圍在 300GHz 以下，由人工所產生的無線電波，常被運用在各項通訊之中，例如衛星、雷達及導航等，訊息傳遞在作戰中是尤為重要，因此無線電量測及訊號的輸出是本次課程主要的教學內容，無線電測試儀主要是由各項儀器功能組成，例如示波器、三用電錶、射頻電錶及頻譜分析儀，可用來進行多項訊號量測。



圖 8 無線電測試儀功能講解

課程中結合先前所學習內容，將各式儀器組合在一起成為一個小型的測試檯，而這個測試檯就可以進行訊號的輸出同時也可以針對外來的訊號進行量測的動作，具備多項的功能，同時也能運用自動校驗程式針對測試儀進行校驗，以應付戰場上瞬息萬變的狀況。

參、心得與建議

一、課程心得

(一)課程內容部分：

1. 本次課程除學習電學及儀器校驗專業知識外，教官在課堂上也會分享本身在實際執行中所遭遇的狀況及困難，而不僅僅是針對教案的內容進行講解，遇到有疑問時，教官與學員都會熱情地討論及交流，讓彼此都能夠教學相長，不管是在課程上及生活上都有很大的幫助及收穫。
2. 報告內容說所提到的自動校驗程式(ICE)，可大幅降低校驗所需時間，提升整體效率，惟教官無法教授程式開發訓練課程，僅說明程式是向廠商採購獲得，建議可由我軍可藉由軍售案向美政府提出採購需求，廠於歷任赴美學習精密試裝校驗訓練課程前輩擘劃下，已陸續完成數位電表、電源供應器、示波器、訊號產生器與頻譜分析儀等自動化校驗程式，建立自主校驗能量，後續期望此精密試裝校驗軍售班可增加程式發展訓練課程，除可培養校驗專長人員外，亦可藉由程式發展

專長，開發武器系統總成件與主件板測修程式，後續將會持續爭取預算及人員培訓課程，持續進行能量開發，加快校驗速度與品質，提升國軍整體戰力。

(二)國外文化學習：

除了平日的學習課程外，也在與各國國際學生交流中了解了各地方的文化及習慣，提升國際觀的同時英文溝通能力也能持續進步，再加上國際軍售學員辦公室(IMS0)時常也會舉辦國際學生的旅遊，加強彼此之間的聯繫，了解美國文化的同時也能夠吸收到其他國家的風俗特色。

(三)英文能力提升：

精密試裝班相對其他班隊訓期，已算是長期班隊，因課程均由教官全程運用英語進行講解，所以英文聽力部分有很大提升，溝通部分，因在國內不常使用，一些單字用語，甚至文法可能有時使用錯誤，但還是可以透過不斷溝通來進行加強，所以受訓 8 個半月，除了專業知識外，也提供了非常好的英文環境，讓受訓學員能夠有充裕的時間，好好加強自身英語能力，是一個非常好的英語學習機會。

二、建議事項

(一)由於課程內容須具備基礎電學知識，故課程具備 12 週之基礎電學課程，但因時間過短，課程僅針對部分重點課程進行教學，且

後續校驗專業課程需配合線路圖進行研析，故建議受訓前先行學習基礎電學相關知識。

(二)雖然在受訓前，會先行針對英語能力進行測驗，合格之受訓學員均具備英語基礎單字、文法及聽力的能力，但溝通部分仍有不足，建議國軍仍能針對英語溝通方面進行加強，例如本軍各對美軍售採購案皆可與美方人員或者技術代表接觸，即可把握各洽談時機多與技代進行溝通，進而成為朋友，這樣不管是對於英語學習和工作方面都能有正面的幫助。

(三)美方在進行基礎電學授課時，所使用之教材非一般傳統紙本教材，而使用電腦引導式教學課程(Student Portal)，這種教材的好處除了環保不用再印製紙張書籍外，也能由學員自行掌握學習進度，已經了解的部分能夠概略讀過，而針對不了解或是有問題的地方能夠投入更多時間，或是協請教官進行講解，教官只需律定學員在規定的時間內完成相應課程即可，國軍也能參考這樣的方式，在一些例行性及基礎的課程，也能夠採用這樣的模式來進行教學，有效節省資源成本且提升學習效率。

肆、 未來規劃

廠為北部地區校修二級實驗室，主要負責全軍北區精密量具校、修作業，因科技日新月異，所需校驗儀器的數量與種類也日漸增多，然而校驗程序複雜且冗長，人工相較自動化校驗，需花費更多精力及時間，因此自

動化校驗勢必是未來發展的主要方向，運用電腦軟體程式，完成儀器校驗設定，減少人為操作失誤，以提升校驗效率。

廠將持續進行校驗程式開發，並積極培養程式開發人員，達到「精實、主動、服務、時效」的後勤目標。

伍、 附件

附件一 ITO

- ... for international Military Student (IMS)
1. ITO Number: TWBOEK0018042 2. Country/Organization: Taiwan 3. Date: 24-Apr-19
 - The U.S. Government hereby issues this ITO for the IMS herein named to attend the course(s) of instruction herein listed, subject to the terms and conditions contained herein, and as may be amended by competent authority. This ITO is the only document that will be used and is valid only for the IMS entering U.S. training under the Foreign Assistance Act of 1961, as amended, or the Arms Export Control Act.
Definitions of acronyms and abbreviations contained in this document, and instructions for completing this form are provided in the Joint Security Cooperation Education and Training Regulation, JSCETR / Joint Security Assistance Training Regulation, JSATR (SECNAVINST 4950.4A/AR 12-15/AFI 16-105). This computer generated, letter format ITO is authorized in accordance with the Security Assistance Management Manual (SAMM), DoD 5105.38-M.
 4. Issuing Security Cooperation Organization (SCO)
 - a. Name of Organization: Security Cooperation Office (SCO), AIT/Taipei
 - b. Mailing Address: Department of State
4170 AIT Taipei Place
Security Cooperation Office (Training Branch)
Washington, DC 20521-4170
 - c. E-mail Address: pengkks@state.gov
 5. Program Type: FMS: Foreign Military Sales TW-B-OEK001
 6. IMS Information:
 - a. Surname: Liu
 - First Name: Han-hsiang
 - b. Sex: MALE
 - c. Country Service Rank: O-3
 - d. U.S. Equivalent Rank/Pay Grade: O3
 - e. Country Service: Army
 - f. Country Service Number: H123995091
 - g. Date of Birth: 10-Aug-92
 - h. Place of Birth: Taoyuan, Taiwan
 - i. Passport Number: 315430275
 - j. Country of Citizenship: Taiwan
 - k. Visa Number: N6746985
 - l. Visa Type: E-1
 - m. Military Unit/Organization: Missile Electro Optics Depot, TA
 - n. Mobile/Cell Phone:
 - o. Email Address:
 7. Invitation.
The Secretary of Department of the Army invites the IMS listed in Item 6 of this order, to proceed from Taiwan to Ft Lee, VA 23801, reporting on 21-May-19 for the purpose of commencing training listed in Item 8 of this order.
 8. a. Authorized Training: No additional training to that specified in this order will be provided.
CASE: OEK001
a. WCN: 8042A 577503.3 MASL: B142501 Title: TMDE MAINTENANCE SUPPORT 5
Military Service Course No: 198-94H10 School: ORDNANCE MUNITIONS & ELECTRONICS SCHOOL
Location: Ft Lee, VA 23801 Report Date: 21-May-19 End Date: 06-Feb-20
*****Last Line*****
 9. Funding.
Fund Cite: 097 8242TWXTXX A57XX OEK001B 21T0 8042Q 8TW0430279Y001 F.0006277.21.5 5064283564 001 4020957
7 021001
 10. Language Prerequisites:
 - a. Highest Required ECL: 70
 - b. IMS completed in-country English language testing as follows:
ECL Exam No: 19H Date Completed: 20-Feb-19 Score: 80
 11. Security and Student Screening:
 - a. Human Rights, Security, and Medical screening have been completed in accordance with SAMM Section C10.8., and JSCET paragraph 10-39 for IMS listed in item 6 of this order. The IMS was properly screened via Department of State (INVEST) and within DoD, Homeland Security and other required databases for records of Gross Violations of human rights, Human Rights abuses, drug trafficking, support of terrorist activity, corruption, criminal conduct, or other activities inconsistent with U.S. policy goals. This in and of itself does not permit the disclosure of classified U.S. information. Such disclosure must be specifically authorized by an officially delegated authority and U.S. foreign disclosure regulations or directives. The IMS may require a security clearance to gain computer access or building/site access associated with training.
 - 1). The highest U.S. classification level required for training is: Unclassified.
 - 2). The U.S. equivalent security clearance level granted to the IMS by the home government is Secret.
 12. Conditions:
 - a. Dependents: Dependents are authorized by U.S. authority to accompany the IMS or join the IMS while in training. Dependents are not authorized to be transported or subsisted at U.S. Government expense. Only the following authorized dependents will be issued the U.S. DoD/Uniformed Services Identification and Privilege Card.
Accompanying Dependents:
Approval for Accompanying Dependents:
Non-English Language Training (DLACDLI)/Follow-on Training Approval Source
The MilDep approved dependents, this requires the name and organization of the person that authorized dependents and approval date.
Approved by Svetlana Lavrentyeva from SATFA on 04/08/2019.

Name	Relation	DOB	Passport No.	Visa No.	VISA Type
I-ting Liu	wife	14-Mar-92	309859289	N6746984	E-1

b. Medical Services.

IMS:
IMS under FMS.
Non-NATO/PFP SOFA IMS-Case. Charges for DoD and civilian medical and emergency dental care are chargeable to the case and will be forwarded to the appropriate MILDEP for processing.
Mildep Billing Address: Army: HQ MEDCOM ATTN:MCRM-F
2748 WORTH RD STE 9
JBSA Fort Sam Houston, TX 78234
Or items may be scanned and emailed to:
usarmy.jbsa.medcom.mbx.medcom-ins@mail.mil

DO Forms 7 and or 7A will be used for DOD reimbursements and SF 1034 for civilian reimbursements.

(d) Medical Examinations (Before CONUS Arrival)
Medical examination, to include HIV Test, was completed on 06-Mar-19.

Dependents:
Dependents.

Non-NATO/PFP SOFA Authorized Dependents-Insurance. Dependent has acquired MilDep-verified qualifying health insurance for DoD and civilian medical care covering the entire period he/she will be present in the U.S. for scheduled training.

Health Insurance:

Company: International Medical Group
Policy Number: PATAI82129715
Address: 2960 North Meridian Street
Indianapolis, IN 46208-4715 USA
Phone: 317-655-4505

c. Participation in Hazardous Duty.
IMS is authorized to participate in hazardous duty training.

d. Physical Fitness Training.
Participation in physical fitness training is required. Check SC-TMS Course Description, International Notes, and Prerequisites for prerequisite physical fitness requirements.

e. Leave.
Upon completion of training, IMS is not authorized leave, and will proceed immediately as directed to home country.

f. Living Allowances.
Lodging is chargeable to the fund cite indicated in Item 9, and in accordance with SAMM C10.13 policy. Meals and incidentals are the responsibility of the foreign government. See Item 15, "Special Conditions/Remarks".

g. Travel.
Travel cost (to/from Home country and U.S.) is the responsibility of the foreign government.

h. Travel by POV.
IMS is authorized to travel by POV.

i. Baggage.

Allowances outlined below apply for the portion of the travel costs payable from U.S. appropriated funds. Baggage sizes and dimensions are to conform to carrier stipulations.

1. No baggage will be transported at U.S. government expense.

NOTE: If the airlines will not accommodate the authorized baggage cited above, the IMS should ship the unaccommodated, but authorized, baggage the most economical way (e.g., FEDEX, UPS, USPS), and seek reimbursement for that cost. Schoolhouse IMSOs should monitor the baggage policies and latest surcharge costs for the carriers used from their commonly-used airports for changes, and inform SCOs when additional authorizations are needed on the ITOs.

Unauthorized Baggage

Shipment of baggage in excess of the weight allowance is not authorized. Disposition of unauthorized baggage is made at the expense of the student or the IMS' government. Commanding officers of the training or administrative installation should ensure that unauthorized baggage is shipped at the student's expense prior to his/her departure from the installation. IMS reporting to ports of departure with unauthorized baggage are requested to forward the unauthorized baggage by commercial means at their expense. If lack of time prohibits this, the traffic representative takes unauthorized baggage into custody, and the IMS is given a receipt for the baggage. The IMS will travel on the scheduled flight or carrier. After departure, the traffic representative delivers the unauthorized baggage to the IMS' consulate.

13. Terms:

- Prior to departure from home country, the IMS and dependents listed herein are required to be medically examined and found physically acceptable in accordance with the health provisions of the Immigration and Nationality Act (8 USC 1182(A)(1)-(7); Public Health Service, Department of Health and Human Services, 42 CFR Part 34, Medical Examination of Aliens, and 42 CFR Part 71, Foreign Quarantine; applicable U.S. MILDEP regulations; and other U.S. laws or DoD directives and regulations which may be enacted from time to time.
- The home country will ensure that the IMS has sufficient funds in United States dollar instruments to meet all expenses while en route to and to include living allowance for not less than the first 2 weeks and not more than 30 days of training, pending receipt of applicable

- custodial fees and personal debts incurred by self or family members. This includes accepting responsibility for reimbursing the providers of all emergency/ non-elective medical costs for the IMS and all authorized dependents during their stay in the United States. If the IMS permits his healthcare policy to lapse, is unable to meet these financial obligations and the home country government has not agreed to indemnify the costs, the IMS may be withdrawn from training and returned to home country. This will jeopardize future grant funding and training allocations for the country. Despite the lack of an indemnification letter from the foreign government, the IMS' government will still be expected to pay for all medical costs to treat an IMS and/or authorized dependents for any pre-existing condition, including, pregnancy coverage, high blood pressure and dialysis.
- d. The IMS will bring adequate uniforms and work clothing for field duty or technical work. U.S. fatigue uniforms and footwear will be purchased by the IMS in the event that the country work uniforms are inadequate. When flying training is involved, required special flight clothing and individual equipment will accompany the IMS, or provisions will be made by the home country or the IMS to obtain the use of all necessary equipment prior to start of training. The IMS will also possess adequate civilian clothing for off-duty wear.
 - e. The Government of the United States is responsible for IMS travel which is part of the training program and for which costs are part of the course tuition.
 - f. The IMS will comply with all applicable U.S. Military Service regulations.
 - g. The United States may cancel training and return to country IMSs who violate U.S. law or Military Service regulation or who are found otherwise unsatisfactory. The IMS government will be alerted to such action in accordance with U.S. MILDEP regulations.
 - h. The Government of the United States disclaims any liability or financial responsibility for injuries received by the IMS listed herein while in transit to and from the training installation, while undergoing training or while in leave status, and any liability or financial responsibility for personal injury claims or property damage claims resulting from the IMS action.
 - i. The IMS will participate in flights of U.S. military aircraft as required for scheduled course(s) or as specified in U.S. MILDEP regulations.
 - j. The acceptance of this order by the host country constitutes agreement that an IMET funded student will be utilized, upon return to the host country, in the skills for which he was trained for a period of time sufficient to warrant the expense to the U.S. Government, in accordance with the SAMM, Chapter 10.

14. Implementing Authority:

a. MILDEP AUTHORIZATION: 0751595

b. Date: 25-Oct-18

15. Special Remarks:

This training Case allows for local area billeting or housing costs (max \$110 per night) for on-post/base or off-post/base billeting or housing when on-post/base billeting or housing is not available. US military installation billeting facilities or housing authorities who accommodate, or who arrange local area billeting, lodging or housing, can utilize the fund cite offered in para 9 of this ITO to direct bill the US Army DFAS. IMS required to utilize off-post/base area housing (i.e., local apartment) with no capability of direct DFAS billing. are responsible for all contracts and will work with local IMSO for reimbursement from US Army DFAS. IMS is not authorized case funding to support any travel, messing or incidentals.

Retainable instructional materials should be shipped to:

TA Liaison Officer
c/o Training Branch
Security Cooperation Office
4170 AIT Taipei Place
Washington, DC 20521-4170

16. Distribution:

ORDNANCE MUNITIONS & ELECTRONICS SCHOOL
Ft Lee, VA 23801
1-DIRSATFA TRADOC ATFA-R FT MONROE, VA 23651
1-AIT/T
1-TECRO/W
3-INDIVIDUAL

17. ITO Authorization:

a. Signature of U.S. Authority Authenticating Orders:
// SIGNED //

b. Title:


Joe Goodrich
Deputy Chief, SCO



Ordnance School



Be it known that

CPT HAN-HSIANG LIU

having successfully fulfilled all requirements,
is declared a
Graduate

*TMDE Maintenance Support Specialist 198-94H10 006-19
28 May 2019 to 6 February 2020*

given at Fort Lee, Virginia



HEIDI J. HOYLE
Brigadier General, U.S. Army
Commandant

附件三 生活照

