

**UNSW@ADFA**  
CANBERRA • AUSTRALIA

Course Manual

**Principles of Surveillance Technology**

ZITE8217

Session 2, 2008

Prepared for the  
School of Information Technology and Electrical Engineering  
UNSW@ADFA

**Course name**  
Principles of Surveillance Technology

**Course code**  
ZITE8217

**School name**  
Information Technology and Electrical  
Engineering

**Program**  
Master of Engineering Science

**Prerequisites**  
None

**Duration**  
One session  
Intensive week 7-11 July 2008

**Session**  
2, 2008

**Credit**  
6 units

**Assessment tasks**  
2 Class Tests  
1 Online Quiz  
1 assignment

**The complete learning package contains**  
Course Manual  
Prescribed Textbook  
Supplied Notes

**Mode**  
Intensive mode

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## Course Staff

**Craig Benson**

Room 206, Building 16

Tel: 6268 8206

[c.benson@adfa.edu.au](mailto:c.benson@adfa.edu.au)

Available in person, by phone or email.

Email is normally answered promptly



## Introduction and Context

This course provides an overview of the theory and practice of the technologies and systems utilised in ground and airborne surveillance systems. Topics include an examination of the portions of the electromagnetic spectrum used for surveillance; optics fundamentals; image intensification techniques; thermal imaging; fundamentals of lasers and laser systems. Participants will be introduced to the theory and practice of a broad range of radar systems including pulse radar, CW and CW/FM radar, pulse doppler and MTI radar and SAR. Radar EW will be covered using the traditional breakdown of Electronic Support, Electronic Protection and Electronic Attack. Students successfully completing this course will understand the fundamentals of surveillance systems, as well as being able to perform high level technical assessment of system capabilities.

## Teaching Strategies

This course is conducted in an intensive mode, with follow-on assignments. The intensive week is composed of a combination of traditional lectures and more informal tutorial sessions to enhance student competency at the material taught. Being a postgraduate course filled with practicing engineers the course will be conducted in a collegial, investigative manner, while still maintaining adequate academic rigour.

## Assessment

Class Test, 0800 Wed 9 July 08, 30%  
Class Test, 0800 Fri 11 July 08, 30%  
Online Quiz, Due 1600 Fri 18 July 08, 10%  
Analysis Assignment, Due 1600 Fri 5 Sep 08, 30%

### LATE SUBMISSION OF ASSESSMENT

Late assignments will only be accepted if prior arrangement is made with the lecturer, or a formal application for special consideration is submitted and the late submission is deemed appropriate.

## Academic Honesty and Plagiarism

Plagiarism is using the words or ideas of others and presenting them as your own. Plagiarism is a type of intellectual theft. It can take many forms, from deliberate cheating to accidentally copying from a source without acknowledgement.

For more information, please refer to the UNSW@ADFA Academic Misconduct website (<http://www.unsw.adfa.edu.au/student/misconduct/>).

## Resources for Students

The compulsory text is R. I. Faulconbridge, "Radar Fundamentals", Argos Press, 2002.

Other course materials will be provided during the course.

A pre-course mathematics package is provided, which forms the baseline assumed mathematical knowledge for the course.

Students should provide their own scientific calculator, and be capable of completing the pre-course mathematics using it. Calculators with stored memory are permitted during the class tests, however the stored memory is to be cleared.

## Course Schedule

**Mon 7 Jul 08:** Optical Systems and Image Intensification

**Tue 8 Jul 08:** Thermal Imaging and Lasers

**Wed 9 Jul 08:** Optics Test & Pulsed Radar

**Thu 10 Jul 08:** Doppler Radar

**Fri 11 Jul 08:** Radar Test, Radar Imaging and Electronic Warfare

Classes run from 0800 to 1600 each day, with a 1 hour break for lunch between 1200 and 1300.

## Course Evaluation and Development

Feedback from this and previous courses has shaped the content and assessment methodologies in this course. Your feedback will help to further improve the course for future students.

## Other Information

**For further information, please consult the UNSW@ADFA Handbook and <http://www.unsw.adfa.edu.au/student/>**

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The University of New South Wales  
at the Australian Defence Force Academy*



Welcome to the course **ZITE8217 Fundamentals of Surveillance Technology**. This Course Manual contains information about the course. From time to time you may receive additional or updated information by mail, email, or within your online course site.

You should read this book in association with the *UNSW@ADFA Handbook* which contains additional useful information.

### Lecturer information

Your lecturer is **Craig Benson**.

**Craig Benson** is a senior lecturer at the School of IT and Electrical Engineering, UNSW@ADFA, where he teaches Guided Weapons, Electronic Warfare, Surveillance Systems, Avionics and Navigation. He is a former RAAF Engineering Officer and consultant, with a substantial background in Electronic Warfare, Radar and Navigation Systems. Having received his BE (Elec) (hons) in 1992 he served as an engineering officer at a RAAF flying squadron before completing an MSc in Electronic Warfare at RMCS Shrivenham in 1996. He then returned to Research and Development Flight at RAAF EW SQN (now JEWOSU), where he was responsible for Electro-Optic countermeasures and provided guidance on a wide range of EW systems. He spent further time as an aircraft systems analyst at the Defence Intelligence Organisation, and as a consultant to the Department of Defence. He completed a second MSc at UNSW in 2005 and is the co-author of a book on Electronic Warfare, as well as authoring or contributing to numerous studies and several publications in scholarly journals.

### Contact information

Please note, **telephone contact numbers are operational only during normal business hours, Monday – Friday**. Email or voicemail messages may be left at any time, however they may not be actioned until the next working day.

As a student of the University of New South Wales, you may also receive notices and information directly from the UNSW Kensington campus e.g. from the Postgraduate Office on graduation, or information about student orientation.

You **must** check your student email account for official notices from the University. Information about how to configure your student email account is available at [http://www.unsw.adfa.edu.au/ict/tip\\_sheets](http://www.unsw.adfa.edu.au/ict/tip_sheets).

Contact details for the lecturer are provided in the course outline section of this guide.

If you are **unable to contact the lecturer**, please leave a message with the **RAAF Professional Development Coordinator, Raeleigh Rogers**. You can also contact Raeleigh for **administration enquiries** relating to progress and graduation, enrolment and examination, and any matters related to the **RAAF Professional Development Program**.

Phone: +61 2 6268 6003  
Fax: +61 2 6268 8666  
email: [r.rogers@adfa.edu.au](mailto:r.rogers@adfa.edu.au)

The contact details for our **Schools and Student Administration Services** can be found in the *Student Gateway* located at <http://www.unsw.adfa.edu.au/student/contact/>.

For **technical assistance** with any UNSW@ADFA information technology systems contact the **Information Communication Technology Services (ICTS) Help Desk** at ADFA on:

Phone: +61 2 6268 8140  
Fax: +61 2 6268 8150  
Email: [helpdesk@adfa.edu.au](mailto:helpdesk@adfa.edu.au)

The **Academy Library** is here to help you – even if you can't visit in person. You will need a current **ADFA student ID card** to access full library services. For more information about the Library, including services for students studying as an off campus student, visit the Library's web page at <http://www.lib.adfa.edu.au>.

### Occupational health and safety

For information about Occupational Health and Safety at UNSW@ADFA visit <http://www.unsw.adfa.edu.au/admin/ohs/index.html>.

### Equity and diversity

The Equity Unit provides a range of services and support to UNSW@ADFA students. A comprehensive list is available from the Equity Unit at <http://www.unsw.adfa.edu.au/about/equity/index.html>.

### Important dates

See the *UNSW@ADFA Handbook* for significant UNSW@ADFA dates. You can access this at <http://www.unsw.adfa.edu.au/student/dates/>.

## Materials and equipment

General information technology requirements are specified on the *UNSW@ADFA Learning and Teaching Website* at [http://www.unsw.adfa.edu.au/learning\\_teaching/downloads/StartingInOlive.pdf](http://www.unsw.adfa.edu.au/learning_teaching/downloads/StartingInOlive.pdf).

Your study may be hindered if you do not have access to the minimum hardware and software specified.

## Online participation

The online learning environment is a required part of this course. You will be expected to use the online learning environment to:

- Complete the on-line quiz
- submit written assessment tasks, and
- access required resources.

Your ability to use the online learning environment is assumed. If you are new to learning online please take advantage of the online information before the course officially begins.

- You will find the Online Learning Site at <http://olive.adfa.edu.au/>.
- Your user name is 'z' followed immediately by your student number.
- Your password is the same as your ADFAPASS password.

After you have logged in, the courses in which you are enrolled will appear as underlined links on the left of the Olive page. Click the link to enter the course. If your course is not visible, contact the ICTS Help Desk.

## Class attendance

Your intensive block will be conducted 7-11 July 2008.

### **This course contains the following subjects:**

STA Requirements and Domains  
Optical Fundamentals  
Visual and Electro-Optic Imaging  
Image Intensifiers  
Thermal Imaging Systems  
Lasers  
Pulsed Radar  
Radar Power Calculation  
Moving Target indication  
Doppler Radar  
Pulsed Doppler Radar  
Radar Imaging  
Synthetic Aperture Radar  
Radar EW

### **Schedule**

**Mon 7 Jul 08:** Optical Systems and Image Intensification  
**Tue 8 Jul 08:** Thermal Imaging and Lasers  
**Wed 9 Jul 08:** Optics Test & Pulsed Radar  
**Thu 10 Jul 08:** Doppler Radar  
**Fri 11 Jul 08:** Radar Test, Radar Imaging and Electronic Warfare

### **Pre course activity**

You are expected to be able to complete the pre-course maths material prior to arriving. This does not mean you must complete the material, but you will be required to use this level of mathematics, and your calculator, to apply knowledge learnt during the course. 60% of the assessment is carried out during the intensive week, much of it requiring you to complete problems that require use of this relatively simple mathematics.

### Grading

You can find a list of the general grade specifications described in the *Student Gateway* at <http://www.unsw.adfa.edu.au/student/assessment>.

If you are unsatisfied with any aspect of assessment refer the matter in the first instance to the lecturer and if necessary, refer to the *UNSW@ADFA Handbook* for details of appeal and special consideration at <http://www.unsw.adfa.edu.au/student/handbook>.



# Assignment – System Assessment

Weight: 30%

Due date: 26 September 2008

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## Task

The **Assignment** is to choose a realistic military surveillance requirement of your choice. Then select three (3) items of real equipment to meet that requirement, and assess each in turn, including basic calculations to assess the utility of each solution. Try and choose very different solutions. For example, a fixed sensor for surveillance of an airfield perimeter, such as the golf course area of Amberley. Ideally requires detection of intruders day and night, in all weather, from running pace to crawling and stationary. Possible solutions are a small ground surveillance radar (MSTAR), a AN/XPS-101 ‘Tubby’ Low Light TV system and a Thermovision 2000 Thermal Imager.

Discussion should include how well each system meets each part of the requirement, as well as calculations (neat handwritten OK) showing range, resolution or accuracy limitations of each competing solution. A discussion of some (though not all) other aspects such as maintenance, calibration, setup, portability, training, covertness, etc will show you understand the broader issues. Naturally you are unlikely to have cost data, but you can make a broad assessment of the likely relative costs of each solution. Likewise adopting reasonable estimates of missing technical data is OK – the main purpose is to exercise the calculations you learned in the course.

## Purpose

The purpose of this assignment is to give to give you an opportunity to demonstrate your ability to apply the knowledge and understanding you have gained throughout the course.

The assignment requires higher order independent thinking beyond the ability to read, comprehend, and remember the information provided in the text book. It will help you draw together all of the discrete areas studied. In particular, you will need to determine appropriate contexts to apply the skills you have learned.

## Preparation

You are expected to make a substantial effort to complete your assignment (worth 30% of the course marks).

## Submission

An electronic submission must be made via OLIVE. If handwritten material cannot be scanned, then an empty electronic submission may be made, and a paper copy of the assignment must be received by mail by the **due date** at the following address:

Craig Benson  
School of Information Technology and Electrical Engineering  
UNSW@ADFA  
Northcott Drive  
CANBERRA ACT 2600

If a hard-copy is submitted it is to be unbound, except for a single staple in the top left-hand corner.

You will need to complete a cover sheet and statement of authorship when you submit your assessment task. A copy of this form is provided at the end of this book. An electronic version is available from <http://www.unsw.adfa.edu.au/units/ets/flexed/downloads/AssesmentCover.doc>.

Unless prior arrangement has been made with the course lecturer, a late submission will not be marked and a result of ‘zero’ will be awarded for that assignment. Approval for late submission should not be taken for granted; extensions will only be given in exceptional circumstances.

## **Return details**

The assignment will be marked within three weeks of the last assignment being received (including any extensions) and marks will be made available on OLIVE at that time. If you would like your assignment returned, please place your mail address on the cover sheet of your assignment.

## **Marking criteria**

Marks for this assignment will be allocated based on the understanding you demonstrate in the analysis and an assessment of the effort you apply to the assignment.

## Assignment cover sheet

Student name: \_\_\_\_\_ Student number: \_\_\_\_\_

Course convenor/lecturer: \_\_\_\_\_

Course name: \_\_\_\_\_

Course code: \_\_\_\_\_

Assessment number: \_\_\_\_\_ Date submitted: \_\_\_\_\_

Assessment task: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

I \_\_\_\_\_ affirm that the  
(print name)  
work in this assignment is solely my own other than where explicitly  
acknowledged to be otherwise.

I assert that the preparation of this work has been completed in  
accordance with ethical standards appropriate to students of  
UNSW@ADFA and is a true representation of my current capabilities  
in this course.

Signature: \_\_\_\_\_