

**SAULT COLLEGE OF APPLIED ARTS AND TECHNOLOGY
SAULT STE. MARIE, ONTARIO**



Sault College

COURSE OUTLINE

COURSE TITLE: Human Factors in Flight
CODE NO.: AVT248-2 **SEMESTER:** Four
PROGRAM: Aviation Technology (Flight)
AUTHOR: Brian Stewart
DATE: Aug/04 **PREVIOUS OUTLINE DATED:** Aug/02
APPROVED:

DEAN **DATE**

TOTAL CREDITS: 2
PREREQUISITE(S): HDG 112
HOUR/WEEK: 2

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I. COURSE DESCRIPTION:

This is the second course involving human factors which aviation students are required to take. Personal Growth and Development discussed both physiological and psychological factors. The psychological factors were not directly linked to aviation, however many links could have been made. The physiological factors were all directly related to flight.

This semester you will learn how the psychological and physiological factors play an important role in flight safety. After the introduction your study will begin with pilot decision making for the general aviation pilot, followed by a description of human factors, the nature and sources of human error, sleep and the role it plays in the body's functions, fitness and how it affects your performance, a review of vision and its associated illusions, motivation, communications, attitudes in aviation, training and training devices, displays and controls, cockpit layout and finishing with the cabin and its payload.

II. LEARNING OUTCOMES AND ELEMENTS OF THE PERFORMANCE:

Upon successful completion of this course the student will demonstrate the ability to:

- Describe the development of human factors in aviation.

Potential Elements of the Performance:

- role of human factors in aircraft accidents in recent years
- historical perspective on the development of human factors
- meaning of human factors

- 2. Describe the man-environment interfaces of the SHEL conceptual model.

Potential Elements of the Performance:

- the meaning of each letter of the SHEL conceptual model
- characteristics of liveware
- the associated scientific disciplines of the characteristics of liveware
- interfaces of the SHEL model

- 3. Describe and employ all aspects of the pilot decision making process.

Potential Elements of the Performance:

- how we make decisions
- information processing, types of decisions, human errors

- strategies to maintain situational awareness, how to reverse a negative trend
 - risk management
4. Describe the nature of error.
- Potential Elements of the Performance:
- normal distribution of human errors
 - accident proneness
5. Identify the sources of error.
- Potential Elements of the Performance:
- mismatches between the SHEL components
 - liveware errors during information processing
 - role of motivation in performance
 - role of arousal and alertness in performance
 - factors affecting the decision making process
 - eye witness errors
6. Identify errors, classify errors and propose mitigations to reduce errors.
- Potential Elements of the Performance:
- four ways to classify errors
 - differences between humans and machines performing tasks
 - error reduction
7. Describe the role of fatigue, body rhythms, and sleep in flight performance.
- Potential Elements of the Performance:
- effect of jet lag and fatigue on performance
 - role of body rhythms on performance
 - types of sleep
 - role of sleep and effects on performance
 - insomnia and sleep drugs
8. Be knowledgeable about the occurrence of incapacitation and explain the relationship between physical fitness, mental fitness and performance.
- Potential Elements of the Performance:
- total and partial incapacitation
 - benefits of physical fitness
 - effects of smoking, drugs and alcohol on physical fitness and ultimately flight safety

- stress
- importance of diet

9. Explain how the eye functions and its role in perception

Potential Elements of the Performance:

- measurement of light
- terms and functions of the eye
- visual perception
- blind spots
- depth and distance perception
- effects of hypoxia and smoking

10. Know when and why visual illusions occur

Potential Elements of the Performance:

- optical illusions
- depth and distance illusions
- sensory illusions
- categorize illusions according to phase of flight
- minimizing your susceptibility to illusions
- meaning of design eye reference

11. Describe the role of motivation in our ability to perform

Potential Elements of the Performance:

- human behavior in accident investigation
- definition of motivation
- theories of motivation
- influencing motivation

12. Explain the meaning, qualities and role of leadership

Potential Elements of the Performance:

- role of a leader
- characteristics and tasks of a leader

13. Describe communication in terms of how information is exchanged, types, intelligibility, characteristics and barriers

Potential Elements of the Performance:

- define communication
- types of communication

- elements of communication
 - factors which make words more understandable (intelligible)
 - the influence that expectation can have on the meaning of the message
 - parts of the vocal and auditory system
 - factors affecting hearing
14. Differentiate between personality, attitudes, beliefs and opinions; explain the influences on attitudes, changing attitudes and why safety doesn't sell.

Potential Elements of the Performance:

- personality, attitudes, beliefs and opinions in aviation
 - nature, function and measurement of attitudes
 - group influences on attitudes
 - attitude survey, hazardous attitudes, changing attitudes
 - selling safety
15. Explain how we learn, the process that is involved and examples of training aids and devices.

Potential Elements of the Performance:

- define education, training and skills
 - the cycle of training
 - the learning process
 - training aids and training equipment
16. Describe the links between the learning process and documentation (manuals, checklists, charts).

Potential Elements of the Performance:

- meaning of documentation
 - language, layout and text of effective documentation
 - application of human factors on charts and maps
17. Understand the use and limitations of displays and warnings

Potential Elements of the Performance:

- historical development of cockpit displays and controls
- the SHELL interface between liveware and hardware
- design aspects of displays; including classifications, markings, presentations, CRT's and HUD
- fail-passive and fail operational concepts in automatic landing systems

- warning, alert and advisory systems

18. Recognize the importance of and/or the deficiency in the type and location of controls

Potential Elements of the Performance:

- functions of controls
- design principles for cockpit controls
- keyboard layout and flight deck applications
- use of autopilots

19. Appreciate and understand the challenges in flight deck design and space utilization

Potential Elements of the Performance:

- application of human factors in usage of space
- anthropometry and biomechanics
- fitting the human into the design and space available
- making the design functional and comfortable

20. Develop both an awareness and an appreciation for the challenges in the passenger cabin

Potential Elements of the Performance:

- human factors applied in the cabin design
- emergencies
- cabin environment

21. Interface between people

Potential Elements of the Performance:

- communications in the cabin and the cockpit
- dealing with passengers – intoxication and fears
- crash statistics
- hijacking

22. Be knowledgeable about human factors and understand how to apply them in the aviation environment

Potential Elements of the Performance:

- qualifications for human factors specialist
- human factors training
- aim of crew resource management
- application of human factors in design and its incorporation into company culture

III. TOPICS:

- Chapter 1: Background to Human Factors
- Chapter 2: The SHEL Conceptual Model
- Chapter 3: Pilot Decision Making
- Chapter 4: The Nature of Error
- Chapter 5: Sources of Error
- Chapter 6: Error Classification and Reduction
- Chapter 7: Fatigue, Body Rhythms
- Chapter 8: Fitness and Performance
- Chapter 9: Vision
- Chapter 10: Visual Illusions
- Chapter 11: Motivation and Safety
- Chapter 12: Communication
- Chapter 13: Attitudes and Persuasion
- Chapter 14: Training and Training Devices
- Chapter 15: Documentation
- Chapter 16: Displays
- Chapter 17: Controls
- Chapter 18: Space and Design
- Chapter 19: Human Factors in the Cabin
- Chapter 20: Interface Between People
- Chapter 21: Further Education and Human Factors Applications

IV. REQUIRED RESOURCES/TEXTS/MATERIALS:

1. Human Factors in Flight – Frank H Hawkins
2. Human Factors in Flight – Workbook – Craig S Funk

V. OTHER RESOURCES/TEXTS/MATERIALS:

3. From the Ground Up
- Chapter 22: A.I.P. – aeronautical information publication
 - Chapter 23: Basic Flight Physiology – Richard O Reinhart (Second Edition) McGraw - Hill ISBN # 0-07-052223-5
 - Chapter 24: Human Factors for General Aviation – Stanley Trollip & Richard Jensen Jeppesen Sanderson ISBN # 0-88487-138-X
 - Chapter 25: Aviation Safety Programs – Jeppesen Sanderson ISBN # 0-88487-236-X
 - Chapter 26: Human Factors in Aviation – Earl L Wiener, David C Nagel
 - Chapter 27: Pilot Judgement and Crew Resource Management – Richard S Jensen
 - Chapter 28: Human Factors in Multi Crew Operations – Harry W Orlady
 - Chapter 29: Flight Safety – A Primer for General Aviation Pilots Alexander T Wells

Chapter 30: Human Factors for Aviation – Basic Handbook - Transport Canada

Chapter 31: Pilot – Mental and Physical Performance David C Edwards

Chapter 32: Beyond Aviation Safety Human Factorsv – Daniel E Maurino, James Reason, Neil Johnston, Rob B Lee

Chapter 33: Flightdeck Performance – Stanley Roscoe

Chapter 34: Redefining Airmanship – Tony Kern

Chapter 35: Flight Discipline – Tony Kern

Internet Access

<http://www.psy.utexas.edu/psy/helmreich/nasaut.htm>

<http://www.hf.faa.gov/>

<http://www.crm-devel.org/resources/human.htm>

http://flightsafety.org/human_factors.html

<http://www.tc.gc.ca/aviation/general/human/litrev/hfflt1e.htm>

VI. EVALUATION PROCESS/GRADING SYSTEM:

The student will be assessed by a combination of attendance and department, quizzes, tests and a final exam. Weighting of each will be as follows: 30% for quizzes, 30% for all tests prior to the final exam and 40% for the final exam. A minimum mark of 70% is required to pass the course. Make-up tests are not permitted except in accordance with section VI of this outline.

- Unexcused absences will result in 2% deduction of the final mark for each occurrence, arriving for class late will result in a 1% deduction of the final mark for each occurrence, and violations of the dress code will result in a 1% deduction of the final mark for each occurrence. Refer to the SOP GEN 1.3 for dress code policies and SOP GEN 1.6.7 for policy regarding absence from classes
- Quizzes will be given without prior notice.
- If it is necessary to write a second final exam in order to pass the course, the highest grade achievable will be a "C". (See make-up policy in section VI)
- Students may request a deferment of a test for compassionate reasons. Compassionate Grounds for deferment will include but not be limited to death of an immediate family member, personal illness, or recent diagnosis of a serious illness of a family member. **Make-ups will not be permitted after the fact for compassionate reasons.**
- **"F" grades in any subject at the end of a semester will result in termination from the Aviation program.**

- Although attitude, co-operation, etc., are not graded, students may be terminated based on their performance in this area (see section VI). These attributes are also considered in the selection of the Air Canada Award and other scholarships.
- Dates of tests will be announced at least 1 week in advance.
- A classroom code of conduct can be found in the SOP General section, and will be adhered to.

The following semester grades will be assigned to students in this course:

<u>Grade</u>	<u>Definition</u>	<u>Grade Point Equivalent</u>
A+	90 -100%	4.00
A	80 - 89%	3.00
B	70 - 79%	2.00
C	assigned if a make-up exam was required to complete the course	2.00
F (Fail)	below 70%	0.00
X	A temporary grade limited to situations with extenuating circumstances giving a student additional time to complete the requirements for a course.	
NR	Grade not reported to Registrar's office.	
W	Student has withdrawn from the course without academic penalty.	

VII. SPECIAL NOTES:

Attitude and Conduct

Attitude plays an important role in your ability to exercise good judgement. Although attitude is not being graded, it affects your ability to learn as well as your safety as a student and future as a professional pilot. Students who display a strong tendency towards any of the five hazardous attitudes pose a grave risk to themselves and others. For this reason, students exhibiting one or several hazardous attitudes will be counselled and if necessary, will be put on a behavioural contract. If this is ineffective in modifying unacceptable behaviour, then the student will be withdrawn from the program.

The five hazardous attitudes are identified as Anti-authority, Impulsivity, Invulnerability, Machismo, and Resignation. These hazardous attitudes are described in "Human Factors for Aviation – Basic Handbook" on pages 151 and 152.

Make-up Policy

- No make-ups on tests occurring prior to final exams.

- No make-ups on quizzes.
- If the final grade achieved for this course is less than 70%, a second final exam may be written at the discretion of the professor for this course. The second exam will be averaged with the first exam to determine the resulting exam mark, and the final grade will then be calculated.
- In the event that a second final exam is required, the highest achievable overall grade for this course will be a C
- Any student that requires 100% or greater on a make-up exam to pass the course will not be allowed to write a make-up exam.

Special Needs:

If you are a student with special needs (e.g. physical limitations, visual impairments, hearing impairments, or learning disabilities), you are encouraged to discuss required accommodations with your instructor and/or the Special Needs office. Visit Room E1204 or call Extension 493, 717, or 491 so that support services can be arranged for you.

Retention of course outlines:

It is the responsibility of the student to retain all course outlines for possible future use in acquiring advanced standing at other postsecondary institutions.

Plagiarism:

Students should refer to the definition of “academic dishonesty” in *Student Rights and Responsibilities*. Students who engage in “academic dishonesty” will receive an automatic failure for that submission and/or such other penalty, up to and including expulsion from the course/program, as may be decided by the professor/dean. In order to protect students from inadvertent plagiarism, to protect the copyright of the material referenced, and to credit the author of the material, it is the policy of the department to employ a documentation format for referencing source material.

Course outline amendments:

The Professor reserves the right to change the information contained in this course outline depending on the needs of the learner and the availability of resources.

Substitute course information is available in the Registrar's office.

VIII. PRIOR LEARNING ASSESSMENT:

Students who wish to apply for advanced credit in the course should consult the professor. Credit for prior learning will be given upon successful completion of a challenge exam or portfolio.

IX. DIRECT CREDIT TRANSFERS:

Students who wish to apply for direct credit transfer (advanced standing) should obtain a direct credit transfer form from the Dean's secretary. Students will be required to provide a transcript and course outline related to the course in question.