Appendix 1 to Chapter 4
HUMAN FACTORS CHECKLISTS

The sample checklists which form this Appendix are based on checklists used by three different ICAO States. Although each checklist reflects a different approach to the investigation of Human Factors, all three have the goal of assisting the investigator to identify the relevant factors and focus analysis on germane issues. Any one, or even all three, may be adapted for use by the investigator.

CHECKLIST A

To determine the relevant areas warranting further Human Factors investigation/analysis, rate the importance of each factor by indicating the appropriate weighting value beside each item.

0 = Not contributory
1 = Possibly contributory
2 = Probably contributory
3 = Evidence of hazard

BEHAVIOURAL FACTORS

A. Faulty planning (pre-flight, in-flight) _____
B. Haste (hurried departure, etc.) _____
C. Pressing the weather _____
D. boredom, inattention, distraction _____
E. Personal problems (familial, professional, financial) _____
F. Overconfidence, excessive motivation ("get-home"itis) _____
G. Lack of confidence _____
H. Apprehension/panic _____
I. Violation of flight discipline (risk-taking) _____
J. Error in judgement _____
K. Delay _____
L. Complacency, lack of motivation, etc. _____
M. Interpersonal tension _____
N. Inadequate stress coping _____
O. Drug abuse _____
P. Alcohol/hangover _____
Q. Personality, moods, character _____
R. Memory mindset (expectancy) _____
S. Habit patterns _____
T. Perceptions or illusions _____
U. Bush pilot syndrome _____

MEDICAL FACTORS

A. Physical attributes, conditioning and general health _____
B. Sensory acuity (vision, hearing, smell, etc.) _____
C. Fatigue _____
D. Sleep deprivation _____
E. Circadian disrhythmia (jet lag) _____
F. Nutritional factors (missed meals, food poisoning, etc) _____
G. Medication(s) (self-prescribed) _____
H. Medication(s) (doctor-prescribed) _____
I. Drug/alcohol ingestion _____
J. Altered consciousness _____
K. Reaction time or temporal distortions _____
L. Hypoxia, hyperventilation, etc. _____
M. Disbarisms, trapped gases, etc. _____
N. Decompression _____
O. Motion sickness _____
P. Disorientation, vertigo _____

Q. Visual illusions _____

R. Stress _____

S. Hypothermia/hyperthermia _____

T. Other acute illness(es) _____

U. Pre-existing disease(s) _____

OPERATIONAL FACTORS

A. Personnel selection _____

B. Limited experience _____

C. Inadequate transition training _____

D. Lack of currency/proficiency _____

E. Inadequate knowledge of A/C systems _____

F. Inadequate knowledge of A/C life support systems _____

G. Company policies and procedures _____

H. Supervision _____

I. Command and control relationships _____

J. Company operating pressures _____

K. Crew compatibility _____

L. Crew training (e.g. cockpit resource management) _____

M. Inadequate flight information (A/C manuals, flight planning, etc.) _____

TASK-RELATED FACTORS

A. Tasking information (briefing, etc.) _____

B. Task components (number, duration, etc.) _____

C. Workload tempo _____

D. Workload saturation _____

E. Supervisory surveillance of operation _____

F. Judgement and decision-making _____

G. Situational awareness _____

H. Distractions _____

I. Short-term memory _____

J. False hypotheses (vs. expectancy, habit, etc.) _____

K. Cockpit resource management _____

EQUIPMENT DESIGN FACTORS

A. Design/location of instruments, controls _____

B. Lighting _____

C. Workspace incompatibility _____

D. Anthropometric incompatibility _____

E. Confusion of controls, switches, etc. _____

F. Misread instruments _____

G. Visual restrictions due to structure _____

H. Task oversaturation (complex steps) _____

I. Inadvertent operation _____

J. Cockpit standardization (lack of) _____

K. Personal equipment interference _____

L. In-flight life support equipment _____

M. Effects of automation _____

N. Seat design/configuration _____

O. Aerodrome design and layout _____

P. Conspicuity of other aircraft, vehicles etc. _____

ENVIRONMENTAL FACTORS

A. Weather _____

B. Air turbulence _____

C. Illusions (white-out, black hole, etc.) _____

D. Visibility restriction (glare, etc.) _____

E. Work area lighting _____

F. Noise _____

G. Acceleration/deceleration forces _____

H. Decompression _____

I. Vibration _____

J. Heat/cold _____

K. Windblast _____

L. Motion (dutch roll, snaking, etc.) _____

M. Smoke, fumes in cockpit _____

N. Oxygen contamination _____

O. CO poisoning or other toxic chemicals _____

P. Radiation _____

Q. Electrical shock _____

R. Flicker vertigo _____

S. Air Traffic Control _____

INFORMATION TRANSFER FACTORS

A. Adequacy of written materials (availability, understandability, currency, etc.) _____

B. Misinterpretation of oral communications _____

C. Language barrier _____

D. Noise interference _____

E. Disrupted oral communication _____

F. Intra-crew co-ordination _____

G. Crew/ATS communication _____

H. Timeliness/accuracy of verbal communications _____

I. Cockpit crew non-verbal communications _____

J. Cockpit warnings, horns, chimes, etc. _____

K. Cockpit instrument displays1 _____

L. Airport signals, marking and lighting _____

M. Ground/hand signals _____

OTHER PERSONNEL FACTORS

Air Traffic Control

A. Attention (vigilance, forgetfulness, etc.) _____

B. Fatigue vs workload _____

C. Communications (phraseology, rate of speech, pronunciation etc.) _____

D. Working environment (lighting, noise, visibility, etc.) _____

E. Equipment/display layout and design _____

F. Judgement _____

G. Training and currency _____

H. Co-ordination and back-ups _____

I. Supervisory presence _____

J. ATC policies and operating procedures _____

Vehicle Operators

K. Selection and training _____

L. Working environment (noise, fatigue, visibility, etc.) _____

M. Command and control, supervision _____

Aircraft Line-Servicing Personnel

N. Selection and training _____

O. Availability of relevant information _____

P. Operating pressures _____

Q. Supervision _____

SURVIVABILITY FACTORS

A. Crashworthiness of design _____

B. Post-accident life support equipment (exits, chutes, life vests, ELTs, medical kits, etc.) _____

C. Command and control procedures _____

D. Crew training _____

E. Passenger briefings and demos _____

B. CHECKLIST BASED ON THE SHEL MODEL

FACTORS RELATING TO THE INDIVIDUAL (LIVEWARE)

1. PHYSICAL FACTORS

Physical characteristics
- * height, weight, age, sex
- * build, sitting height, functional reach, leg length, shoulder width
- * strength, co-ordination

Sensory limitations

Vision
- * visual threshold
- * visual acuity (seeing details)
- * focus time
- * light adaptation
- * peripheral vision
- * speed, depth perception
- * empty field myopia
- * glasses, contacts

Others
- auditory threshold, understanding
- vestibular (ear senses)
- smell, touch
- kinaesthetic (body feelings)
- g-tolerances

2. PHYSIOLOGICAL FACTORS

Nutritional factors
- food intake 24 hours
- hours since last meal
- dehydration
- on a diet/weight loss

Health
- disease
- fitness
- pain
- dental conditions
- blood donation
- obesity, pregnancy
- stress coping (emotional/ behavioral signs)
- smoker

Lifestyle
- friendships
- relations with others
- change in activities
- life habits

Fatigue
- acute (short term)
- chronic (long term)
- skill (due to task)
- activity level (mental/physical)

Duty
- duration of flight
- duty hours
- leave periods — activities

Sleep
- crew rest, nap duration
- sleep deficit, disruption
- circadian disrythmia (jet lag)

Drugs
- medication over the counter
- medication — prescription
- illicit drugs
- cigarettes, coffee, others

Alcohol
- impairment
- hangover
- addiction

Incapacitation
- carbon monoxide poisoning
- hypoxia/anoxia
- hyperventilation
- loss of consciousness
- motion sickness
- food poisoning
- nauseating fumes
- toxic fumes
- others

Decompression/diving
- decompression
- trapped gas effects
- underwater diving

Illusions

Vestibular
- somatogyral (vertigo)
- somatogravic
- the leans
- coriolis illusion
- elevator illusion
- giant hand

Visual
- black hole
- autokinesis
- horizontal misplacement
- circularvection
- linearvection
- landing illusions
- chain-link fence illusion
- flicker vertigo
- geometric perspective illusion

3. PSYCHOLOGICAL FACTORS

Perceptions

Types
- non perception
- misperception
- delayed perception

Reaction time
- to detect
- to make an appropriate decision
- to take the appropriate action

Disorientation
- situational awareness
- spatial
- visual
- temporal
- geographic (lost)

Attention
- attention span
- inattention (general, selective)
- distraction (internal, external)
- channelized attention
- fascination, fixation
- vigilance, boredom, monotony
- habit pattern interference
- habit pattern substitution
- time distortion

Information Processing
- mental capacity
- decision making (delayed, poor)
- judgment (delayed, poor)
- memory capacity
- forgetting
- co-ordination — timing

Workload
- task saturation
- underload
- prioritization
- task components

Experience/recency
- in position
- in aircraft type, total time
- on instruments
- on route, aerodrome
- night time
- emergency procedures

Knowledge
- competence
- skills/techniques
- airmanship
- procedures

Training
- initial
- * on the job
- ground
- * flight
- * transition, learning transfer
- * recurrent
- * problem areas
- * emergency procedures

Planning
- pre-flight
- * in flight

Attitudes/moods
- * mood
- * motivation
- * habituation
- * attitude
- * boredom
- complacency
- *Expectations*
  - * mind set/expectancy
  - * false hypothesis
  - * "get-home"itis
  - * risk-taking
- *Confidence*
  - * in aircraft
  - * in equipment
  - * in self
  - * overconfidence, showing off

Mental/emotional State
- * emotional state
- * anxiety
- * apprehension
- * panic
- * arousal level/reactions
- * self-induced mental pressure/stress

Personality
- * withdrawn, grouchy, inflexible
- * hostile, sarcastic, negative
- * aggressive, assertive, impulsive
- * excitable, careless, immature
- risk taker, insecure, follower
- * **disorganized, late, messy**
- * **anti-authoritative,resigned**
- * **invulnerable, "macho"**

4. PSYCHOSOCIAL FACTORS

- * mental pressure
- * interpersonal conflict
- * personal loss
- * financial problems
- * significant lifestyle changes
- * family pressure

FACTORS RELATED TO INDIVIDUALS AND THEIR WORK

1. LIVEWARE-LIVEWARE (HUMAN-HUMAN) INTERFACE

Oral communication
- * noise interference
- * misinterpretation
- * phraseology (operational)
- * content, rate of speech
- * language barrier
- * readback/hearback

Visual signals
- * ground/hand signals
- * body language

Crew interactions
- supervision
- * briefings
- co-ordination
- compatibility/pairing
- * resource management
- * task assignment
- * age, personality, experience

Controllers
- * supervision
- * briefing
- * co-ordination

Passengers
- * behaviour
- * briefing
- * knowledge of aircraft, procedures

WORKER-MANAGEMENT

Personnel
- * recruitment/selection
- * staffing requirements
- * training
- policies
- * remuneration/incentives
- * crew pairing, scheduling
- * seniority
- * resource allocation
- * operational support/control
- * instructions/directions/orders
- * managerial operating pressure

Supervision
- * operational supervision
- quality control
- * standards

Labour relations
- employee/employee-management
- * industrial action
- * unions/professional group

Pressures
- mental pressure — operational
- morale
- peer pressure

Regulatory agency
- * standards
- * regulations
- * implementation
- audit
- inspection
- monitoring
- * surveillance

2. LIVEWARE-HARDWARE (HUMAN-MACHINE) INTERFACE

Equipment
- *Switches, controls, displays*
  - * instrument/controls design

* instrument/controls location
* instrument/controls movement
* colours, markings, illumination
* confusion, standardization

Workspace
* workspace layout
* workspace standardization
* communication equipment
* eye reference position
* seat design
restrictions to movement
* illumination level
* motor workload
* information displays
* visibility restrictions
* alerting and warnings
* personal equipment interference
(comfort)
* data link
* operation of instruments
(finger trouble)

3. LIVEWARE-SOFTWARE (HUMAN-SYSTEM) INTERFACE

Written information
* manuals
* checklists
* publications
* regulations
* maps and charts
* NOTAMs
* standard operating procedures
* signage
directives

Computers
computer software
user friendliness

Automation
operator workload
* monitoring task
* task saturation
* situational awareness
* skill maintenance
utilization

Regulatory requirements
qualification — in position
qualification — in management
certification
* medical certificate
* licence/rating
* non-compliance
* infraction history

4. LIVEWARE-ENVIRONMENT (HUMAN-ENVIRONMENT) INTERFACE

INTERNAL
* heat, cold, humidity
* ambient pressure
* illumination, glare
* acceleration
* noise interference
* vibrations
* air quality, pollution, fumes
* ozone, radiations

EXTERNAL

Weather
* weather briefing, FSS facilities
* weather: actual and forecasts
* weather visibility, ceiling
* turbulence (wind, mechanic)
* whiteout

Other factors
* time of day
* lighting/glare
other air traffic
* wind blast
* terrain/water features obstacles

Infrastructure

Dispatch facilities
type of facilities
* use
* quality of service

At the gate
APU
* towing equipment
* refuelling equipment
* support equipment

Aerodrome
* runway/taxiway characteristics
* markings, lighting, obstructions
* approach aids
* emergency equipment
* radar facilities
* ATC facilities
* FSS, weather facilities
* airfield facilities

Maintenance
* support equipment
* availability of parts
* operational standards,
procedures and practices
* quality assurance practices
* servicing and inspection
* training
* documentation requirements

CHECKLIST C — SELECTION, TRAINING AND EXPERIENCE

INTRODUCTION

The purpose of this checklist on selection, training and experience for human factors aspects of accident investigation is to assist the investigator during the field phase in developing a comprehensive factual base on the pilot selection, training and experience issues relevant to the specific accident under investigation.

An effort has been made to present the checklist in a generic format so that investigators can apply it to any modality by substituting "air traffic controller", "mechanic", etc., for "pilot", as appropriate. However, since most accidents are by nature unique and diverse, some degree of discretion will be required to tailor the checklist to particular cases. In this way, the checklist is a dynamic tool, to be modified and updated with use over time.

A. SELECTION

1) When was the pilot selected for this position?

2) How was the pilot selected?

   a) What were the required qualifications? (e.g. experience, education, training and physiological/medical requirements)

   b) Were any examinations required? What? When taken?

   c) What special licences were required?

   d) Were the pilot's qualifications, references and licenses verified by his/her employer prior to selection for employment?

3) Was specific training on this position provided to the pilot before he was selected for it? If yes,

   a) Describe the content of the training.

   b) When was this training?

   c) Who provided this training?

4) Was specific training on this position provided to the pilot after he was selected for it? If yes,

   a) Describe its content.

   b) When was this training given?

   c) Who provided this training?

5) Where any problems ever noted with the pilot's performance after he assumed the duties of this position? If yes,

   a) describe the problems.

   b) When were these observations made?

   c) Who made these observations?

   d) What actions, if any, were taken to correct the problems?

B. PILOT EXPERIENCE

1) What other experience has the pilot had using this specific equipment?

2) What other jobs has the pilot had using other equipment in this modality?

3) What is the total length of time the pilot has worked in this modality?

4) How long has the pilot worked for this specific employer?

5) How long did the pilot work for his previous employers?

6) Was the pilot's previous experience verified by his/her current employer?

7) Has the pilot ever been involved in any other accidents in this modality? If yes,

   a) Describe the circumstances.

   b) When?

   c) What equipment was in use?

8) Has the pilot ever been involved in any other accidents in other modalities? If yes,

   a) Describe the circumstances.

   b) When?

   c) What equipment was in use?

9) Has the pilot ever complained about or reported any problems related to the use of this specific equipment? If yes,

   a) Describe the nature of the complaints or report.

   b) When?

   c) Were any corrective action made? By whom? When?

   d) Have any other similar complaints or reports ever been made? Provide details.

C. PILOT TRAINING

The investigator should review (requesting copies when applicable) training-related records, documents, rule books, manuals, bulletins and pilot examinations.

1) What training has the pilot received on the use of equipment in this modality?

   a) Describe the training: classroom? simulator? on-the-job-training (OJT)? materials used? topics?

   b) When did the pilot receive it?

   c) Who were the instructors and/or supervisors?

   d) How was the pilot's performance evaluated (e.g. check ride, on the road, simulation, paper and pencil examination)?

   e) What was the over-all evaluation of the pilot's performance?

   f) Were any problems noted in the pilot's performance? If yes,

      — What were they?

      — How were they noted and by whom?

      — What corrective actions were taken, if any?

2) Initial training vs. follow-on training using this specific equipment:

   a) Has the pilot received training on this equipment from more than one employer? If yes,

      — Which employer provided the initial training?

      — When?

      — How much emphasis was placed on:

         — compliance with Standard Operating Procedures (SOPs)

         — compliance with rules and requirements?

         — use of performance evaluations (e.g. check rides, examinations)?

b) How does the pilot's initial training differ from any follow-on or subsequent training in terms of the following:

— Compliance with SOPs?

— Compliance with rules and regulations?

— Use of performance evaluations (e.g. check rides, examinations)?

c) Do any of these differences appear related to the mishaps?

— Did the pilot violate any SOPs he had been taught? If yes,

— What were they?

— When were they taught?

— Did the pilot violate any rules or requirements he had been taught? If yes,

— What were they?

— When were they taught?

— Has the pilot ever violated any rules, requirements, or SOPs before? If yes,

— What were the circumstances?

— What actions were taken?

— Has the pilot received any new, recent training that may have:

— Interfered with his knowledge and skills in using this equipment?

— Required his use of new, different SOPs under emergency conditions?

3) Other training issues:

a) Has the pilot received any recent training for:

— Transition to operation of different equipment in this modality?

— Learning different operations of similar equipment systems?

b) If the pilot has received any recent transition and/or differences training:

— Describe when and type.

— Check potential interference from this training with operation of accident equipment.

c) Is the pilot current in all areas of accident equipment operation?

— Describe areas lacking currency.

— Describe required exams, certificates or licenses indicating full currency.

d) Rate sufficiency of training on:

— Emergency situations.

— Equipment malfunctions.

— Maintenance reports, complaint procedures, logs.

— Crew interaction and coordination skills.

— Degraded conditions (e.g. reduced visibility, high sea state, gusty or high winds, heavy precipitation).

— Communication procedures.

— Physiological requirements (e.g. issues related to rest, health, nutrition and use of medication, drugs and alcohol).

e) If simulators or training device were used for training:

— What specific training was provided in the simulator or training device?

— What are the major similarities and/or differences between the simulator or training device and the actual equipment?

— How recent was the training with the simulator or training device?

— Were any problem areas noted in the pilot's performance?

f) Did the pilot receive training specifically related to the conditions of the mishap (e.g. wind-shear, equipment, malfunction, specific type of emergency, specific weather conditions)? If yes,

— Describe when and type.

— How did the pilot perform in training?

g) Was the pilot providing or receiving training at the time of the mishap? If yes,

— Describe the circumstances in detail.

— Determine the qualifications of instructor(s) and/or trainee(s) involved.

— When did this training begin and how long had it been in progress?