Arousal and Stress

Arousal is one of the physiological responses to stress.

Only an optimum level of arousal has positive influence on performance.

Both over and under arousal will reduce performance.

Thus the effect of stress on human performance is often measured through arousal.

The arousal mechanism is part of the autonomic nervous system.

Autonomic Nervous System (ANS)

ANS controls the involuntary activities of the body e.g. beating of the heart.

It has two sub systems: Sympathetic and Parasympathetic nervous systems.

Sympathetic and Parasympathetic nervous systems work in opposition to each other to produce a balanced response.

E.g. In response to exercise, sympathetic nervous system will increase heart rate whereas parasympathetic system will reduce it to cope with oxygen demand.

The two systems will reach a balance where increase oxygen demand is matched by increased volume of blood being pumped by the heart.

This balance achieved by interplay of the two systems is known as homeostasis.

Sympathetic nervous system is responsible for increasing arousal.

Parasympathetic nervous system is responsible for reducing arousal.

Fight or Flight Reflex

When confronted with a threatening situation the ANS automatically prepares the body for instant physical action.

Noticeable symptoms include:

- Increased heart rate
- Increased respiration rate
- Tense muscles
- Reduced saliva production
- Blood diverted to brain

This response from the ANS is part of the general adaption syndrome.
**General Adaption Syndrome**

Following three responses are collectively known as "General Adaption Syndrome":

1) Alarm Reaction

2) Resistance

3) Exhaustion

1) **Alarm Reaction:**

These are the physiological changes of "Fight or Flight Reflex" and prepare the body either to face the threat and fight, or to run away.

In either case, intense physical activity is anticipated.

2) **Resistance:**

This stage of response is reached when the source of stress is not removed from the body.

Parasympathetic system initiates recovery from the initial reaction.

There is a reduction in physical symptoms.

However there is an increase in hormonal activity and glucose production.

Blood sugar levels slowly normalize when source of stress is removed.

3) **Exhaustion:**

This stage of response is reached when the source of stress is still present in the body.

Brain overrides the body's natural physiological urge to return to normality.

Thus the production of an excited response continues.

There is using up of body resources.

Blood sugar levels drops.

This stage causes physiological disorders like hypertension, heart disease, asthma and ulcers.

**The Ideal Level of Stress**

A moderate amount of stress makes us feel excited, sharp and alert for the challenge. It focusses attention and increases vigilance.

A complete absence of stress (underload) is undesirable because it can be harmful.

High levels of stress can lead to anxiety and a reduction in performance. Anxiety affects
Prolonged exposure to a stressful stimulus can lead to physical illness.

**Causes of Stress**

Stress is a heightened state of arousal caused by stressors in the environment.

Stressors can be any event or situation that induces stress.

Stressors can be:

1) Physical: e.g. Uncomfortable environment (too hot, too cold, noise, vibration etc.).

2) Psychological.

Psychological stressors can be further divided into two types:

a) Domestic Stress: e.g. Bereavement. Death of spouse creates the highest level of stress.

b) Occupational Stress: Main cause of stress for airline pilots e.g. Lack of control and disruption to routine rostering causing disruption to their lives.

Both good things and bad things cause stress. Only bad events, however, are perceived as stressful.

Environmental stress caused by excessive heat, noise, vibration and low humidity can result in reduced resistance to other stressors.

e.g. Crew subjected to continuous noise and vibration is less likely to perform well in a subsequent emergency.

**Anxiety and Disorders**

Stress may also be caused by irrational fears.

Generalised Anxiety Disorder: Inconstant tension and worry for no rational reason.

Obsessive-Compulsive Disorders: When individuals are obsessed with (for example) their work and allow few intrusions. In a flight deck scenario this could be

a pilot who checks the flight plan, met and other documentation more than required or is necessary.

Phobic Disorders: Irrational fears e.g. claustrophobia (fear of enclosed spaces), acrophobia (fear of heights) etc.

**Response to Stress**

Individuals respond to stress in different ways.

e.g. Transitioning to new equipment.
Some feel the stress and some do not.

It depends upon the individual’s internal perceptions about their ability to deal with the situation. Individuals evaluate both the stressor and their perceived ability to deal with it. If an individual perceives that he is unable to deal with the situation he will experience a high stress level. If an individual perceives that the situation is within his capabilities he will experience little or no stress.

**Stress Evaluation and Feedback**

If an under confident person makes a negative evaluation of a task ahead he will become highly stressed. If the stress level does not adversely affect the performance, the feedback system will subsequently allow him to realise that he is up to the demands of the job and stress will consequently diminish.

The evaluation process is constantly modified with experience. Consequently, the same individual may not be as stressful in future to the same stressor as he was before.

**Effects of Stress**

Effects of stress can be classified as:

- **Physiological:**
  a) Short-term effects of acute stress:
     - Increased heart rate
     - Increased blood pressure
     - Perspiration
     - Flushed skin
     - Dilated pupils
     - Fast breathing
  b) Long-term effects of chronic stress:
     - Ulcers
     - Heart disease
Physical illness stemming from psychological causes is known psychosomatic illness.

- **Behavioural:**
  
The immediate behavioural response to stress includes:
  
  - Restlessness.
  - Nervousness.
  - Trembling.
  - Excitability or anxiety.
  
  Further effects can include loss of appetite and excessive drinking and smoking (psychological stress reactions).

- **Cognitive:**
  
  Stress can affect the brain's ability to process information. Symptoms include:
  
  - Forgetfulness.
  - Inability to concentrate.
  - Poor attention.
  - Inability to make decisions and prioritise.
  - Difficulty in relaxing or switching off.

- **Personality:**
  
  Chronic stress can lead to temporary (but long-lasting) changes in personality. Individuals can become:
  
  - Depressed.
  - Moody.
  - Permanently anxious.
  - Tired.
  - Tense.
  - Tearful
  - Irritable
Stress is a cumulative effect.

A combination of domestic stress and pressure at work can accumulate to the point where an individual is overloaded with stress.

Under extreme conditions this can result in "mental breakdown".

Highly stressed individuals become more accident-prone as they reach their "break point".

**Coping with Stress**

Coping is the process of identifying the cause of stress and then either adjusting or removing oneself from the stressful situation altogether.

Some methods for coping are useful and positive while others are unhealthy and hazardous.

Coping strategies can be divided into three categories:

1) **Action Coping:**

   Individual takes positive action to cope with the source of stress e.g.
   
   - Removing oneself from the problem (ejecting from a burning aircraft or not turning up for work which is an extreme form of coping).
   
   - Addressing the problem (carrying out the fire drill).
   
   - Altering the situation so that demands are less burdensome (refusing to agree to the new rostering arrangement).

   **Common theme in all these approaches is that the individual is reducing the size of the Actual Demand.**

2) **Cognitive Coping:**

   It involves reducing the Perceived Demand and thereby reducing the psychological impact of the stressor.

   The healthy method involves rationalising the problem to bolster one's confidence e.g. "Yes I can do this – it's not as difficult as it seems". Advice or counselling can help in rationalising problems.

   The unhealthy method involves denial, where the individual completely ignores the problems. In aviation circumstances this occasionally occurs when an individual is already heavily overloaded.

3) **Symptom-Directed Coping:**

   It involves treating the symptoms rather than the cause of stress.

   e.g. use of alcohol, drugs or tobacco to reduce the psychological stress.

   A healthier alternative would be to dissipate the stress through physical exercise and/or mediation
techniques.

**Stress Management**

Fitness Programmes: Regular exercise.

Relaxation Techniques: Meditation, breathing exercises.

Counselling: Seeking advice of a good friend or colleague.

**Fatigue**

Fatigue is a term used to describe everything from a state of mental exhaustion to physical tiredness resulting from exercise.

**Causes of fatigue:**

- Inadequate Rest: commonly refer to as tiredness.
- Disruption of Circadian Rhythm: Commonly known as jet lag.
- Excessive Muscular Activity: It is physical tiredness felt after physical activity.
- Excessive Cognitive Work: Mental tiredness or exhaustion following a prolonged period of mental workload.
- Environmental Factors: Low humidity, vibration and noise.

**Types of Fatigue:**

(1) Chronic Fatigue:
- Extends over a long period.
- It can be due to continuous strain because of domestic pressure or an underlying disease.
- Often has a psychological cause.
- It can cause physical disorders e.g. intestinal problems, general aches and pains.
- It can cause emotional illness.

(2) Acute Fatigue:

It is weariness felt after excitement, lack of sleep, effects of unusually loud noise or after a period of strenuous activity.

Usually short lived.

Relaxing or sleeping is the cure.
Fatigue in Aviation

Both chronic and acute fatigue cause a significant decrease in performance. Some effects are:

- Reduced ability in calculation tasks.
- Reduce vigilance.
- Mood changes.
- Behaviour changes.
- Reduced motivation.
- Poor self-monitoring leading to lack of awareness of deteriorating performance.

These symptoms can appear even following relatively small disturbances in sleep patterns.

Fatigue Management

The major source of fatigue for pilots is sleep loss or disturbance of the circadian rhythm.

Short nap while on task may not be a good technique as performance decreases for as long as 20 minutes after a quick nap.

However this has to be balanced against the possible decrease in performance that would occur if a nap wasn't taken.

Intelligent and sensitive rostering is the most important factor in combating fatigue.

Since pilot has little influence over rostering, fatigue management involves delaying of the fatigue onset.

Some useful techniques are:

- Undisturbed sleep before a flight.
- Eat and drink in moderation before sleep. Avoid alcohol and caffeine.
- Stretching exercises and chatting during cruise.
- Caffeine increases alertness but its diuretic effect is unwelcome in a low humidity environment.
- Bright light helps to re-adjust body’s circadian rhythm.