

Introduction

The Dirty Dozen refers to twelve of the most common human error preconditions, or conditions that can act as precursors, to accidents or incidents. These twelve elements influence people to make mistakes. The Dirty Dozen is a concept developed by Gordon Dupont, in 1993, whilst he was working for Transport Canada, and formed part of an elementary training programme for Human Performance in Maintenance. It has since become a cornerstone of Human Factors in Maintenance training courses worldwide, as exemplified in UKCAA CAP715[1].. The Dirty Dozen is not a comprehensive list of human error accident precursors, for example, ICAO Circular 240-AN/144[2] lists over 300 human error precursors. However, since 1993 all areas of the aviation industry, not just aircraft maintenance, have found the Dirty Dozen a useful introduction to open discussions into human error in their businesses, organisations and workplaces. So, it may be possible to find Dirty Dozen lists for pilots, ramp workers, air traffic controllers and cabin crew.

1 .Countermeasures

Whilst The Dirty Dozen list of human factors has increased awareness of how humans can contribute towards accidents and incidents, the aim of the concept was to focus attention and resources towards reducing and capturing human error. Therefore, for each element on The Dirty Dozen list there are examples of typical countermeasures designed to reduce the possibility of any human error from causing a problem.

2. Lack of communication

Poor communication often appears at the top of contributing and causal factors in accident reports, and is therefore one of the most critical human factor elements. Communication refers to the transmitter and the receiver, as well as the method of transmission. Transmitted instructions may be unclear or inaccessible. The receiver may make assumptions about the meaning of these instructions, and the transmitter may assume that the message has been received and understood. With verbal communication it is common that only 30% of a message is received and understood.. Detailed information must be passed before, during and after any task, and especially across the handover of shifts. Therefore, when messages are complex they should be written down, and organisations should encourage full use of logbooks, worksheets, and checklists etc. Verbal messages can be kept short, with the most critical elements emphasised at the beginning and repeated at the end. Assumptions should be avoided and opportunities for asking questions both given and taken.

3. Complacency

Complacency can be described as a feeling of self-satisfaction accompanied by a loss of awareness of potential dangers. Such a feeling often arises when conducting routine activities that have become habitual and which may be "considered", by an individual (sometimes by the whole organisation), as easy and safe. A general relaxation of vigilance results and important signals will be missed, with the individual only seeing what he, or she, expects to see. Complacency can also occur following a highly intense activity such as recovering from a possible disaster; the relief felt at the time can result in physical relaxation and reduced mental vigilance and awareness. This particular psychological experience is referred to as a Lacuna.. Whilst too much pressure and demand causes over-stress and reduced human performance, too little results in under-stress, boredom, complacency and reduced human performance. It is therefore important, when conducting simple, routine and habitual tasks, and when fatigued, to maintain an adequate, or optimum, level of stress through different stimulation. Always expect to find a fault! Following written instructions, and adhering to procedures that increase vigilance, such as inspection routines, can provide suitable stimulus. It is important to avoid: working from memory; assuming that something is ok when you haven't checked it; and, signing off work that you are unsure has been completed. Teamwork and mutual cross-checking will provide adequate stimulus when fatigued..

4. Lack of knowledge

The regulatory requirements for training and qualification can be comprehensive, and organisations are forced to strictly enforce these requirements. However, lack of on-the-job experience and specific knowledge can lead workers into misjudging situations and making unsafe decisions. Aircraft systems are so complex and integrated that it is nearly impossible to perform many tasks without substantial technical training, current relevant experience and adequate reference documents. Furthermore, systems and procedures can change substantially and employees' knowledge can quickly become out-of-date.. It is important for employees to undertake continuing professional development and for the most experienced workers to share their knowledge with colleagues. Part of this learning process should include the latest knowledge on human error and performance. It should not be a taken as a sign of weakness to ask someone for help or for information; in fact this should be encouraged. Checklists and publications should always be referred to and followed, and never make assumptions or work from memory.

5. Distraction

Distraction could be anything that draws a person's attention away from the task on which they are employed. Some distractions in the workplace are unavoidable, such as loud noises, requests for assistance or advice, and day-to-day safety problems that require immediate solving. Other distractions can be avoided, or delayed until more appropriate times, such as messages from home, management decisions concerning non-immediate work (e.g. shift patterns, leave entitlement, meeting dates, administrative tasks etc), and social conversations.. Psychologists say that distraction is the number one cause of forgetting things: hence the need to avoid becoming distracted and to avoid distracting others. Humans tend to think ahead. Thus, when returning to a task, following a distraction, we have a tendency to think we are further ahead than we actually are.

To reduce errors from distraction it is best to complete a task before responding. If the task cannot be completed without hurrying, then we can prominently mark (or, "lock off") the incomplete work as a reminder to ourselves and anyone else who may complete the work. When returning to work, after being distracted, it is a good idea to commence at least three steps back, so that we re-trace some steps before picking up the task again. If necessary, having someone else double-check our work using a checklist may be appropriate and useful.. Management have a role to play in reducing the distractions placed on their employees. This may involve good workspace design, management of the environment, and procedures that create "safety zones", "circles of safety" or "do not disturb areas" around workers engaged in critical tasks.

7. Lack of teamwork

In aviation many tasks and operations are team affairs; no single person (or organisation) can be responsible for the safe outcomes of all tasks. However, if someone is not contributing to the team effort, this can lead to unsafe outcomes. This means that workers must rely on colleagues and other outside agencies, as well as give others their support. Teamwork consists of many skills that each team member will need to prove their competence.

Some of the key teamwork skills include: leadership, followership, effective communication, trust building, motivation of self and others, and praise giving.

To create an effective team it is necessary that the following issues, as appropriate, are discussed, clarified, agreed, and understood by all team members:

- A clearly defined and maintained aim, or goal(s)
- Each team member's roles and responsibilities
- Communication messages and methods

7. Lack of teamwork (cont)

- Limitations and boundaries
 - Emergency procedures
 - Individual expectations and concerns
 - What defines a successful outcome
 - Debriefing arrangements
 - Team dismissal arrangements
 - Opportunities for questions and clarification
- A team's effectiveness can also be improved through the selection of team members to reflect a broad range of experience and skill sets, and also through practice and rehearsal.

8. Fatigue

Fatigue is a natural physiological reaction to prolonged physical and/or mental stress. We can become fatigued following long periods of work and also following periods of hard work. When fatigue becomes a chronic condition it may require medical attention but, workers should never self-medicate! As we become more fatigued our ability to concentrate, remember and make decisions reduces. Therefore, we are more easily distracted and we lose situational awareness. Fatigue will also affect a person's mood, often making them more withdrawn, but sometimes more irrational and angry.. It is a human problem that we tend to underestimate our level of fatigue and overestimate our ability to cope with it. Therefore, it is important that workers are aware of the signs and symptoms of fatigue – in themselves and others. Fatigue self-management involves a three-sided programme of regular sleep, healthy diet (including reduced use of alcohol and other drugs), and exercise. Work of a critical and complex nature should not be programmed during the low point on the body's circadian rhythm (usually 03:00 – 05:00am); and, when fatigued always get someone else to check your work..

9. Lack of resources

If all the parts are not available to complete a maintenance task, then there may be pressure on a technician to complete the task using old, or inappropriate parts. Regardless of the task, resources also include personnel, time, data, tools, skill, experience and knowledge etc. A lack of any of these resources can interfere with one's ability to complete a task. It may also be the case that the resources available, including support, are of a low quality or inadequate for the task.

9. Lack of resources (cont)

When the proper resources are available, and to hand, there is a greater chance that we will complete a task more effectively, correctly and efficiently. Therefore, forward planning to acquire, store and locate resources is essential. It will also be necessary to properly maintain the resources that are available; this includes the humans in the organisation as well.

10. Pressure

Pressure is to be expected when working in a dynamic environment. However, when the pressure to meet a deadline interferes with our ability to complete tasks correctly, then it has become too much. It is the old argument of Quantity versus Quality; and in aviation we should never knowingly reduce the quality of our work. Pressure can be created by lack of resources, especially time; and also from our own inability to cope with a situation. We may come under direct, or indirect, pressure from the Company, from clients and even our colleagues. However, one of the most common sources of pressure is ourselves. We put pressure on ourselves by taking on more work than we can handle, especially other people's problems, by trying to save face, and by positively promoting super powers that we do not possess. These poor judgements are often the result of making assumptions about what is expected of us.. Learning assertiveness skills will allow a worker to say 'No', 'Stop!', and communicate concerns with colleagues, customers and the Company. These skills are essential, and when deadlines are critical, then extra resources and help should always be obtained to ensure the task is completed to the required level of quality.

11. Lack of assertiveness

Being both unable to express our concerns and not allowing other to express their concerns creates ineffective communications and damages teamwork. Unassertive team members can be forced to go with a majority decision, even when they believe it is wrong and dangerous to do so.

Assertiveness is a communication and behavioural style that allows us to express feelings, opinions, concerns, beliefs and needs in a positive and productive manner. When we are assertive we also invite and allow others to assert themselves without feeling threatened, undermined or that we've lost face. Speaking one's mind assertively is not to be confused with aggression. It is about communicating directly, but honestly and appropriately; giving respect to the opinions and needs of others, but not compromising our own standards..

11. Lack of assertiveness (cont)

Assertiveness techniques can be learnt and they focus on keeping calm, being rational, using specific examples rather than generalisations, and inviting feedback. Most importantly, any criticisms should be directed at actions and their consequences rather than people and their personalities; this allows others to maintain their dignity, and a productive conclusion to be reached.

Stress

There are many types of stress. Typically in the aviation environment there are two distinct types - acute and chronic. Acute stress arises from real-time demands placed on our senses, mental processing and physical body; such as dealing with an emergency, or working under time pressure with inadequate resources. Chronic stress is accumulated and results from long-term demands placed on the physiology by life's demands, such as family relations, finances, illness, bereavement, divorce, or even winning the lottery. When we suffer stress from these persistent and long-term life events, it can mean our threshold of reaction to demands and pressure at work can be lowered. Thus at work, we may overreact inappropriately, too often and too easily.. The situation of stress arising from lack of stimulation at work has been covered above under Complacency above.

Some early visible signs of stress include changes in personality and moods, errors of judgement, lack of concentration and poor memory. Individuals may notice difficulty in sleeping and an increase in fatigue, as well as digestive problems. Longer-term signs of stress include susceptibility to infections, increased use of stimulants and self-medication, absence from work, illness and depression.

It is important to recognise the early signs of stress and to determine whether it is acute or chronic. Coping with daily demands at work can be achieved with simple breathing and relaxation techniques. However, perhaps more effective is having channels of communication readily available through which to discuss the issue and help to rationalise perceptions. It is entirely appropriate that some of these channels involve social interaction with peers. As with fatigue, sleep, diet and exercise are all important factors in helping to reduce stress and build resilience to stressors. If the stress is chronic, then definite lifestyle changes will be required; this must be achieved with support from the Company. Companies ought therefore, to have employee assistance (or wellbeing) policies that include stress reduction programmes..

11. Lack of awareness

Working in isolation and only considering one's own responsibilities can lead to tunnel vision; a partial view, and a lack of awareness of the affect our actions can have on others and the wider task. Such lack of awareness may also result from other human factors, such as stress, fatigue, pressure and distraction.

It is important to build experience throughout our careers, especially concerning the roles and responsibilities of those we work with, and our own place in the wider Team. Developing our foresight is essential in pre-empting the affects our actions may have on others. This is an attitude of professionalism and involves constant questioning "what if ...?" Asking others to check our work and challenge our decisions is useful in gaining the relevant experience and expanding our awareness. Vigilance is closely related to situational awareness, and workplace procedures, such as scanning, two-way communication and use of checklists will help to maintain vigilance..

12. Norms

Workplace practices develop over time, through experience, and often under the influence of a specific workplace culture. These practices can be both, good and bad, safe and unsafe; they are referred to as "the way we do things round here" and become Norms. Unfortunately such practices follow unwritten rules or behaviours, which deviate from the required rules, procedures and instructions. These Norms can then be enforced through peer pressure and force of habit. It is important to understand that most Norms have not been designed to meet all circumstances, and therefore are not adequately tested against potential threats.. Rules and procedures should have been designed and tested, and therefore ought to be enforced and followed rigorously. Where workers feel pressure to deviate from a procedure, or work around it, then this information should be fed back so that the procedure can be reviewed and amended, if necessary. Developing assertiveness can allow workers to express their concerns about unsafe Norms, despite peer pressure.

