

4.0 QANTAS ENGINEERING & MAINTENANCE HUMAN FACTORS: THE H.E.A.R. PROGRAMME (HUMAN ERROR AND ACCIDENT REDUCTION)

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BACKGROUND

The Qantas E&M Human Factors Program commenced in February 1995 as the result of several ongoing repeat incidents that had occurred over the previous twelve months. A pro-active result of this was the bringing together of seven Aircraft Maintenance Engineers from the aircraft 'frontline' sections to be formed as a Human Factors Steering Group. The 'frontline' areas were defined as: Brisbane (BNE) Domestic Terminal; Sydney (SYD) Domestic Terminal, International Terminal, Heavy Maintenance, Minor Maintenance; Melbourne (MEL) International Terminal, Heavy Maintenance. Group members were from Mechanical (Airframe/Engine) or Avionic (Electrical/Instrument/Radio) Trades and are classified as Aircraft Maintenance Engineer (AME), Licensed Aircraft Maintenance Engineer (LAME), Senior LAME (Senior Licensed Aircraft Maintenance Engineer), or Maintenance Supervisor with an experience level between eight and 30 years.

The group has the guidance and support of a 'Patron' (General Manager Line Maintenance Operations) together with the full backing of the Executive General Manager, Engineering & Maintenance.

The group was to be largely autonomous in nature in terms of direction or scope of projects with minimal Management direction other than to 'find ways and means to help our people do their work better' and to 'find out what prevents our people doing their work.'

To this end the Qantas Engineering and Maintenance Human Factors Group differs greatly from other airlines' Human Factors Groups in that the highest rank of anybody within the group is that of Maintenance Supervisor, and thus the Qantas Human Factors Group is governed by a philosophy of 'by the engineers for the engineers.'

Following various training sessions and an introduction to the principles of Human Factors, the group was left to 'get on with it.' This consisted mainly of reading voluminous amounts of material and various HF meetings proceedings, so that group members could become familiar with the subject.

Within a short time an acronym was chosen to help identify the programme. The acronym chosen was the H.E.A.R. Program, being **H**uman **E**rror and **A**ccident **R**eduction, which, after all is what the basic underlying principles of Human Factors are all about.

The group generally holds meetings of 1 or 2 days duration every 3 - 4 weeks to co-ordinate and plan their work and strategy.

As a foundation stone of Human Factors is to share knowledge, two members of the H.E.A.R. Group undertook a study tour of the British Airways Human Factors Program spending time both at Heathrow and BAMC (Cardiff). H.E.A.R. Group members have also attended various conferences such as the [IATA](#) 1995 Aircraft Maintenance Seminar and Exhibition held in Sydney, NSW, Australia; the 10th Annual FAA Human Factors Conference held in Alexandria, Va. USA in 1996 and the Australasian Airlines Ground Safety Conference in Sydney, NSW, Australia in 1996.

CURRENT PROJECTS

To continue the 'shop floor' based approach two members of the group developed and now present a Human Factors package to Qantas' apprentices whereby the apprentices are encouraged to express their concerns openly. The importance and the relevance of Human Factors as pertaining to them is explained. Apprentice numbers are approximately 300 in Sydney and 90 in Melbourne.

In November and December of 1995 several of the H.E.A.R. Group members conducted a tour of all Australian bases so that [E&M](#) frontline staff would receive the same information on Human Factors and the H.E.A.R. Program. By this method of being visible and as well as being peers, it seems that the H.E.A.R. Program is having some success. A similar tour for 1997 is currently being planned, however, the focus this time will be on the Managers and Senior [LAMEs](#) to create a desire for the need of consideration and implementation of Human Factors within their work environment.

To date the H.E.A.R. Group has carried out several projects, not only to establish a 'feel' for Human Factors within Qantas [E&M](#), but also to assist the staff. Projects include:

1. [NASA](#)/University of Texas Management Attitudes Survey (adapted for Qantas [E&M](#)) so that a 'base line' could be established
2. Representation at the 10th Annual [FAA](#) Human Factors conference
3. Apprentice Training Package
4. Investigation of Aircraft Cannibalization Methods and a proposed new format
5. Investigation of current [ETOPS](#) Maintenance Procedures and development and presentation of a reworked package
6. Investigation of current Accident/Incident Investigation procedures and development and presentation of a reworked package;
7. Development of a Heavy Maintenance Shift Handover package - written and oral
8. Identifying areas that prevent 'frontline people' from doing their job and informing those areas of their responsibilities under the auspices of the '[SHEL](#)' model
9. Development of Staff Induction Programmes (for existing staff when transferring to different areas e.g., MEL International Terminal to Domestic Terminal, etc.)

The members of the [H.E.A.R.](#) Program realized quite early on that Human Factors is not an exact science or an instant fix; and consequently it would be a big ask to expect an instant embracing of HF principles by all the staff. A long term approach would undoubtedly be the most successful one. Of course there are the doubting Thomases, but the H.E.A.R. Group has been able to 'get some runs on the board early' with several issues and the majority of people can see that we are not a threat; essentially we are asking the engineers to help themselves.

A PLACE FOR MANAGEMENT?

While this philosophy is no doubt most successful, so far as many of the issues the [H.E.A.R.](#) Group have addressed have in fact been raised by the work force in general. It was also seen that unless Management felt the desire or a need to look at Human Factors issues within their portfolios, the entire program could soon collapse. To this end the H.E.A.R. Group members presented a paper on a modified version of Gordon DuPont's 'Dirty Dozen' to Senior E&M Management. This modified version is known within Qantas E&M as 'The 12 E.R.C's (Error Reducing Conditions)([Appendix A](#)). An accompaniment to this paper was an area self assessment form for each Manager known as 'The [H.E.A.R.T.](#) (Human Error and Accident Reduction Trend) Survey' whereby Managers are asked to address the appropriate E.R.C. that scored low on a scale of 1 to 10 ([Appendix B](#)). To date this has raised eyebrows amongst our E&M Managers and the response from them has been positive.

MEASURING SUCCESS

The Qantas [E&M](#) Human Factors Program, although in its early stages, is considered to be a successful initiative to date. By their very nature, engineers, and particularly Australian engineers, are a cynical lot and are quite unforgiving if the promised goods are not delivered. The [H.E.A.R.](#) Program was received as 'another' process team trying to change the climate of the place. However, in this instance the make-up and self autonomy of the group has been a masterstroke as far as Qantas engineers are concerned. As mentioned previously the H.E.A.R. Program has been able to get some 'runs on the board' viz: Cannibalization Procedures, [ETOPS](#) Procedures, involvement in accident/incident investigations. This has been successful in giving the group valuable credibility as these initiatives and involvements have been the ideas of the 'people.' The engineers are now also pleased to see that Management is becoming involved at the direction of the H.E.A.R. Program and not the other way around.

CONCLUSION

The concept of Human Factors within Qantas is not a new idea. In fact the Flight Operations Department has had Human Factors as part of the curriculum for Flight Crews in excess of 30 years and for Cabin Crew for approximately five years in the form of [C.R.M.](#)

Like most other organizations, the idea of Human Factors for [E&M](#) staff is quite a recent one and although the approach Qantas has taken differs from just about everybody else, we feel it is the best one for them and their people. Australians have a culture of questioning (probably from our convict past) and are always concerned that anything new represents worthwhile change and value. At this time it can be argued that given recent past successes and support the [H.E.A.R.](#) Program will be given at least equal time to the existing Flight Crew Human Factors Program.

Perhaps it is our motto which best describes our approach: 'If you're not part of the solution, then you're part of the problem' which not only emphasizes the importance of peoples actions, but also their inactions.

APPENDICIES

Appendix A

[H.E.A.R.](#) PROGRAMME.

IMPROVING SAFETY HEALTH IN [E&M](#).

In 1995 Qantas formed H.E.A.R. (Human Error and Accident Reduction). Made up of a group of engineers coming from departments that represent the last barrier of defense against the 'human factor', their task was to eliminate the results of human failure - accidents and incidents.

[E&M](#)s response to incidents and accidents is exemplary. Great effort goes into 'getting it right' so as the same mistake is never made again. Procedures are improved and responsible individuals who fall victim to human fallibility are treated fairly and become central to an energetic awareness program. Problem solved? Not really! The reality is that [E&M](#) is reacting to random events due to random causes. Given that the reactive process is handled well it is timely that a proactive process is introduced to complement it. The proactive process against human errors would be of:

- identification of the type of errors;
- the measurement of how bad the problems are; and
- the targeting of remedial action.

The proactive process will improve what James Reason calls 'Safety Health'. That is our organizational resistance to human failure. The immediate challenge is to establish how healthy we are. We need to do the equivalent of 'having a check-up' in the same way as we would go to a doctor.

If incidents and accidents are the result of active and organizational latent failures, then good safety health is the result of the elimination of those failures before the event.

It is argued that [E&M](#) would do well to focus on twelve (12) main error reducing conditions (ERCs).

1. EFFECTIVE COMMUNICATIONS.

Communication is more than telling someone something. It involves the transfer of information and understanding from one person to another. It is successful only when it is understood by the receiver in the way the sender intended.

2. CAREFULNESS.

That quality that makes up good 'airmanship' Taking pains, fussing over, attentiveness, diligence and cautiousness. These things eliminate complacency.

3. KNOWLEDGE AND EXPERIENCE.

There is the need to ensure that the correct person is assigned to a task. We need to ensure that those who don't know 'how' are learning.

4. VIGILANCE.

Where concentration is totally focused. Distraction is either eliminated or is effectively managed.

5. EFFECTIVE STRESS MANAGEMENT.

Stress is a reaction to physical or psychological tension. The reaction needs to be managed.

6. CONTINUOUS QUESTIONING OF HOW WE DO THINGS.

We have some good norms and some bad. Some have originated as a result of previous incidents. Their application may still be effective or may not. We need to eliminate the bad ones and look to make new good ones.

7. EFFECTIVE TEAMWORK.

Teams need to be coordinated with each team member knowing their role and trusting other team members. Effective teams are higher achievers than individuals and less likely to make errors than bad teams or individuals.

8. PHYSICAL & MENTAL ALERTNESS.

An exhausted person has the equivalent performance of a drunk.

9. NECESSARY RESOURCES.

Without the necessary resources, additional pressure is applied to a situation.

10. EFFECTIVE MANAGEMENT OF EXTERNALLY IMPOSED PRESSURE.

This is an issue for supervision. If allowed to break through the supervision defense barrier stress is allowed to develop in an individual.

11. ASSERTIVENESS.

Engineers are the last defense against organizational failure. If an organizational failure or error has penetrated all other defense barriers and is identified by an engineer he needs assertiveness skills to enunciate the problem. Particularly a problem with those who feel vulnerable: Apprentices; Junior Tradesmen and new employees. [CRM](#) for junior [QF](#) pilots has proved helpful when flying with cranky old pilots. [E&M](#) has a few cranky old engineers. Strategies need to be developed to take the bark out of cranky old engineers; and ones that don't encourage middle order engineers to become cranky old engineers.

12. SITUATIONAL AWARENESS.

In knowing what is going on in a given situation and being able to project what may happen if nothing is done about it. Historically a problem for [E&M](#) when things are about to move.

e.g.:

- an aircraft is about to be towed into a hangar and contacting docking; or amongst light poles.
- functionals where thrust reversers, landing gears and flight controls are moved whilst other maintenance is still being performed.

[E&Ms](#) performance is currently measured against the parameters of profit, costs (particularly equipment and aircraft damage) and schedule. E&M needs to include the 12 error reducing conditions (ERCs) in our measured parameters. It then needs to respond to the weak areas. The response will be more important than the act of measurement or the size of the problem.

[HEAR](#) proposes that a manager of a department and his 'key people' would regularly ask of themselves how their department rated with respect to the 12 [ERCs](#). Say a score of 0 - 10. Recent past big and little incidents and near misses should be a reference.

THE PRO'S.

[HEAR](#) has successfully raised a profile and have had reasonable success in convincing engineers that they are vulnerable to human factors. This is an approach from beneath which is ingenious by design. Inviting active management participation complements this with an approach from above. Change is perceived as painful and is only ever implemented by active intervention. Measuring the problem generates the NEED.

When a given department analyses their results they:

- accept that **THEY** have a problem of defined magnitude;
- accept **OWNERSHIP** of their problem; and
- originate **STRATEGIES** that suit local needs.

Subsequent incidents when analyzed for human factors elements of the 12 [ERCs](#) can be compared with the ratings they gave their department. This highlights any subjectivity error. It also removes the reward for rating the department higher than the reality.

Whilst [H.E.A.R.](#) encourages engineers to accept their vulnerability to human factors and adopt recommended strategies to combat them, there is a reluctance to do this. Principally among them is that they feel they may be ignored or reprimanded for chasing a goal that may be in conflict with our current goals of cost, profit and schedule. Even if it is not, they would be operating in a manner perhaps different to their peers. In short, they need to be rewarded in knowing that despite these barriers that they face that their 1st level management will appreciate their efforts. For the same reasons the managers efforts will not be transparent and he will be more inclined to chase those goals.

THE CONS.

The ratings scores are highly subjective. For this reason the 'panel of key people' should be cycled frequently. This would also help to spread the ownership of the problem. Individual managers may feel threatened by comparison between departments.

In an effort to totally take out the subjectivity of the ratings, we could end up with a cumbersome document.

A poor score for a department may reflect unfairly on the manager. What should reflect on the manager is his management of the given identified weakness areas.

Matt Wright.
John Fitzpatrick.
[HEAR](#) Program.
November 1996.

Appendix B

HEAR PROGRAMME.

H.E.A.R.T. SURVEY.

(Human Error & Accident Reduction Trends.)

DEPARTMENTAL SELF - ASSESSMENT.

A departmental self-assessment of the 12 Error Reducing Conditions (ERCs).

Note: When rating: '1' is lowest, '10' is highest.

1. EFFECTIVE COMMUNICATIONS.

Communication is more than telling someone something. It involves the transfer of information and understanding from one person to another. It is successful only when it is understood by the receiver in the way the sender intended.

Rating: 1 2 3 4 5 6 7 8 9 10.

2. CAREFULNESS.

That quality that makes up good 'airmanship'. Taking pains, fussing over, attentiveness, diligence and cautiousness. These things eliminate complacency.

Rating: 1 2 3 4 5 6 7 8 9 10.

3. KNOWLEDGE AND EXPERIENCE.

There is the need to ensure that the correct person is assigned to a task. We need to ensure that those who don't know 'how' are learning.

Rating: 1 2 3 4 5 6 7 8 9 10.

4. VIGILANCE.

Where concentration is totally focussed. Defocused is eliminated or is effectively managed.

Rating: 1 2 3 4 5 6 7 8 9 10.

5. EFFECTIVE STRESS MANAGEMENT.

Stress is a reaction to physical or psychological tension. The reaction needs to be managed.

Rating: 1 2 3 4 5 6 7 8 9 10.

6. CONTINUOUS QUESTIONING OF HOW WE DO THINGS.

We have some good norms and some bad. Some have originated as a result of previous incidents. Their application may be still effective or may not. We need to eliminate the bad ones and look to make new good ones.

Rating: 1 2 3 4 5 6 7 8 9 10.

7. EFFECTIVE TEAMWORK.

Teams need to be coordinated with each team member knowing their role and trusting other team members. Effective teams are higher achievers than individuals and less likely to make errors than bad teams or individuals.

Rating: 1 2 3 4 5 6 7 8 9 10.

8. PHYSICAL AND MENTAL ALERTNESS.

An exhausted person has the equivalent performance of a drunk.

Rating: 1 2 3 4 5 6 7 8 9 10.

9. NECESSARY RESOURCES.

Without the necessary resources, additional pressure is applied to a situation.

Rating: 1 2 3 4 5 6 7 8 9 10.

10. EFFECTIVE TEAM MANAGEMENT OF EXTERNALLY IMPOSED PRESSURE.

This is an issue for supervision. If allowed to break through the supervision defense barrier, stress is allowed to develop in an individual.

Rating: 1 2 3 4 5 6 7 8 9 10.

11. ASSERTIVENESS.

Engineers are the last defense against organizational failure. If an organizational failure or error has penetrated all other defense barriers and is identified by an engineer, he needs assertiveness skills to enunciate the problem. Particularly a problem for those who feel vulnerable. Strategies need to be developed to take the 'bark' out of cranky old engineers and ones that don't encourage middle order engineers to become cranky old engineers.

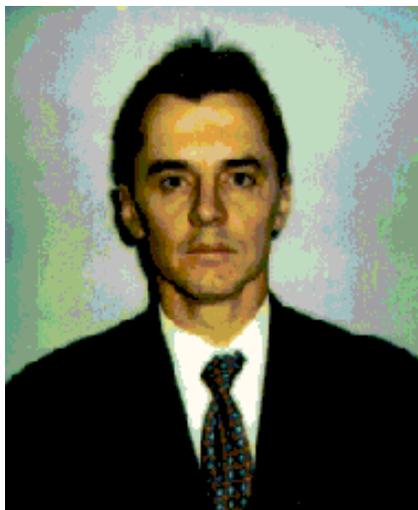
Rating: 1 2 3 4 5 6 7 8 9 10.

12. SITUATIONAL AWARENESS.

The ability to be aware of what is happening around you and what will be the end result of any action you may take.

Rating: 1 2 3 4 5 6 7 8 9 10.

MR. JOHN FITZPATRICK



John is a Justice of the Peace (JP) and is currently employed in the Heavy Maintenance Department in Sydney as a Senior [LAME](#). John commenced his career with Qantas as an apprentice in 1976 and after qualifying as an [AME](#) has successfully advanced to his current position. John holds mechanical licenses on the B747 Series, B747-400 and B767 Series as applicable to the Qantas fleet.

As well as being involved in the [H.E.A.R.](#) Program from its inception John is involved in various other projects such as: Occupational Health and Safety Representative; Member of Qantas Jet Base Occupational Health And Safety Committee; Member Qantas Aircraft Recovery Team (Airmash); Member of Qantas Sydney Hazardous Materials Committee. John has also worked as a Technical Representative in Australian and Overseas Ports. John is continuing in his studies to obtain an MBA and in 1997 is commencing a Graduate Diploma in Aviation Human Factors.



Matthew is currently employed in the Line Maintenance Department at Melbourne (MEL) International Airport as an [LAME](#). Matthew began his career with Qantas as an apprentice in 1984 and transferred to the Line Maintenance Department in Melbourne in 1987. Matthew holds mechanical licenses on the B747 Series, B747-400 and B767 Series as applicable to the Qantas fleet. Matthew also holds limited Avionic licenses on the aforementioned aircraft types.

Matthew has been a member of the [H.E.A.R.](#) Program since its inception.
