

6.0 HUMAN FACTORS IN MAINTENANCE

A REGULATORY VIEWPOINT

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The purpose of this short presentation is to provide you with an understanding of the [CAA](#) perspective of human factors in aircraft maintenance. Why we consider it to be important, what we are doing now and what we see happening in the future. To do this it is best if we go back to 1988, the start of human factors in aircraft maintenance for many of us.

The Aloha accident in April of that year shook and concerned us all. The human factors elements in the [NTSB](#) report were not overlooked by the [CAA](#) but we had not experienced anything similar ourselves and hence had no reason to believe that a similar situation could happen here. However, in June 1990 we had our own maintenance mishap which this time came very close to home. A BAC 1-11 windshield was incorrectly installed and blew out at 17,000 feet under cabin pressurization loads. The accident investigators, for the first time I believe, made a serious attempt to determine not just what had occurred but why it occurred, in terms of human performance and contributing factors. The CAA reaction at the time was to explain the event in terms of probability, similar to that used in aircraft type certification and [JAR/FAR 25.1309](#) criteria.

Data supplied by the [CAA](#) Economic Regulation Group and the Safety Data Analysis Unit revealed that during the period 1982 to 1991 just over 11 million flying hours were accrued by aircraft greater than 5700 kgs and 1270 Mandatory Occurrence Reports (MOR) involving maintenance human error were recorded. 230 of these events manifested themselves in the form of an aircraft operational event. It was determined that, when considering the number of maintenance actions that must have been performed, maintenance human error did not pose a significant risk to the traveling public.

Since 1990 we have learned a lot. Not least that statistics can be misleading and can provide comfort when perhaps they should not. In 1993 and again in 1995 UK operators experienced two further maintenance mishaps that by good fortune did not result in any loss of life, but it could easily have been a different story.

So it was from early 1994 when the Air Accidents Investigation Branch (AAIB) published their A320 report that the [CAA](#) and UK industry really started their efforts to address human factors in maintenance. During the period 1993 to 1997 the CAA strategy was to monitor the research activities being performed in America and encourage the UK industry to apply good human factors principles, particularly the training of engineering staff in human factors awareness.

The United Kingdom Operators Technical Group (UKOTG) established a Human Factors Working Group in April 1995 and quickly produced a report which stated amongst other things their desire to implement human factors training. To assist them in meeting this goal the [CAA](#) arranged and sponsored Transport Canada to come over and show them what such training comprised of and how it could be delivered effectively. This met with some success in that a few maintenance organizations started to conduct awareness training, but not nearly enough as we would have liked.

In 1995 and again in 1997 the [CAA](#) analyzed its Mandatory Occurrence database looking for maintenance errors. We had now experienced three potential accidents directly attributable to maintenance and our perception of a worsening trend was confirmed.

As mentioned previously, during the nine year period 1982 to 1991 we had received 230 reports of maintenance related human error that had an operational effect on aircraft above 5700kgs. Between 1992 and 1994 we had exactly the same number of reports, 230, only this time it was of course only a two year period. The following two year period 1995 to 1996 showed the trend steeply rising as 534 reports were received.

This startling trend could not readily be explained by the increase in the UK fleet which has grown over the period. We had to conclude that a once stable system of maintenance had now been disrupted and more maintenance errors were genuinely occurring.

I would like us all to think about today's maintenance environment and how it has changed over the last five years. It is now an extremely competitive market place. Competition and the need to make a profit is not new, but the methods by which we achieve this have changed significantly.

Business consultant gurus such as Tom Peters and Michael Hammer told us all in the late 80's that we must radically re-write the way we do business if we are to survive, let alone make a profit. This message hit home in the early 90's and we started to see Chief Executives appointed to Boards, fired with enthusiasm for these progressive business processes. Whilst these processes undoubtedly make for a more efficient and dynamic organization they have been imported from industries which are not safety dependent. The conventional processes and culture were in fact developed over a long period from lessons learned, often hard lessons. When mistakes were made the system was modified or hardened to prevent recurrence. This may very well have made for inefficiencies but it did ensure that the needs of airworthiness and safety were retained. We must remember that the risks that IBM or Hewlett-Packard takes are predominantly commercial but in aviation we have to consider safety alongside the hungry needs of the shareholders. Following the road map used by other industries will ensure that the minimum [JAA](#) requirements are met, as they are necessary for the business, but compliance alone does not ensure that an organization is intrinsically safe.

It is often quoted during error investigation that commercial pressure was the cause or at least a contributing factor. Is this true? Is commercial pressure a cause, or an effect. I believe that it is an effect. Frequently an effect of the new business processes such as Business Process Reengineering (BPR), Total Quality Management, Outsourcing, Performance Based Rewards, Self Managed Teams etc. etc. It is apparent to me that we need to consider organizational dynamics far more than we do now and consider just how they impact safety, culture and shape human behavior in the workplace. I am prepared to predict that in five years time the term organizational factors will feature more heavily than human factors at our symposia.

It is now almost universally accepted that an increase in the frequency of fatal accidents would result in a loss of public confidence in the air transport system. The [CAA](#) is therefore committed to ensuring that the frequency of fatal accidents does not increase in line with the predicted growth in air traffic. This is the major challenge we and industry face, particularly so when set against the current dynamic, complex maintenance environment and the increasing number of human errors.

Two things have therefore shaped our current strategy regarding human factors in maintenance. Firstly, our resources are finite and we need to focus on the areas of risk. With 70 - 80% of accidents attributable to human error, human and organizational factors are going to give us the most return in terms of improved safety. Secondly, we have set ourselves an objective to develop safety improvement concepts and a safety improvement action plan in partnership with industry to ensure that the frequency of fatal accidents does not increase. The following points summarize how we intend to achieve this.

- Ensure that the maintenance related requirements are adequately human centered
- Promote a global approach to human factors
- Ensure that the UK maintenance community have the necessary knowledge and skills relating to human performance
- Identify best practices and facilitate adoption in industry and [CAA](#)
- Identify the areas of error which form the major contribution to accidents
- Require the adoption of Safety Management Systems by industry
- Develop a [CAA](#) human factors data collection and analysis system
- Identify and focus on areas of risk
- Develop a safety partnership relationship between industry and [CAA](#)

The CAA has embarked on a number of initiatives in the last 12 months. Multi-functional teams have been set up to look at human centered design, human factors within the Safety Regulation Group, and Safety Management Systems.

At the request of the [CAA](#) the [JAA](#) has conducted a review of the maintenance related requirements to determine if they are adequately human centered. This has now been completed and the CAA is participating in the group established to work the recommendations and produce enhanced requirements.

A confidential reporting program has been available to pilots and air traffic controllers for many years. In order to increase our understanding of human and organizational factors in maintenance we have, from June last year, extended the Confidential Human Incident Reporting Program (CHIRP) to include Licensed Aircraft Maintenance Engineers and approved maintenance organizations.

Clearly the subject of human factors is not going to go away. Enhanced aircraft technology may provide some more improvements in safety but whilst the maintenance system is dependent upon people performing tasks, mistakes will continue to occur. Our mission is to ensure that those involved in maintaining aircraft are skilled and well educated about human factors and that the application of good human factors principles make the necessary improvements in safety our industry needs and society demands.