

# 13.0 THE INTRODUCTION IN THE ROYAL AIR FORCE OF SELF-SUPERVISION PROCEDURES IN AIRCRAFT MAINTENANCE

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## BACKGROUND

Although relatively small when compared with the [USAF](#) which is the world's most powerful air force by far, the RAF is still a sizeable organization. We have almost 700 operational aircraft ranging from large wide-bodied Transport and Tanker aircraft such as the L-1011 Tristar; several different types of combat aircraft including the Tornado and VSTOL-capable Harrier; as well as medium- and heavy-lift helicopters, for example Chinook. We also operate some 350 training aircraft and 150 gliders. Strike Command now 'owns' all the operational [RAF](#) aircraft and these fly from fixed bases in the UK and Germany, and also in the Falkland Islands and Cyprus. We have of course always sent our large transport aircraft 'down route' around the globe in much the same way as any commercial operator. However, driven by the current geo-political climate, more so than ever before all of our aircraft types now operate singly or in small packages on long-term deployments such as those in support of peacekeeping in Bosnia and to help maintain the no-fly zone in Iraq. Also, to make use of the excellent range facilities not available in Europe we take a full part in annual USAF-run Flag-style exercises in Nevada, Florida and Alaska; in the Canadian Forces Maple Flag in Alberta; and fly regularly from Goose Bay in Labrador. We also take part in multi-national exercises in South East Asia, the Gulf, and Eastern Europe.

The UK Ministry of Defence has its own regulatory framework to govern military aircraft design, operation and maintenance, so we establish and follow our own maintenance practices and procedures. Most of the maintenance work on our aircraft and their equipments is carried out by [RAF](#) engineering tradesmen although there are exceptions such as in the case of the BAe 146/RJ series and the Raytheon 125s we operate from RAF Northolt, both of which are maintained by a Contractor following RAF procedures. Some of our aircraft have always operated in unusual circumstances: for example, Harriers and our Support Helicopters fly from rural 'field' sites working with the Army. More significantly we now routinely need to be capable of operating virtually all our aircraft fleets from airfields with no or very few maintenance facilities. This has put our operational flexibility at a premium and prompted us to look very closely at our maintenance procedures to ensure we are optimising the use of our aircraft engineering manpower.

For over thirty years all aircraft-related maintenance activity in the [RAF](#) has been underpinned by a formal, auditable documentation process involving two signatures: first that of the individual doing the work and then a counter-signature by a supervisor. This Paper describes an initiative to introduce a system of what we describe as ‘Self-Supervision’. In effect this means that carefully selected individuals are empowered to carry out and sign for maintenance work without direct supervision by a second person. We recognise that this move away from a ‘dual check/dual signature’ procedure increases the potential for Human Factors considerations to induce maintenance error, with significant airworthiness ramifications. We are therefore introducing the new Self-Supervision process in a measured manner.

Against that general backdrop and to aid understanding of our approach to Self-Supervision an explanation is first necessary of the general structure of our maintenance workforce and documentation system. Therefore, this paper includes the following main sections:

- a. Our maintenance personnel and their roles as producers and supervisors.
- b. The original ‘checks and balances’ in our maintenance work and documentation processes.
- c. Our Self-Supervision terminology.
- d. How we select and evaluate our Self-Supervisors.
- e. Our Self-Supervision implementation procedures.
- f. A short review of progress and the benefits gained.

## **RAF MAINTENANCE PERSONNEL - PRODUCERS AND SUPERVISORS**

### **RAF Producers and Supervisors**

There are approximately 12000 uniformed aircraft maintenance personnel in the [RAF](#) spread between the flight-line operation and base hangars on our main operating bases, and our repair and overhaul depots. All RAF maintenance activity, both on-aircraft and component maintenance off-aircraft, for example on aero-engines, is very closely controlled. There is naturally a comprehensive suite of maintenance manuals and procedures for each of our aircraft and equipment types, which relate directly to the skill and knowledge within our aircraft maintenance trades of Airframes, Propulsion, Electrics, Avionics and Weapons specialisations. As a military organization we have a rank structure which we exploit using regulations linking the various ranks with status as maintenance Producers, Supervisors and Junior Managers, thus reflecting the skill and experience of an individual as his career progresses. The ranks and status are as follows:

- a. Leading Aircraftsman (LAC)          Producer (needs close supervision and instruction in his first year of productive work after initial training).
- b. Senior Aircraftsman                  Producer.
- c. Junior Technician                    Producer.
- d. Corporal                                Producer/Supervisor.
- e. Sergeant                                Producer/Supervisor.
- f. Chief Technician                    Producer/Supervisor.
- g. Flight Sergeant                      Junior Manager.
- h. Warrant Officer                      Junior Manager.

## **LONG-STANDING 'CHECKS AND BALANCES' IN RAF MAINTENANCE PROCEDURES**

### **Maintenance Work Signature Chain**

All [RAF](#) maintenance activity is recorded and signed for. A mandatory signature chain was introduced in the early 1960s at the onset of the Cold War when we tended to operate permanently from large well-formed bases in this country and Western Europe. The signature chain introduced then is still in use today and is as follows:

- a. The signature of the individual who has carried out the task, i.e. the producer.

- b. A countersignature by the task supervisor.
- c. A co-ordinating signature, usually by a Sergeant or above, to certify the integrity of the documentation.

## Independent Inspections and Vital Checks

We also employ a similar safeguard to the ‘duplicate inspection’ procedure followed in UK commercial aviation. Our regulatory framework stipulates that ‘independent inspections’ are to be carried out after maintenance work on most aircraft flying control systems, undercarriage, brake and ejection seat systems. Here, of course, safety considerations are paramount, and we need to take the extra precaution to ensure that the disturbed system has been re-assembled and functions correctly. Additionally, following work on ejection seat systems, ‘Vital’ checks are mandated at defined stages of installation to ensure that all locking, routing and installation processes are satisfactory. It is not necessary in the course of this Paper to describe the ‘independent’ and ‘vital’ check processes in detail. Suffice it to say that they both involve an extra pair of eyes looking at the maintenance work, and the formal recording that this has taken place.

## SELF-SUPERVISION TERMINOLOGY

### Self-Supervision Study

In 1993 the [RAF](#) carried out a detailed study into the benefits of introducing Self-Supervision, which you will recall involved moving towards a ‘single-signature’ concept for selected individuals. The study recommendations, which were subsequently endorsed by the Air Force Board, included a full appraisal of [CAA](#) regulations for training and licensing aircraft maintenance personnel. The agreed way ahead was the introduction of Self-Supervision, subject to rigorous authorization, certification and tasking procedures.

### Self-Supervision Terminology

At this point, I need to introduce some more terms which now form part of our maintenance ‘vocabulary’:

a. **Type Specialisation.** Although for very many years we have had a system of recording an individual's experience of working on a certain aircraft or equipment, as part of our move towards Self-Supervision we have introduced a more formal Type Specialisation procedure. Now, when an individual has accumulated on-type aircraft or equipment experience and systems knowledge over a period of approximately 2 years, his line management judge whether or not he can be considered 'Type Specialised' on that particular equipment. Type Specialisation is the first building block in our Self-Supervision procedure. Once an individual achieves Type Specialisation on a particular equipment, he retains that qualification as he moves around from base to base on posting (or transfer). However, the authorization lapses if he does not work on the particular equipment concerned for a period exceeding 2 years.

b. **Self-Supervision.** In our terminology Self-Supervision means that an aircraft maintenance engineer has the authority to discharge the responsibilities of task supervisor as they apply to work he also completes as the 'producer'. A Self-Supervisor's signature on the appropriate documents certifies that he takes full responsibility for the quality and completeness of the work tasked. An individual gains Self-Supervisor status at his particular base or unit. When he leaves that unit on posting he does not automatically take his Self-Supervising powers with him to his next unit; and local management there will re-assess his capability and decide if and when he may re-gain the authority to Self-Supervise. To take this explanation a little further, we also have two different categories of Self-Supervision; Full or Limited as defined as follows:

(1) **Full Self-Supervision.** Only Type Specialised [NCOs](#), that is Corporals, Sergeants and above may be authorised as Full Self-Supervisors. A Self-Supervisor's 'power' extends to all tasks designated as being within his or her Type Specialisation annotation.

(2) **Limited Self-Supervision.** Any of our aircraft maintenance engineers, except for our [LACs](#) (who are in effect still 'in training'), may be authorised as Limited Self-Supervisors. This enables them to carry out specific, simple and repetitive maintenance activities under the 'single signature' philosophy.

(3). **Tasks Which Are To Be Fully Supervised.** In principle Self-Supervision can apply to all maintenance activities. The one exception to this is that, for the time being, we continue to require all maintenance work on ejection seats to be subject to the 'two signature' philosophy. However, more generally, the relevant [RAF](#) Engineering Authority, that is the office which approves the maintenance manual for a particular equipment, decides whether there are certain other tasks which must continue to be fully supervised. This is done using the simple algorithm at Figure One and by considering the flight safety implications and the need for independent and vital checks associated with specific activities. Each aircraft or equipment maintenance manual now contains a list of activities where the full 'two signature' procedure is always to be followed, and Self-Supervision is not permitted.

# HOW WE SELECT AND TRAIN SELF-SUPERVISORS

Having explained why we have decided to introduce Self-Supervision, and the terms and basic groundrules we use, I shall now describe how we go about selecting and training Self-Supervisors.

## Local Procedures

Probably in much the same way as commercial operators and maintenance organizations, at each of our flying squadrons or maintenance units we appoint a 'Trade Manager' for each of our maintenance specialisations (Airframes, Avionics etc). Normally, the Trade Manager is of Chief Technician rank. As discussed later, the Trade Manager plays a vital role in selecting and 'educating' potential Self-Supervisors. Also, as part of the process of introducing Self-Supervision on our various units, we have introduced Standards Cells, which I shall speak about in due course. However, before doing that, I first need to describe our process of 'Boarding' an individual for Self-Supervision. We regard this as a very important milestone, and a key safeguard measure which helps us to ensure that the risk associated with adopting a 'single signature' approach is minimised.

## The Squadron Board

A Board is convened to assess an individual's suitability before he is authorised as a Self-Supervisor. We deliberately make the Squadron Board a formal occasion. Chaired by the Officer-in-Charge (always an engineer) of the particular maintenance squadron (a Squadron Leader or Major), Board members also include the squadron Warrant Officer (Chief Master Sergeant), the relevant Trade Manager and a representative from the Standards Cell, which I mentioned earlier. The Squadron Board:

- a. Checks the individual's awareness, understanding and acceptance of the added responsibilities he will hold when employed as a Self-Supervisor.
- b. Determines his attitude towards:
  - (1) Airworthiness.
  - (2) Flight Safety.
  - (3) Health and Safety.
  - (4) Quality Assurance.

(5) Engineering husbandry.

c. In the case of a candidate for full Self-Supervisor status, the Board also checks that the individual fully understands the systems on which he is employed, and that he has successfully completed a broad spectrum of representative trade tasks.

d. For potential Limited Self-Supervisors, the Board confirms that the candidate understands fully that his 'single signature' authority is confined only to those very specific maintenance tasks listed in his personal 'log book' by his Trade Manager.

Following assessment as suitable by a Squadron Board, the unit's Chief Engineer personally authorises an individual as a Full Self-Supervisor; the Chief Engineer may delegate the authorization of Limited Self-Supervisors to Squadron Board chairmen.

## **The Role Of The Trade Manager**

The Trade Manager obviously has a very important role to play in the assessment and preparation of individuals for Self-Supervision. He knows his people and their working environment. Therefore the Trade Manager:

- a. Constantly monitors and reviews an individual's performance and attitude, and through this his suitability to Self-Supervise.
- b. When the individual achieves Type Specialisation, and is ready in all respects, agrees the individual's nomination with his line management.

The Trade Manager also must monitor the work of all authorised Self Supervisors and recommend removal of their authorization if required.

**The Role of the Standards Cell.** On each unit, as we introduce Self-Supervision, we form a Standards Cell comprising 5 experienced [SNCOs](#), one in each of our main trade specialisations, and headed up by a Warrant Officer. The Cell reports directly to the unit's Chief Engineer, and its role is to:

- a. Prior to an individual's Squadron Board, provide local training on the general principles of Self-Supervision to ensure that he fully understands the Self-Supervisor's role and responsibilities, and is fully familiar with the related [QA](#) processes, Orders and Instructions, and documentation procedures.
- b. Again prior to the Squadron Board, formally examine individuals to test their knowledge of all the Self-Supervision safeguard mechanisms.

- c. Carry out an Annual Standardisation Check on each authorised Self-Supervisor.
- d. On behalf of the unit Chief Engineer, audit by attending Squadron Boards to ensure that these are being conducted properly and uniformly in all squadrons.

The flow-chart at Figure Three summarises the path an individual follows to become a Self-Supervisor.

## **OUR SELF-SUPERVISION IMPLEMENTATION PROGRAMME**

**Timescales of Introduction.** We have deliberately approached the introduction of Self-Supervision cautiously through a controlled implementation programme. The result has been a long gestation period. Not only was our original study in 1993 very comprehensive but we also trialled the initiative on two units for a 12 month period to iron out all the inevitable wrinkles in our procedures, and to ensure ourselves that our maintenance standards would not become lower under a 'single signature' regime. However, by the end of this year, 9 of our main bases will have adopted Self-Supervision, and we aim to have completed its introduction fully before the end of the Millennium.

### **Implementation Procedures - Staff Advisory Team**

In order to confer a degree of uniformity of approach and to offer practical advice to units, we have set up an Advisory Team which spends a few months on each unit during the initial introduction of Self-Supervision.

## **RESULTS AND BENEFITS**

### **Benefits of Self-Supervision**

The general consensus of opinion is that the Self-Supervision scheme is of great benefit. In particular, the enhanced operational flexibility resulting from the ability to fix aircraft in remote locations with fewer maintenance personnel has been extremely valuable. Also some minor manpower savings have been possible in the component maintenance areas, where the workflow is predictable.

### **Reaction Of Personnel**

There were some initial misgivings and resistance to change. Some of our very experienced maintenance personnel believed there would be an inevitable degradation in standards without the 'second pair of eyes' observing all maintenance activity, and were reticent to accept the new concept. Also, there was a view that we needed to reward Self-Supervisors financially for the extra responsibility they would bear. We have not done this, but gradually individuals have begun to realise that authorization as a Self-Supervisor is a recognition of their skill and integrity; this itself generates a degree of self-satisfaction, but also, of course, such recognition is likely to be a positive 'tick in the box' when annual performance reports are completed. The net result is that Self-Supervision is being wholeheartedly embraced and has become accepted as an invaluable discipline.

## **Importance of Continuous Standards Monitoring**

So far, we have no reason to believe that our move to introduce Self-Supervision in our aircraft maintenance process was ill-advised. However, accepting that we have actually removed some of the earlier 'checks and balances', we recognise very clearly that if we are to continue to maintain airworthy aircraft, an effective [QA](#) system is now even more important. Given their closely-related roles, we have amalgamated the Self-Supervision Standards Cells with our unit QA department, and this arrangement is working well. For the time being, in addition to our full programme of quality audits, we consider that the personal Annual Standardisation Check of Self-Supervisors should remain part of our quality process. That said, we shall continue to monitor the efficacy of this particular mechanism over the next few years.