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SWISS F/A-18 FATIGUE TRACKING SYSTEM

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Abstract

A new fighter is presently introduced to the Swiss Air Force: The F/A-18 C/D is planned to be in service deep into the 21^{st} century. To keep the aircraft safely in the sky and to perform the required structural maintenance at the right time, a Fatigue Tracking System is monitoring the usage of the aircraft. Flight parameters and strain sensor data are recorded in each aircraft to appraise the fatigue behaviour of the Swiss structure under Swiss usage. The recorded data is downloaded from the aircraft after each flight and then it is transferred with the Swiss system to a VAX for the processing. A database is maintained for each aircraft and reports showing the structural health and fatigue behaviour can be created. Switzerland is following a combined philosophy for tracking and inspection, which is based on the experience of older fighters. First F/A-18 tracking results are available today. Such results together with theoretical studies and a Full Scale Fatigue Test will be the base to manage the structural integrity of the F/A-18 during the service life.

Introduction

Switzerland is presently introducing its new fighter aircraft, the F/A-18 Hornet. Both the aircraft and its avionics belong to a new generation. A lot of engineering know-how has to be built-up in order to be able to operate and maintain the new system.

It is an interesting task to transform an aircraft, that is designed to operate on aircraft carriers, to land based usage. It's a task other countries already fulfilled successfully.

The Swiss idea is to have the F/A-18 in service for at least 30 years. To attain that goal it is needed to get a reliable feedback from the usage severity and the aircraft's structure during the flight. This requires an efficient Fatigue Tracking System. Nowadays, it is possible to collect and process much more flight-data than it was possible years ago. In modern aircraft, a system is built-in that is able to track the relevant fatigue-data, and each flight is monitored in detail. Using software installed on a ground-based computer, regularly updated indices for the Fatigue Life Expended (FLE) of each individual aircraft can be defined. This indices provide the basis for the comparison with the expected design values.

Each aircraft is equipped with the monitoring system. That allows an individual aircraft tracking, with which the life consumption within the fleet can be controlled and optimized actively. It will be a task to keep all aircraft at a similar rate of accumulated damage. The Fatigue Tracking System will help to reduce costs and to operate the F/A-18 safely.

In summer 1998 Switzerland is having about twenty F/A-18 in service and will have accumulated towards two thousand Hornet flight hours totally. Our goal is to process more than 90 % of the data with the Fatigue Tracking software SAFE and we will regularly create monitoring reports.

Fatigue Tracking System

To process the flight-data, SF procured the SAFE V200 software (Structural Appraisal of Fatigue Effects) from Boeing (former McDonnell Douglas Aerospace). It is a huge software tool with a lot of capabilities, processing the data and creating reports.

There are two main sources of data fed to the tracking system. One source is the strain sensors and the other one are actual flight parameters. The data is monitored at a sampling rate of 20 Hertz.

Examples for the monitored flight parameters are the normal acceleration (Nz), lateral acceleration, aircraft weight including the fuel level, pitch- and roll degrees and -rates. The altitude, Mach-number and the configuration flown is monitored together with a lot more parameters. A relevant fatigue-data monitored is the angle-of-attack - dynamic pressure (AOA-Q).

The main part of the Fatigue Tracking data is provided by the strain sensors monitoring the major component load paths of the aircraft structure.

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The main characteristic properties of the Swiss specific F/A-18 structure can be seen in Figure 1. The three carry-through bulkheads, as well as the upper dorsal longerons are made by titanium. The improvements are justified by durability and damage tolerance requirements (see Table 1).

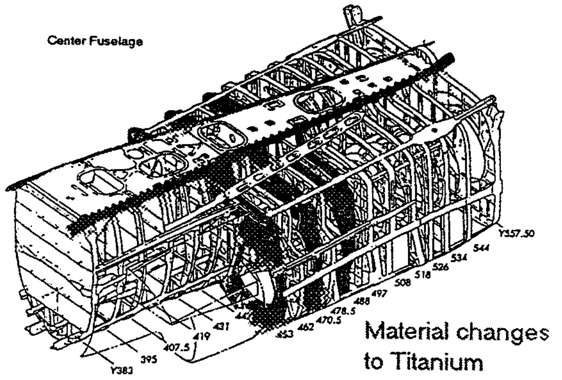


Figure 1: Structure of Swiss F/A-18. The dark colour marks the Swiss material change to Titanium

Four of the Fatigue Tracking sensors are located at a Swiss-specific location. The idea is to monitor the influence of the Swiss material changes during the Swiss service life. In Figure 2 the Swiss sensor locations can be seen. All Swiss-specific sensors are located within the fuselage: The positions are at the Canopy Sill, two at the Dorsal Deck and a sensor at the titanium bulkhead. The sensors are providing strain-data, which are transferred to loads within the SAFE -software for further data evaluation.

The sensor at the bulkhead delivers the most reliable results. It is located at the main load path of the aircraft, just close to the wing-attachment to the fuselage.

This bulkhead sensor was defined at a position where we have to expect less measuring-drift than the previous Wing Root sensor of other fleets. The sensor-drift can become a problem over the lifetime of the aircraft. With the Swiss bulkhead sensor we expect to get more reliable results.

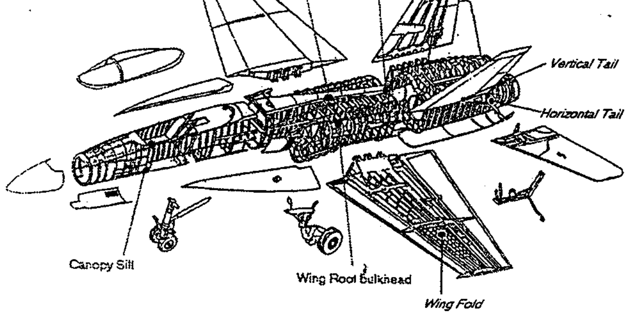


Fig. 2: Locations of strain sensors in Swiss F/A-18

It is possible to transfer the measured results of a sensor adequately to a component or location near the appropriate sensor. That procedure allows to produce spectra and to make damage calculations for other locations than the exact sensor location. Depending on the section of the aircraft you look at, you have to assign the results of another sensor.

The SAFE V200 software tracks ten different Replaceable Structural Assemblies (RSA) of the aircraft. One specific sensor is assigned to each RSA. The usage values as well as the fatigue values are assigned to and accumulated with this RSA.

When one of these RSA parts is interchanged between aircraft, it is still possible to track the history and the fatigue damage of this part.

SAFE provides another useful feature: In-flight incidents can be investigated very detailed. There we even have the possibility to do that years after the event, because all data of all flights are stored and can be reanalyzed if needed.

Data Processing

The main computer of the F/A-18 aircraft, the so-called Mission Computer (MC), collects all relevant data generated during the flight: This consists of aircraft flight parameter data and measured strain data from the strain sensors. The strain sensors are used to monitor the structural loading in the closest possible way, and they are described in the previous chapter.

The peak and valley strain data is filtered by the MC. This reduces the amount of data that has to be recorded. The information is then sent to the Memory Unit, which records the data onboard the aircraft. The Memory Unit is downloaded by Swiss operating personnel after every flight. The Swiss data processing is graphically illustrated in Figure 3.

A ground based station creates a SAFE input file which consists of a header line and the Memory Unit data. These files are transferred by the Swiss Mission Data System (SMDS) from every airbase at which a Swiss F/A-18 lands, first to the Data Center in Interlaken and then to the VAX at SF Emmen.

In Emmen the flight - files are processed by the F/A-18 Fatigue Tracking software SAFE. The data-processing procedure performs many steps, most of them are done automatically.

First the flight data are read in and each message is processed. Several checks on the flight data are performed then. For example certain checks on the reliability of the recorded sensor data or on the altitude/Mach ranges are done.

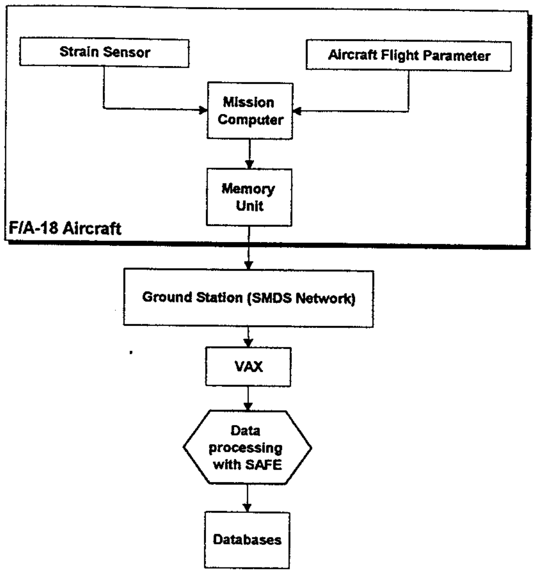


Figure 3: Flow of Swiss Fatigue Tracking Data

SAFE takes the strain (ε) values from the sensor as input. It is then transformed to a stress (σ) Peak-Valley sequence by the following formula:

$$\sigma_{spectrumP/V} = \frac{\varepsilon_{measured,P/V}}{\varepsilon_{reference}} \bullet cal\_factor \bullet \sigma_{reference} \tag{1}$$

; with: cal_factor: calibration factor.

$$cal\_factor = \frac{\varepsilon_{calculated}}{\varepsilon_{measured}} \tag{2}$$

The calibration factor is defined for each sensor in each aircraft during a special inflight-manoeuvre. The description of this factor can be found further down in the manuscript.
The reference values ($\varepsilon_{reference}$, $\sigma_{reference}$) are defined for each sensor location for the Swiss structure and the assumed Swiss specific aircraft usage.

The damage is computed with the appropriate module (both safe life and damage tolerance philosophy). It is calculated based on the normalized strain sensor peak-valley spectrum, reference stress and material data from (1). SAFE calculates fatigue data by different methods and for different locations in the aircraft. The Swiss use a Crack Initiation approach (Strain-Life Approach) as well as a Crack Growth approach (Linear Elastic Fracture Mechanics). As the most important output value of SAFE the FLE (Fatigue Life Expended) is calculated using the following rule:

$$FLE = \frac{Damage \bullet FH \bullet 2}{DH} \tag{3}$$

; with FH: Flight Hours of the aircraft
DH: recorded Data Hours of the aircraft
Factor 2: Safety Factor

The FLE describes the amount of fatigue life the appropriate location already did consume. The definition tells that as soon as the FLE_{CI} reaches a value of 1.0, the lifetime is over, based on crack initiation.

After the calculation part of the SAFE data - processing, the software automatically updates its databases. The SAFE software maintains a cumulative database for each aircraft in the fleet. The database contains up-to-date usage data for the aircraft with a large amount of information. There are separate databases for each RSA.
Examples for the available information in the database are the FLE, FH, usage severity parameters, landing statistics, all kind of updated tracking parameters and accumulated flight parameters.
Out of the database several reports can be extracted as a summary, showing the effects of the aircraft usage so far. Reports for a specific aircraft or a certain group of F/A-18's can be generated.
Examples of Swiss specific reports can be found further down.

Swiss Philosophy

Swiss Specialties of SAFE V200

Switzerland got the Version V200 of the F/A-18 Fatigue Tracking software SAFE. The Swiss version of SAFE is specified for our requirements and has many more capabilities than the original version does. The Swiss version contains several new program-modules and capabilities.
The sensor-data-processing in V200 has been improved over previous versions. To be sure that the strain sensors provide reliable results, certain checks have to be made automatically. If a sensor fails (status bad) a message is given to the data-processor. These sensor-checks were defined and improved on the experience of older versions.
For four sensors an automatic calibration-factor is computed out of the normal dayly aircraft usage. The calibration factor qualifies the sensors properties. So far it had to be defined in special test flight manoeuvres or during ground calibration. The automatic calibration-factor calculation is still a

working issue and needs some improvement. (There is a closer look at it further down in this paper).

Other special program-modules of V200 are a tracking method for the F/A-18 leading edge flap, and a module calculating the dynamic damage of the Vertical Tail, induced by buffeting. The module appraises the dynamic damage based on angle-of-attack - dynamic pressure (AOA-Q) tracking data.

The Swiss SAFE V200 version can extract more information and reports than most F/A-18 users in other countries.

Examples for the reports are:

- Normal acceleration (Nz-) exceedence data and additional: Strain exceedence data.
- List for each aircraft of the top ten Nz-levels and new: Strain-levels ever occurred during usage.
- For every single F/A-18 each second flown in its life is summed up in the appropriate range of the AOA-Q table. The ranges are selected specially for analysis at the Vertical Tail and at the Outer Wing.
- In V200 there are ten RSAs tracked and reports showing their actual fatigue indices (FLE) can be generated.

Swiss Tracking and Inspection Philosophy

The Swiss experience on structural integrity for fighter aircraft is based on the Mirage III (Safe Life design based on AIR 2004D) and the Tiger F-5 (USAF damage tolerance philosophy). The main spar of the Mirage III showed cracks very early, to ensure the structural integrity the Swiss replaced the main spar in the fleet by a refurbished one. The Swiss F-5F fleet showed cracks very early at the upper cockpit longeron due to their much more severe usage than the design of the USAF (the Swiss usage generally is three times more severe than the USAF or USN usage). Based on the experience of the two fighters, the Swiss decided during the evaluation phase of the F/A-18 to start with a special Aircraft Structural Integrity Program, so-called ASIP, specified by MIL-STD-1530A. (1)

There are two unique features of the Swiss ASIP Master Plan. First, it is written for an airplane which has been designed and has been build for the USN operational requirements. But it will be used for significant different operational requirements of the Swiss Air Force. Second, it is written for an airplane which originally was designed with crack initiation as fatigue life criterion but is reanalyzed and modified for the Swiss with combination of crack initiation and crack growth as fatigue life criterion.

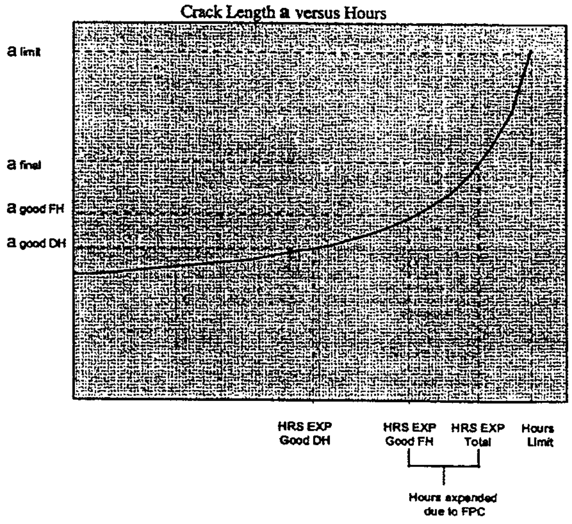
The Swiss fatigue design requirements for a service life of 5000 SFH are summarized in Table 1 below.

Part Qualification	Requirements
Maintenance & fracture critical parts	-Two durability lifetimes 10000 SFH (CI-Life)
Fracture critical parts	-Two damage tolerance lifetimes 10000 SFH (CG-Life)
Others (normal control parts)	-Satisfy static strength requirements -Meet USN durability requirements

Table 1: Swiss fatigue design requirements

The Swiss ASIP design phase results in the reinforcement of the structure of some locations. The major modification was a material change from aluminium to titanium for the three carry-through bulkheads and the upper dorsal deck longeron (see Figure 1).

All maintenance critical parts additionally were analyzed by damage tolerance. At the end still a few locations showed crack growth life below 10000 SFH which means that these locations must be inspected during the service life.



$$FLE_{CG} = \frac{\left[Hrs\exp goodDH * \left(\frac{GoodFH}{GoodDH}\right) * \left(\frac{1}{factor}\right)\right]}{HrsLimit} + \frac{Hrs\exp FPC}{HrsLimit}$$

Figure 4: For normal data collection GoodFH = GoodDH, factor = 1, if there is some data missing due to a bad sensor a fill-in procedure by flight purpose code (FPC) is used for the gap, the crack length $a_{good\ DH}$ will be calculated by crack growth analysis using the actual recorded spectrum. With the input of $a_{good\ DH}$ from the above curve (crack growth ASIP design) the HrsexpgoodDH can be determined. HrsLimit = the crack growth ASIP design life, the ratio of HrsexpgoodDH and HrsLimit is the FLE(CG) value.

For fatigue tracking purpose the Swiss developed a crack growth FLE so-called FLE(CG) based on the damage tolerance concept of MIL-A-83444 for scheduling the inspections for the critical parts of the F/A-18. (2) For the definition of the FLE(CG) see Figure 4.

For the fatigue tracking sensors the Swiss selected the most maintenance critical location which was close to the sensor. The idea is to use the recorded normalized strain sequence from the fatigue tracking sensor for crack growth analysis. If the FLE(CG) reaches the value 0.5 inspection will be required for the selected critical location. This information will drive all the other critical locations near the fatigue tracking sensor location for scheduling the inspections. All FLE(CG) are calculated within the SAFE software automatically. At the moment only the sensor at the fuselage station 470.5 location (wing root bending moment) records reliable data for accurate FLE calculation. This FLE calculation is done for each individual aircraft. The so far obtained information from the fatigue tracking system may be limited just for tracking of the center barrel section and the wing root area of the Swiss F/A-18. The Swiss are currently doing some investigation how they want to track the other components of the F/A-18. More information about the sensor-calibration can be found further down in this chapter.

The Swiss idea is to use the FLE(CI) as a local material response due to fatigue cycling during aircraft usage. The FLE(CI) compares locally the actual usage with the design spectrum. If the usage is all the time below the design usage the aircraft should reach the service life without any structural failure. The Swiss ASIP design will be verified by a Full Scale Fatigue Test at SF Emmen.

For the Swiss F/A-18 structure all the critical parts meet the durability criteria (USN Safe Life philosophy). If the usage is below the ASIP design these critical parts will never be inspected. The situation is quite different if we apply the USAF damage tolerance concept for the maintenance critical locations which must be inspected at least once during the service life.

The following example may demonstrate this fact more clearly. The sensor at the bulkhead location fuselage station 470.5 monitors the strain of the wing root bending moment. The normalized sequence by the reference strain is used to calculate the FLE(CI) at the wing root location. The same normalized strain sequence is used to calculate the FLE(CG) at the lower splice fitting location at fuselage station 488. The wing root spectrum at fuselage station 470.5 is more severe than the wing root spectrum at fuselage station 488. So the FLE(CG) will not be an unconservative result.

An example from the actual Swiss usage should give some demonstration of the Swiss FLE interpretation. The results from one of the first aircraft delivered to the Swiss Air Force had accumulated 98.75 FH. We have to state that it was not typical Swiss usage yet. An evaluation of the recorded wing root data for the 98.75 FH running the software SAFE yields a FLE(CI) = 0.012 and a FLE(CG) = 0.009. These two values clearly indicate that this aircraft's usage is below the design usage [FLE(CI, ASIP design) = 0.020 and FLE(CG, ASIP design) = 0.011]. Furthermore the FLE(CG) value tells us that this kind of usage would never require an inspection during the service life of 5000 FH. The Swiss also analyzed the Nz spectrum, the points in the sky, and the configurations flown during the 98.75 FH. All this data demonstrated clearly that the usage of this aircraft is less severe than the ASIP design. All the results are consistent and the Swiss so far believe that the wing root fatigue tracking sensor located on the titanium bulkhead records reliable fatigue tracking data.

One important point to get appropriate results from the strain sensors of the F/A-18 is the calibration of the sensors. For every sensor location a calibration method has to be defined. The calibration takes into account the influence of the:

- qualities of the adhesive bonding of the sensor
- gauge factor
- different load paths in an individual aircraft structure
- other influences

Boeing (former McDonnell Douglas Aerospace) delivered the calibration-procedure for the standard sensors. The so-called WUT-calibration defines the calibration-factor for a sensor during a well-defined flight-manoeuvre (Wind Up Turn). For the bulkhead sensor the WUT-calibration computes a reproducible calibration-factor without scatter. At the other sensor locations there was more scatter and an improved method had to be found. SF and Boeing were working on this issue.

It was remarked early that for the other sensors more flight parameters are needed than for the bulkhead sensor. Several efforts were taken especially to calibrate the Dorsal Deck sensors (DD) and the Canopy Sill (CS) sensor. Investigations on several possible flight parameters influencing these sensors were made by SF. For example we stated the influence of the fuel level, Mach number, deflections of the Horizontal Tail, and more. We were happy to collect a lot of interesting flight data on the occasions of F/A-18 Acceptance Test Flights, the Swiss Defence Procurement Agency (DPA) had to perform anyway. No additional flights were required, but we had the possibility to closer specify some flight manoeuvres. We got manoeuvres at certain fuel levels or roll rates to analyse. This allowed to make investigations on parameters at fixed flight conditions. SF tried to quantify the influence of the parameters as far as possible. Some parameter studies showed pleasing results.

But finally there all the same unexplained influence parameters remained. On some flights we had a clear sudden shift of the measured strain (at the DD sensors and the CS sensor). This offset did reach values up to factor two of the measured strain. This did lead to a scatter of the strain values measured during several flights, but at identical flight conditions. It is possible that this is due to torsional effects in the longeron, which cannot be tracked with the Tracking System.

We had to come to the conclusion, that it is not possible to define a direct calibration-procedure with the parameters and parameter-sampling-rate SAFE provides, in spite of the advanced system.

At Boeing then a procedure was defined computing a calibration factor out of the normal dayly aircraft usage. SAFE is collecting strain sensor data measured at certain conditions. Whenever the defined flight parameter conditions are fulfilled, the system is taking another data point. As calibration factor the average of all these data is taken. It's an averaging calibration-procedure.

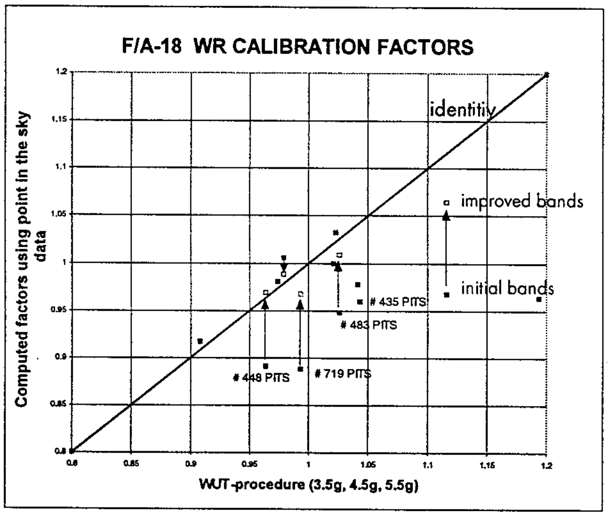


Figure 5: Similarity of two different methods defining the calibration factor

For the bulkhead sensor SF now had two calibration-procedures and it was interesting to compare the two calibration factors for an aircraft.

Figure 5 shows that in the first trial many factors stayed well away from the expected identity line. Then SF together with Boeing defined tighter and better flight parameter-bands. The satisfying results can be seen in Figure 5: The calibration factors came much closer to the identity line (at the head of the arrows, named improved bands).

We can conclude that the tighter and improved flight parameter-bands produce good results for the averaging calibration-procedure at the bulkhead sensor. The averaging method is verified for the bulkhead sensor.

The question now is about the validity for the other sensor locations (at the Dorsal Deck sensors and the Canopy Sill sensor). The difference between the sensor's behaviour can be seen in Table 2.

	right Points In The Sky selected with the bands	ε - scatter occurring
bulkhead sensor (WR):	yes	no
DD, CS:	yes (same as above)	**yes**

Table 2: Strain sensors in the averaging calibration-procedure

The only difference for the DD and CS location compared with the WR is the mentioned scatter found for these sensors between several flights. The item is reduced to the question if averaging the <u>scatter</u> of all data points, how it is made in the averaging method to define the calibration factor, is an acceptable method. Several analytical investigations were made on that issue. Here are some thoughts about it:

Let's put Formula (2) into Formula (1). When we take the results from the averaging calibration-procedure for defining the cal_factor (2) we get:

$$\sigma_{spectrP\,/\,V} = \frac{\varepsilon_{measured,\,P\,/\,V,\,SC}}{\varepsilon_{reference}} \bullet \frac{\varepsilon_{calculated}}{\varepsilon_{measured,\,avg\,-\,proc.,\,SC}} \bullet \sigma_{ref} \tag{4}$$

We see that there scatter is occurring in the two terms labelled with "sc". The idea is, that the influence of the scatter in both terms will be crossed out with ongoing usage. Both types of strain-data are collected during normal aircraft usage, what means they are collected under the same conditions. Therefore we hope to get the same kind of scatter for both terms (sc), which is then eliminated in the formula (4).

In other words we can say, that the scatter occurred during the evaluated flights for defining the

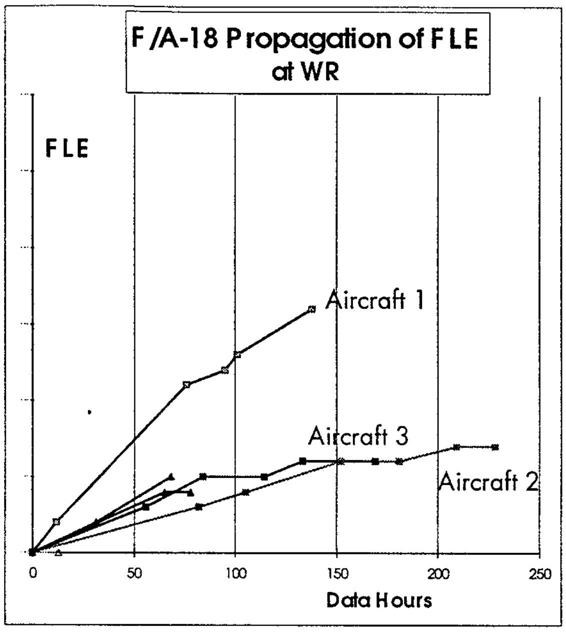


Figure 7: Different propagation of FLE between several aircraft

Figure 7 clearly shows that the expended fatigue life can be very different for several aircraft at the same amount of flight hours. With the FLE-tracking we will take into account more reliable information than just a number given by flight hours. The available resolution of information is increased. It's a step forward. Structural maintenance based on flight hours forces a lot of superfluous activities. These activities can be eliminated with the FLE-tracking. The structural maintenance will only be done when really required, at a certain amount of accumulated FLE. The method is more adequate to the aircraft usage.

The FLMP will define when to make an inspection. Intervals can be defined with FLE-values, flight hours or a combination of both. It tells when to repair, when to rotate, or even when to retire an aircraft. Components of the aircraft are tracked individually and SAFE declares their fatigue values. For currently not tracked locations it is possible to develop spectras. The induced damage can be calculated with a module outside of the SAFE-software if needed.

There is many input information to the FLMP. The Fatigue Tracking System provides the main input. But also questions like the required aircraft-availability or the planned in-service time of the fleet will have an influence. Very important to the FLMP will be the results from the Swiss F/A-18 Full Scale Fatigue Test (FSFT). So far the Fatigue Tracking calculations are based on the results from the ASIP- study. As soon as FSFT-results will be available, the FLE-calculations will get a new standardization, and it will become even more accurate.

In the FLMP there will be an option to actively influence the Air Force's aircraft usage. It is possible to set limitations to the usage severity to improve the fatigue life of the aircraft. It is desirable and important to leave the efficiency of the missions untouched. This can be reached with a skillful procedure. The monitoring system would be the tool to reach this goal together with the involved people in the Air Force. Air Forces of other countries already did go that way successfully.

All the same for Switzerland this remains an option. It only would be activated if we would have problems with the aircraft's structure fulfilling the required lifetime. So far this is not anticipated.

Objective

The design severity from the Swiss ASIP-study will have a key function for future F/A-18 maintenance. Most of the analysis made are based on it. The FSFT as well will reproduce the aircraft's loading according to the Swiss ASIP design. It will provide indispensable information about the Swiss F/A-18's structural behaviour under Swiss design conditions.

The Fatigue Tracking System will provide the data necessary to compare the real Swiss fleet F/A-18 usage severity with the ASIP design. Our idea would be to fly below the design spectrum, which can be easily checked with the results from the SAFE software. With a usage below design we would be covered by the possible critical parts / locations in the aircraft we have to expect. The locations are known from the ASIP study and they will be improved and completed with the future FSFT.

With a usage below design we are prepared to ensure the aircraft's structural integrity by knowing the critical locations we ever will have to expect. The Fatigue Tracking System will tell us when (at what FLE) and where fatigue damage is to be anticipated.

References

(1) "Aircraft Structural Integrity Program, Airplane requirements", MIL-STD-1530A.

(2) "Military Specification: Airplane Damage Tolerance Requirement", MIL-A-83444 (USAF), 2 July 1974.

averaging cal_factor <u>must</u> be the same type of scatter, which occurs during the later aircraft usage. That means averaging all strains (over a certain observation time) for the same manoeuvre always must result in the same strain-value.

Of course this method remains an average-method and SF knows about limitations it can have. After we are aware that it's hardly possible to find a full (direct) calibration method predicting the strains on the base of all available (flight-) parameters, it seems to be the most appropriate method delivering results with a certain reliability. But before we will be able to use the results a validation is still needed.

Tracking Results

After about two years of Swiss F/A-18 usage Switzerland can review the first reliable Fatigue Tracking results. The content of the actual databases is shown in the SAFE reports. The available reports give a good feedback on the usage of the aircraft.

An example can be seen in Figure 6. It is showing a normal acceleration spectrum of F/A-18's. This is a very important plot, with which comparisons with the ASIP design spectrum or comparisons with the usage of other Air Forces can be made.

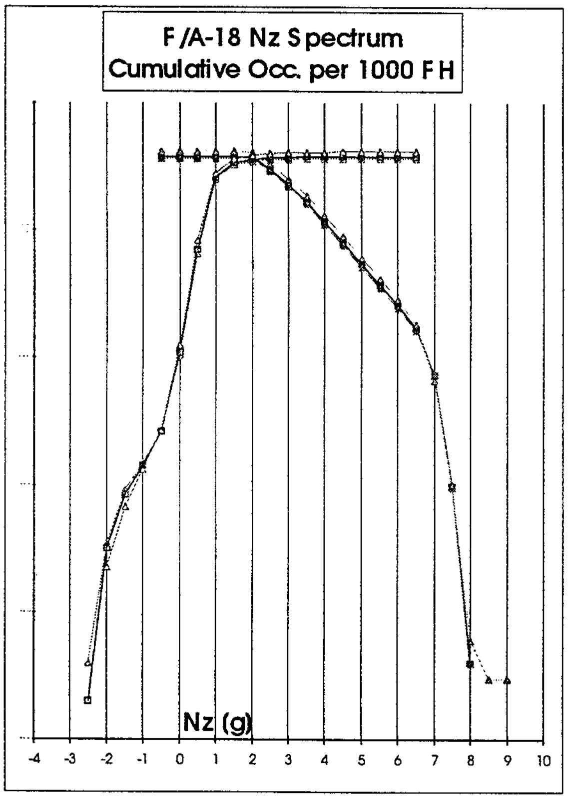


Figure 6: Normal acceleration exceedence plot

Figure 7 shows the propagation of the fatigue indices (FLE) of some F/A-18. There's a remarkable difference of fatigue life consumption between several aircraft. A check SF made did confirm this fact: The data coming from the recorded <u>flight parameters</u> are fully independent on the <u>strain sensor</u> data. But the result we got from both mainly contains the same message: The flight parameters as well showed a more severe usage for the same aircraft (aircraft 1 in Figure 7). The Nz spectrum generally was more severe for those aircraft where the FLE showed more usage severity. The FLE is calculated based on measured strains, which is much more precise than the Nz information only. The influence of everything concerning the structural behaviour is distinguished by the strain sensor recording.

The consideration above is a validity check which fundamentally confirmed that the Fatigue Tracking results for the bulkhead sensor are consistent.

Goal and Objective

Goal

The idea of the Fatigue Tracking System is to supply enough information to manage efficiently the usage and the maintenance schedule of the whole F/A-18 fleet. It is the tool to get the information about the real usage severity and about the structural behaviour. The monitoring data allows a comparison with the assumptions made during the Aircraft Structural Integrity Program (ASIP) - phase. The Swiss Hornet Fatigue Tracking System will help to reduce future maintenance effort and to manage fleet operation in order to assure that the maximum flight hour is attained for each aircraft.

It will help to increase the safety. Critical structural parts can be detected and, under certain conditions, even predicted. An Individual Aircraft Tracking can be realized additionally to the fleet tracking. Each aircraft and each flight is monitored. An aircraft's history is known and adequate measures can be taken if needed.

SF in Switzerland will establish a Swiss Fatigue Life Management Program (FLMP) for the F/A-18 fatigue issues. The FLMP concerns the structural part of the maintenance activities. It will mainly be based on fatigue indices (FLE) and not on flight hours any more. The FLE-tracking is more accurate to track fighter aircraft, and finally cost can be lowered.