



Design Acceptance of US Government Software

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Performing Design Acceptance of software provided by the US Government for ADF platforms where the software is altered from the US Government baseline can present challenges. This is becoming more of an issue as the ADF moves towards the purchase of advanced weapon systems where release of software data will not occur. In most cases, providing that the ADF configuration, role and environment (CRE) is the same, or contained within, the US Government CRE then the ADF can use recognition of prior acceptance as per TAREG 2.2.7 for the majority of the software. The difficulties arise for the ADF specific requirements that are to be incorporated into the software. For tactical aircraft, all software must be acquired by FMS due to ITAR considerations and this allows us to apply exemptions from TAREG 2.2.3a(4), however the ADF still requires certain assurances in order to perform Design Acceptance.

This brief presents an approach to Design Acceptance that considers the difficulties in data and information release from the US Government while still providing an adequate basis for the performance of the Design Acceptance activity.

This brief provides a concept that may be applied to future Design Acceptance efforts on any software based platform.



Scope

- Requirement for Design Acceptance
- Issues Related to Design Acceptance
- History
- DGTA Guidance
 - Requirements Satisfaction
 - Requirements Validity
- What Does All This Mean?
- Where to From Here?
- Brief Case Study

- Brief is biased towards Classic and Super Hornet software Design Acceptance.



Requirement for Design Acceptance

- New/modified software is a change to the Type Design
- A change to the Type Design requires Design Acceptance
- Governed by Technical Airworthiness Regulations (TAREGs)
 - 2.2.3 for new aircraft or major changes
 - 2.5.6 for minor changes

New or modified software will change the basis of the Type Design. This change may be minor or major depending on the criticality of the software change individually or as part of an overall software set.

•Even a small correction will change the Type Design

As it is a change to the Type Design, Design Acceptance is required prior to its release for flight.

TAREGs 2.2.3 and 2.5.6 govern the requirements for Design Acceptance.

This brief will mainly focus in software as a major change and thus 2.2.3 is the applicable regulation.

TAREG 2.2.3 requires:

- A Design Acceptance strategy
- TAR endorsement of the Statement of Requirement and any amendments
- Design agencies are AEOs (An exemption for FMS procurement is provided, reference Section 3 Chapter 7 para 29 & 30 of the TAMM). This will be discussed further in a few slides time
- Design agency has the appropriate supporting documentation
- The supporting documentation has been reviewed and a compliance finding made



Issues Related to Design Acceptance

- Exemption to TAREG 2.2.3a(4)
- FMS releaseability
- Visibility of development process

Due to ITAR restrictions, all US Government software must be purchased through the FMS system for tactical aircraft. This can be a very complex process and may be completed as part of the aircraft acquisition FMS case or separately as a stand alone FMS Case.

In Section 3 Chapter 7 (para 29 and 30) of the Tamm, an exemption to TAREG 2.2.3a(4) (AEO requirements of the design agent) is provided for FMS acquisitions, however para 30 still requires that a Design Acceptance Strategy is used to ensure that sufficient rigour has been applied to assure design quality, and in the case of software, safety. For FMS case acquisitions it is important to get the required release or disclosure in the SOW and agreed to with the US Government to enable sufficient checks to be made to satisfy the DAR that sufficient rigour has been applied.

History has shown in the case of the Classic Hornet, that while the ADF gets significant release of technical data, the process details are still closely guarded. This will only become worse as commercial companies in the US seek to protect their process Intellectual Property. In this case it is unlikely that the US Government is going to over-ride them and force the release of this information to the ADF.

All this leads to the dilemma of how do we undertake Design Acceptance for US Government delivered software?



History

- ADF tend to undertake Design Acceptance activities at the end
- Software development can be a long process
 - We can forget what happened early in the process
 - Postings lead to loss of background knowledge
 - Hard to retrospectively correct deficiencies
- Lack of centralised management
- Requirements get missed

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At TFWSSF, the focus has been very much on the performance of the Design Acceptance activity at the end of the process. In many cases when undertaking this activity it has been difficult to establish a suitable basis for the software delivered from the USN. As a result TFWSSF undertakes additional effort to reverse engineer some of the required artefacts to support design acceptance. In these cases we are using the technical data to make up for the fact that we have little visibility of the USN detailed process. For Classic Hornet this is an acceptable method, albeit not as efficient as it could be, as we have sufficient data and suitably skilled people to undertake the effort. When it comes to other platforms where we do not have this level of release or skilled people, we need to get smarter.

The software development process for advanced aircraft tends to take a significant amount of time, normally in the order of years. If we only seek to undertake Design Acceptance at the end of the development cycle we can face a number of issues:

- It may be difficult to get 'old' information to support compliance findings, especially from the US Government.
- Postings and staff turnover can cause a loss of corporate knowledge.
- Deficiencies identified during the Design Acceptance process of artefacts from early in the program may be hard to correct.

For platforms with multiple projects that require software support, there can be confusion as to who is responsible for the software as a whole. This can cause two main issues:

- Confusion from the US Government on who to take direction and priority from.
- Confusion from the ADF on who is responsible for Design Acceptance of the software as a whole.

This lack of centralised management can lead to some project and sustainment requirements being missed either by:

- Not being included in the software by the US Government, or
- Not verified sufficiently by the ADF.



History (2)

- To assist Design Acceptance activities, a change in focus is required

What all this history has shown us is that we need to undertake a fundamental shift in how we view Design Acceptance.



Design acceptance is an ongoing process that starts when the design process starts

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We need to readjust our focus and recognise that Design Acceptance **is a process and not an action**. It needs to start when the requirements are being defined and it must be coordinated.

This is supported by the TMM requiring oversight of the original SOR by DGTA. Actions and compliance findings need to be undertaken and documented along the way. This helps in performing the action of Design Acceptance Certification at the end of the process.



DGTA Guidance

- Requirements Satisfaction
- Requirements Validity

For both Classic and Super Hornet DGTA have provided guidance on the requirements for the software Design Acceptance to both HUG 2.3 and the ASHPO. The guidance is consistent in that it details the compliance findings in support of Design Acceptance should focus on two areas:

- Requirements Satisfaction. This is all about establishing the process that is used to produce the ADF software baseline is as equally rigorous as that used to produce the US Government baseline.
- Requirements Validity. This is all about establishing that the process of creating the ADF unique requirements has taken into account the ADF CRE.



Requirements Satisfaction

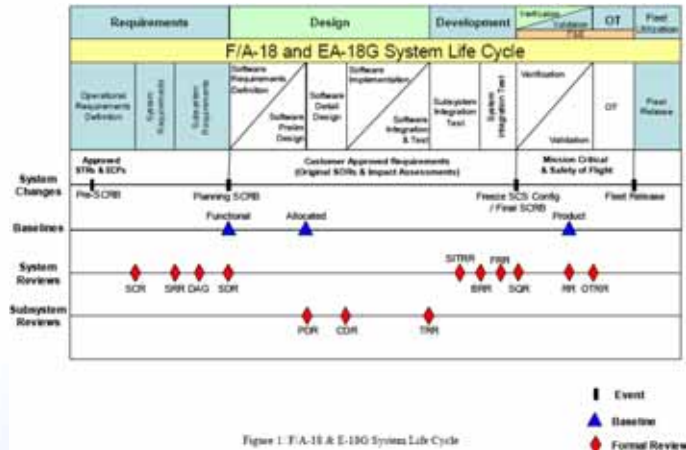


Figure 1: F/A-18 & E-18G System Life Cycle

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Requirements satisfaction is about establishing that the process adopted for the production of the ADF baseline is equally as rigorous as the process adopted for the production of the US Government software. The key point here is that the process should be the same, although the requirements and data may be different.

This slide provides a high level view of a typical software development process. It is important to understand any nuances within the process that will actually be used and tailor the evidence requirements to suit.



Requirements Satisfaction (2)

- Understand the process
- Gather information on what activities are undertaken (not how)
- Ensure sufficient coverage as per TAREG

As mentioned on the previous slide, there is a need to understand the development lifecycle and the assurance activities employed such as (this is a non exhaustive list)

Software Assurance

- System Safety
- Configuration Management
- Requirements traceability
- Response to Issues
- Residual Risk
- Response to Issues

It is important to make sure the appropriate documentation exists to provide evidence in support of the Design Acceptance. Required documents include:

- Design assumptions
- Test Plans
- Test reports
- Calculations
- Any other Type Design data necessary to show compliance with the ADF SOR



Requirements Satisfaction (3)

- Make a determination on
 - What data/deliverables are really required
 - Attendance at milestone reviews
- Review of meeting artefacts
- Action issues at the time
- Engineering Note to document outcome

Once the process is understood, a determination on what is really required to help support the design Acceptance activity must be made. With an AEO we would audit them but we do not have that luxury with FMS. So what do we really need to give us the confidence that:

- They understand our CRE
- They follow the same process for both US and ADF software
- They would certify if it was for them and not us

It is not about getting the information, more about getting evidence that the process has been followed for ADF as it would have been for US.

It may be important for ADF representation at key milestone reviews to allow sufficient understanding to be gained that the process is being followed for the ADF software development process. At other times it may only be necessary for a review of the milestone review presentation and minutes. What is key is that a review must be undertaken at the time to determine whether there are any items that have not been sufficiently completed and require further ADF action to ensure that they do not slip through the cracks. Any outstanding issues should be dealt with at the time while they are fresh in everyone's mind. After all issues have been appropriately addressed, an Engineering Note should be compiled detailing the outcomes. This is a key piece of documentation that will support Design Acceptance.



Requirements Validity

- For common elements of the software
 - Is CRE relevant
 - Safety requirements
- For ADF unique elements
 - Understanding of ADF CRE in requirements derivation
 - Impact of ADF unique requirements on common baseline
 - Safety requirements

Requirements validity is about establishing that the US Government agency and associated contractors have been systematic in identifying, analysing and deriving the unique ADF software requirements, both functional and safety, for the ADF CRE.

There are two key aspects to be considered here:

- CRE as it affects the common elements of the software baseline
- CRE as it affects the ADF unique elements of the software baseline

For the common elements it is essential to determine whether the US Government and their associated contractors understand:

- The ADF CRE (education issue)
- Any specific ADF safety requirements that the US Government may not impose (if any)

For the ADF unique elements it is essential to determine whether the US Government and their associated contractors understand:

- The ADF CRE as it applies to those unique elements
- Whether there are any impacts on the common baseline that may be affected by the inclusion of the ADF unique requirement (ie the same switch performing different functions in the US Government and ADF aircraft)
- Any safety requirements that may be imposed by the ADF on the ADF unique requirement.



Requirements Validity (2)

- Evidence
 - Appropriate meetings undertaken
 - Appropriate testing conducted
 - Appropriate reporting completed
 - Appropriate software assurance undertaken
 - Appropriate System Safety undertaken
 - Disposition of anomalies
 - Residual risk

In order to support the key findings on the previous slide it is necessary to gather evidence. This evidence is similar to that required to support the Requirements Satisfaction, however there are some key differences. For validity it is necessary to at least gain disclosure that not only were the key milestones undertaken, but that the US Government has sufficiently documented the outcomes of their required processes. This could include statements such as:

- There were X System Safety Working Groups held since the last milestone. No new hazards were identified and the existing hazard have all be mitigated such that their residual hazard rating is Low.
- X number of test points were undertaken, Y passed with retesting scheduled for dd Mmm YY
- A Risk Management Working Group was held on dd Mmm YY with the following risks remaining.

The main aim of this is to gather evidence that they are following the process as detailed earlier. The intent is not to take their statements to 'use against them'. A team approach needs to be taken so that the US Government can see that we are not trying to see more than we are entitled to. It is important for the ADF to communicate why we need the evidence that we do.



What Does This Mean?

- Develop a compliance finding plan early
 - Applies to Projects and Sustainment
- Communicate ADF needs with US Government Agency
 - Include in FMS Case
- Explain why information is required
 - What is required and why
- Disclosure versus release
 - Compliance finding 'audit' vice AEO audit

It is important to develop a compliance finding plan early in the process, ideally as the requirements are established. This plan not only needs to detail the effort to be undertaken, but also who is responsible for undertaking it. It can help to insert wording to define why the elements are required to assist in maintaining focus through the turbulence of the posting cycle.

It is vital to involve all parties in the development of the plan, including the US Government. It is important to remember that without their assistance it will be extremely difficult to undertake the Design Acceptance process. In any case it is likely to lead to additional extensive testing by the ADF which could be costly from a funding and schedule perspective.

Once the plan is finalised, it is vital to get agreement from **ALL** parties. It can be difficult to get the US Government to sign up to anything, however a program letter requesting their support and detailing why it is critical can go a long way towards achieving the desired goal. In most cases the US Government will sign up to providing their best efforts to support the program and this can be used as a gentle reminder when things start to become difficult.

Make it clear that the ADF is not trying to get everything, just enough to enable suitable compliance findings to be made in support of Design acceptance Certification. You may be surprised how accommodating the US Government can be when they understand what the ADF are trying to achieve and that release of everything is not required to support the goal.

At the end of the day, the ADF cannot perform an AEO audit on the US Government agency and even if they did it would be impossible to force them to comply full with our requirements. What we seek to achieve is a high level audit to assure ourselves that the process is being undertaken as they would do it for themselves and that sufficient documentary evidence exists to support this decision.



What Does This Mean? (2)

- TLOs may require some EA
 - TLO duty statements may need revising
 - TLOs may require pre posting training
- TLOs may need to attend more meetings
 - Provides assurance on the process
 - Able to be a 'Smart Customer'
- TLOs document throughout the process
 - Avoids loss of knowledge due to postings
 - Avoids 'big bang' Design Acceptance at the end when time is compressed

In order to achieve the required outcome, we need to use our technical liaison officers (TLOs) more effectively. There may be a requirement for the duty statements to be revised and possibly some pre-posting training/familiarisation to be undertaken. There is also likely to be a requirement for the TLOs to hold an appropriate level of EA to support their expected effort. As the person on the spot they are more likely to achieve a positive outcome than someone on the other side of the globe in a different time zone. In accordance with the compliance finding plan, they will also be held responsible and accountable for the tasks required of them.

The TLOs may need to attend more key milestone meetings than they currently do. Even if they do not, they will need to review the outcomes of each meeting to ensure that there is sufficient documentary evidence to support a compliance finding leading to Design Acceptance. This has the added benefit of making the ADF a 'smart customer'. If the US Government are aware that we do review the outcomes then they are more likely to ensure their key milestone review presentations include the information that the ADF requires.

After all this, it is imperative that it is documented in the form of an engineering note. The engineering note forms a piece of the documentary evidence in support of the Design Acceptance Certification. By having this evidence it will ensure that the knowledge is not lost through the posting cycle. It also forms a good starting point for the newly posted personnel to get up to speed on where the process is and any associated issues that are relevant.

The main point here is that the design Acceptance process is being undertaken by appropriately qualified personnel throughout the development of the software. It then becomes a much simpler matter at the end to draw all the elements together for the Design Acceptance Certification. We need to remember that at that part of the program we are normally time compressed and really trying to get everything out the door to meet the expectant customer's needs. The less chasing we have to do at that time the better. It will make us more prepared at the critical time and less prone to miss something.



What Does This Mean? (3)

- The person performing Design Acceptance Certification needs to ensure that
 - The appropriate processes have been undertaken
 - Sufficient rigour has been used in the development of the ADF software
 - Sufficient documentation exists in support of the ADF software
 - An appropriately qualified individual has made these findings
- The person performing Design Acceptance Certification **does not** need to review all these decisions personally

It is key to remember that the person performing Design Acceptance Certification does not actually have to check everything along the way. They need to ensure that all the required processes have been followed and that sufficient rigour was used to develop the ADF software baseline. Documentation is the key and referencing it is a suitable method of documenting that the Design acceptance process has been undertaken.



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PROFESSIONALISE | REORIENT | STANDARDISE | BENCHMARK | IMPROVE INTEGRAL RELATIONSHIPS | LEAD REFORM IN DEFENCE

I will reiterate a key point from an earlier slide.

We need to readjust our focus and recognise that Design Acceptance **is a process and not an action**. It needs to start when the requirements are being defined and it must be coordinated.

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Where to From Here?

- Lower level details
 - Define meeting attendance
 - Define detailed responsibilities for TLOs
 - Update duty statements
 - Implement changes
 - Work with DP
- Application to Mission Planning Systems

Whilst these concepts are already being worked within TFSPPO, the next step is to:

- Take a critical look at the software lifecycle and make determinations relating to which meetings are required or optional attendance.
- What artefact review is required and exactly how will it be documented and by whom. What will occur when there are unresolved issues.
- With the assistance of the various TLOs, update the duty statements to encompass the required change of focus, if any, in their duties.
- Work with the current TLOs to start implementing the changes to assist in Design Acceptance of software that is currently in development.
- Work with DP to implement the required changes for the postings in support of TLOs. This is especially important where pre-posting experience may be required in support of the selected candidate.

The final piece of the puzzle is to include mission planning systems in this process. This is becoming more vital as additional capabilities are being realised through mission planning initialisation files. For example, enhanced multi-source integration (E-MSI) is already enabled in the RAAF Classic Hornet software, however it requires an initialisation bit to be set by the mission planning software prior to functioning. This change is not in the current Joint Mission Planning System (JMPS) release but will be released with the next iteration of JMPS software.



Brief Case Study – 21X

- Multiple players in 21X
 - AIR 5418
 - HUG 2.3
 - JP 2089
 - Sustainment
- No overarching compliance plan
- 21X critical for HUG 2.3 OT&E
- PEM retrospectively gathering evidence from multiple sources

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As there are multiple players in 21X, there has been considerable confusion from the US Navy on who to take direction and priority from. At China Lake the following representation is provided:

- RAAFSCO – responsible for the overall coordination of requirements into the AWL and delivery of data from the AWL.
- HUG 2.3 RPT – responsible for maintenance of the aircraft at China Lake in support of HUG 2.3 and AIR 5418 ground and flight testing.
- AIR 5418 Resident Engineer – responsible for the progression of JASSM functionality in the 21X SCS.

This can lead to confusion in the Australian FMS Support team as to who to get direction from.

Initially AIR 5418 and HUG 2.3 had roughly equal share of requirements effort, HUG 2.3 then pushed some from 21X to 23X and de facto handed case management to AIR 5418 (represented by the Weapons Integration Manager at TFSPPO). What they did not do though was to pass all information through that contact. This is also true of other players in 21X. The initial plan for 21X was to gather all the required data but not release 21X to the fleet. Instead AUSTBLK7, the TFWSSF software based on 21X would be released in support of OT&E and full fleet release. Due to some issues with maturity of functionality, two additional major builds were added to 21X which affected schedule, but no initial schedule relief for the AUSTBLK7 was provided.

To make matters more difficult, not all deliverables were making it to the TFSPPO repository for software information, TFWSSF. What all this meant was that no one element in TFSPPO had a complete picture of 21X.

Due to various reasons, no overarching compliance plan for 21X was developed, instead a generalised plan to use the RPT at China Lake was instigated. While this has provided valuable results, the team did not look at any functionality that was not AIR 5418 or HUG 2.3 related unless it affected the Safety of Flight of the aircraft. There was also a lack of focus on JMPS.

It transpired that 21X is critical to support the OT&E for HUG 2.3 and that Design Acceptance would be required in support of this. The HUG Project Engineering Manager is now trying to gather evidence in support of the Requirements Validity. TFWSSF would normally assist in this, however they are resource limited due to the need to release AUSTBLK7 (which is based on 21X) which is required in support of HUG 2.3 IOC.

We are now in the end game, time compressed and underprepared. As a result there has been an affect on:

- HUG 2.3 IOC dates as AUSTBLK7 is required for this milestone and OT&E must be completed before IOC
- AIR 5418 schedule as key capabilities will not be in AUSTBLK7 due to them arriving in a later build of 21X which is not included in the AUSTBLK7 baseline due to schedule implications.
- Delay in AUSTBLK7 due to the additional builds introduced to support HUG 2.3 and AIR 5418.

A good plan initially would most likely have avoided many of these adverse outcomes, or at the very least, allowed for replanning earlier. A good plan would also have identified any gaps in coverage for Design Acceptance and allowed timely resolution before they became major issues affecting schedule at the end game.



Questions?

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