



MILITARY DESIGN ORGANISATION

From nowhere to 21J A Journey to Compliance

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“What’s On the Cards?”

- Opening Admissions
- The Aim
- Background
- Why we set out on this journey
- Where we were
- Where we wanted to go
- The Journey so far
- Where we are now
- Where to from here
- The issues

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Opening Admissions

and design jokes

- Slides have no polish
 - Most of you are engineers so you should have low aesthetics (Hogan's)
 - They are more for my benefit, not yours, they will keep me on track.
- I have only done high level requirements
 - There has been no requirements workshop
 - I have not verified them against a Certification Standard
 - There has been no independent verification of compliance

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The Aim (Requirements)

- To tell you:
 - Where we (the AIR MDO) were.
 - Where we are now.
 - How we got there.
 - Where we are going to from here.
 - Why we are doing it.

(not necessarily in that order, and definitely not as succinctly)

- Why:
 - In case you are thinking of doing the same



Background (1)

- In June 2013 the RAAF (ADF) briefed the RNZAF on their Technical Airworthiness Regulatory Reform Programme.
- That programme identified that the RAAF set of Technical Airworthiness Regulations were safe but:
 - There was over regulation
 - They were poorly structured
 - Were inconsistent in interpretation
 - Were Inefficient in implementation and
 - Required burdensome certification and compliance activities





Background (2)

- The ADF identified Best Practice Regulation as:
 - Purposive
 - Hazard Based
 - Outcome focused
 - Simple in language
 - Clear in compliance criteria
 - Recognised by other systems
 - Void of extraneous material





Background (3)

- The ADF wanted a better system and took a long term view. They considered the following models:
 - A bespoke Australian Military solution (Status Quo) (no, no, no)
 - A system based on the Australian Civil System (still bespoke)
 - A system based on an International Military System (if one existed)
 - A system based on an International Civil System (if one existed)





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Background (4)

- The ADF considered adopting ICAO SARPs directly.
- ICAO said “don’t be stupid, adopt EASA framework”
- European Defence Agency were already militarising EASA Requirements and creating European Military Airworthiness Requirements (EMARs).
- EMARs met both International Civil and International Military options,
 - best of the civil regulations,
 - customised for the Military (by Militaries).
- The ADF decided to adopt EMARs, and
 - issued Defence Aviation Safety Rules (DASRs) (their version).



Background (5)

In good Kiwi tradition we

Stole their work and
Called it our own.

Created Defence Aviation Rules (DARs vice DASRs)
(just a copy of DASRs, replace Kangaroo with Kiwi)

Background (6)

Airworthiness Board approved start of transition to EMARs Oct 2015

Paused March 2016 (change of leadership)

Justification re-visited

Started true transition from Mid 2017



Why did we set out on this journey (1)

- The ADF felt they were bad (they were OK).
 - There was a high administrative burden to maintain their rules
 - Always having to justify their level of safety
- We were worse.
 - We had all the same problems
 - Compounded by our small size (double hatting)
- We thought we were safe,
 - but if asked I don't think we could prove it easily.





Why did we set out on this journey (2)

- We knew our system was not good
- We had been trying to fix it through evolution
- Evolution was not working, we needed revolution.
- EMARs was a revolution that
 - Met all requirements.
 - Provided a defensible level of safety.
 - Was internationally recognised.
 - Was ready for use.
 - Someone else had done the hard yards to sell and
 - Was already implementing





Why did we set out on this journey (3)

EMARs

It just made sense!

(to me anyway)





Where were we? (1)

Design Perspective Only

We were almost nowhere:

- We had a Change Classification System:
 - Grade A: Failure of the Part will kill you
 - Grade B: Failure of the part wont kill you
- Pretty coarse, component based, poorly understood, often misused, or incorrectly applied.





Where were we? (2)

Design Perspective Only

We were almost nowhere:

- We had a Basic Leaflet covering design approval
 - A3.1: Engineering Change
 - Requirement
 - Proposal
 - Justification
 - Check and Review
 - Approve





Where were we? (3)

Design Perspective Only

The People:

- Approvers held Delegated Engineering Authority (DEA).
 - A bit like a DDH but no experience in design necessary, just good general engineering and management experience.
- Design Engineers were:
 - “anyone the DEA holder thought was good enough”:
 - No Authorisation System for design engineers.
 - No Formal Assessment System.
 - No minimums





Where were we? (4)

Design Perspective Only

The System:

- We had no Design Organisation (except SSU and SDU)
- We had no Design Assurance System
- We had no Design Handbook
- We had no Design Procedures
- We had some OEM Data and Manuals (eg stress manuals)
- We had some people with work experience in design organisations (AIRBUS, Marshal)
- Some people who had Aerospace Masters degrees.
 - A degree does not make you a design engineer.





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Where were we? (5)

Organisation

- We had no Authority Organisation
 - Just two independent advisors
 - “Airworthiness Authority” held by Chief Engineer and Air Component Commander (Poachers and Gamekeepers)
- We had no compliant organisational structure
- We had no Plan
- Very few had read the rules
- We were pretty much nowhere!

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Where did we want to go? (1)

Design Perspective Only

We wanted to be:

- A fully approved DAR 21 J Military Design Organisation
- With All the Privileges
- Covering all the technologies

Very aspirational



Where did we want to go? (2)

Design Perspective Only

Privileges we got.

- To Classify Changes to Type Design and repairs as 'major' or 'minor'.
- To approve minor changes to Type Design and Minor Repairs
- For P-3K2, C-130H(NZ) and SH2G(I), to approve Major repairs for which we held sufficient type design data.
- To issue information or instructions (such as Maintenance Manual Supplements) under the statement
 “the content of this is approved under the authority of MDOA”
- To declare applicability of data when it has been approved by a recognised airworthiness authority.



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Where did we want to go? (3)

Design Perspective Only

Technologies:

- Metallic and Composite Aircraft Structures
- Electrical
- Avionics
- Mechanical Systems
- Software

(Where competencies are held!)

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Where did we want to go?

Organisation

- We wanted:
 - An independent Airworthiness Authority (organisation)
 - An approved Part 145
 - An approved Part M
 - An approved Part 21 B (Military Type Certificate Holder (MTCH))
 - An approved Part 21 J (Military Design Organisation (MDO))



The Journey (1)

Whole Organisation

The Start

- A lot of talk, reading, meetings and working groups to understand what the NZDF actually needed:
 - Part 145
 - Part M
 - MTCH
 - MDO



The Journey (2)

Whole Organisation

The biggest issue was the unknowns

- Nobody was sure exactly who would end up where.
 - Part 145, mostly clear
 - Part M, partly clear
 - MTCH, mostly unclear
 - MDO, almost opaque (The DEA system confused things)
- More workshops etc.





The Journey (3)

Design Organisation

Key for the MDO

- Structures Unit (SSU) knew they were in the MDO
- Started to do it themselves, rather than have it done to them.
- Forced higher levels through the process
- Drafted MDOE and DASM
- Limited without the appointment of a Head of Design





The Journey (4)

Design Organisation

Key Decisions (Feb 2019)

- Appointment of a Head of Design (me)
- Agreement of units to move to the Air MDO
 - Project Engineering and Certification
 - All of Structures
 - Most of Avionics and Software Support
- Agreement on a transition philosophy
 - Interim Operating Capability (IOC) (at least as safe)
 - Final Operating Capability (FOC) (almost there)



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The Journey (5)

Design Organisation

1 July 2019

- Restructure Occurred (sub units moved to MDO).
- Appointment of Chief of the Office of Airworthiness.
 - Dedicated focus on Transition, MDOE and DASM refinement.
- Fine tuning of transition plan.
 - Old System Delegations.
 - Using new system rules.

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The Journey (6)

Design Organisation

Initial Operating Capability Nov 2019

- Given by the CENG / TAA
 - Still did not have an independent authority.
- A Half Way House:
 - Operate in conformance with the MDOE and DASM
 - Using legacy existing DEA construct.
 - HoD had all the privileges, but could delegate some.
- No Chief of Independent System Monitoring (no QMS)
- Justified as:
 - better than the old system but
 - not yet fully compliant with the new.





The Journey (7)

Design Organisation

While under IOC:

- Identified areas for improvement by exercising the Design Assurance System.
- Allowed rapid changes to be made (even during lockdown)
- Independent Technical Airworthiness Authority (TAA) (Feb 2020)
 - Conduct first review of MDOE and DASM
 - Approve Form 4s for HoD and COAW, without MDOA (chicken and egg)
- CISM was appointed (Feb 2020) (QM of CENG plus CISM)





The Journey (8)

Design Organisation

FOC / MDOA 1 Dec 2020

- Organisational Approval (MDOA) was given by the NZ DAA
- Privileges fully approved
- “Shortfalls for resolution”
 - No Sub Contractor Management System, resolution Nov 21
 - No Flight Test Operations Manual, resolution Nov 22
 - No QMS/ISM, (HoD and COAW to cover) resolution Dec 22
 - Incomplete Authorisation records, resolution Dec 22





The Journey (9)

Design Organisation

We had:

Most of the “Product Assurance” (CVEs)

Very Little of the “Process Assurance” (CISM/QM)

Other Factors

- Design aside we were a new organisation, we also needed:
 - Our own administrative systems
 - Our own identity



Where are we now? (1)

Not much further than at FOC / MDOA

- Change in HoD
- Change in COAW
- Change in TAA
- Change in CENG
- Catching up on Administration
- Focusing on outputs

Where to from Here? (1)

- Continue to deliver design and project management outputs
- Address NZ DAA Shortfalls
- Address internally identified shortfalls
- Continuous Improvement
- Keep learning the system
 - Continually referring to the Rules (DAR part 21, Subparts A, B, D, J, M)



The Issues (1)

Everyone (outside the MDO) thought setting up a design organisation would be easy.

“you already do it”

Not about design, It is about Design Assurance

People Assurance (Office of Airworthiness)

Product Assurance (Office of Airworthiness)

Process Assurance (Independent System Monitoring)

Customer Engagement (non DARs ready organisations)

Still a lot of learning to do for us and them



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The Issues (2)

The MDO is the first, and still the only unit to transition.

No other units at IOC yet.

MDO is learning its system, but also teaching the others ours, and theirs.

Interfaces are difficult, internal customers default to the old system.

We are students but also teachers, and we get it wrong

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The Issues (3)

Military posting cycle

- Continuity
 - New HoD
 - New TAA
 - New Chief Engineer
 - New COAW (me, but I was HoD)





The Issues (4)

Breadth and Depth of Coverage with small teams

- Structures
 - Major and Minor Repairs,
 - Support to Modifications
- Software
 - Level A (SH2G, C130)
 - Level D (ish) (P3 DMS)
- Avionics
 - ADS B Out (C130, 757, SH2G)
 - SATCOM (757 and P3)
 - MAWS (SH2G)



The Issues (5)

Training, knowledge and experience as a 21J

- Our “experts” are still just apprentices
- Limited internal knowledge and experience
- Limited local knowledge and experience
 - Training from Australia (AIRBUS and ADF)
 - Training from UK (Bains Simmons)

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The Issues (6)

Low levels of Qualifications and Experience in Design

- Reasons
 - Posting Cycle
 - Small Numbers
 - New (better) requirements), ie the bar is now higher
- Approach
 - A Conservative Approach
 - Coaching, Mentoring
 - Waivers, and reliance on self assessment

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So How did we do it?

We Were Lucky

Change Management, “The People Side of Change”

It did not happen.

We did not appreciate its importance (or existence)

But was not required inside the MDO because they all wanted to change.

Outside the MDO, they just accepted it.

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So...

We are not there yet.

We have a way to go.

I think we are better than we were.

Time will tell.

Questions?

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