

# QinetiQ Ageing Aircraft Programmes on UK MoD Aircraft

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The QinetiQ logo is located in the bottom right corner of the slide. It consists of the word "QINETIQ" in a white, bold, sans-serif font, set against a dark blue background that is part of a larger graphic element consisting of two overlapping triangles, one purple and one dark blue.

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# Introduction

- For over 10 years QinetiQ have conducted a wide range of Ageing Aircraft Programmes on 20 plus aircraft types.
- Today such programmes are branded '*Platform Airworthiness Reviews*' in recognition of the fact they can be triggered at any point in an aircraft's lifecycle; although most are conducted at the perceived mid-life point, typically 15 years.
- There are 3 elements to the Platform Airworthiness Review
  - Continuing & Type Airworthiness Review
  - Condition Survey
  - Zonal Hazard Analysis





# Continuing & Type Airworthiness Review

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# Continuing & Type Airworthiness Review

The aims of this review are to:

- Conduct a periodic, independent assessment of the airworthiness of the fleet, with particular consideration to ageing.
- Consider individually and collectively the Structural Integrity, System Integrity and Propulsion Integrity activities, often carried out in isolation, in order to assess the effectiveness of the fleet's airworthiness management.
- Undertake an independent review of the continued applicability of procedures, management processes, assumptions and documentation that are in place to ensure airworthiness, integrity and functionality.
- Identify patterns or trends that suggest future airworthiness and integrity problems.
- Identify significant risks to the airworthiness and integrity of the aircraft and to the achieving of its planned OSD.

# Continuing & Type Airworthiness Review – Core Topics

Operation & Usage	Design & Modification Engineering	Continuing Airworthiness Engineering	Type Airworthiness Engineering
Operating Intent & Usage	Design Substantiation	Reliability & Maintainability Data	Integrity Management (Structure, Systems, Propulsion)
Air Occurrences	Ageing Materials	Fault Reporting	Life Extension & OSD Extension Programmes
.....	.....	.....	.....

- Structure
- Systems
- Propulsion

# Continuing & Type Airworthiness Review - Examples

## Change of Usage:

- A review of usage of a helicopter established that future use would include embarked operations as the norm, with specific Sortie Profile Codes derived. Modifications had been initiated to cover flotation gear, but there was no intention by the DO to modify the landing gear.
- The original design assumptions catered for heavy landings on land. Although during aircraft development the DO considered Naval operations, the requirement was dropped, so was not funded for and never implemented.
- Hence, the fatigue implications of a helicopter tied down on a rolling deck for many hours introduced loads into the undercarriage and back-up structure that were not tested for or certified under the original landing gear DDP, or for the back-up structure.
- QinetiQ recommended that the PT determine how the DO intend to qualify or demonstrate that the undercarriage and back-up structure are suitable for the proposed change of use.

# Continuing & Type Airworthiness Review - Examples

## Static Type Record:

- A review of the Static Type Record of a light trainer aircraft showed that increases over time of crew boarding mass had been analysed by the DO, which resulted in a shortfall in wing strength.
- To respect the original design loads the DO reduced the manoeuvre limitations.
- The review found that the Type Authority had failed to transpose these limitations into the RTS, resulting in the aircraft being flown out of design limits.

# Continuing & Type Airworthiness Review - Examples

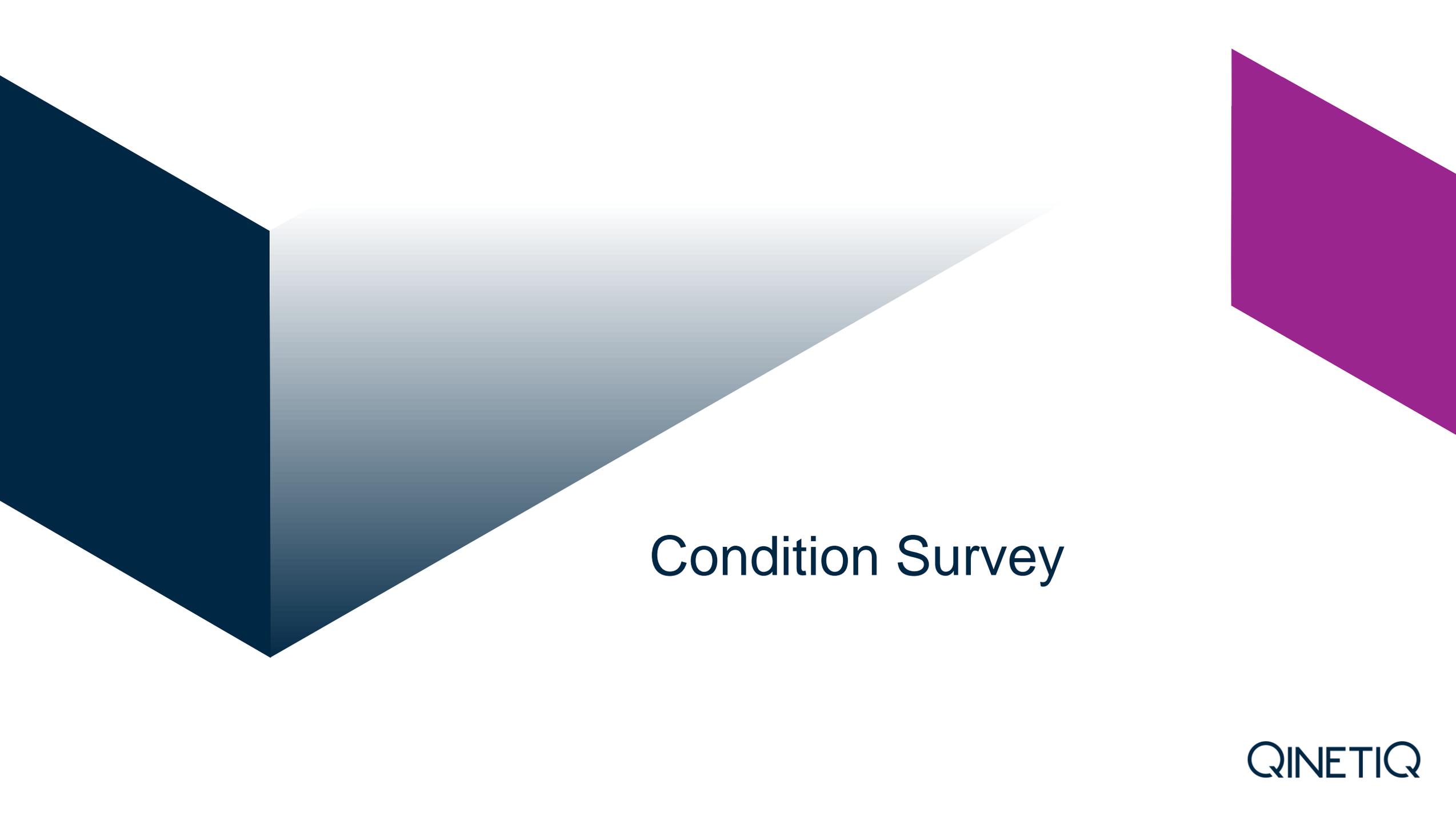
## Environmental Damage Prevention and Control:

- During a recent review it was found that the mandated EDPC Working Group had not been held for over 3 years. As corrosion had been found during the Condition Survey, further scrutiny was applied to the process for management and rectification of corrosion.
- It was subsequently found that the DO was unaware of the extent of the corrosion on their aircraft. This was entirely due to the break-down in the EDPC process that should have been managed by the Project Team and the CAMO.
- QinetiQ reported to the Project Team on its findings; that there was little or no EDPC policy being enacted and that the aircraft (one in particular) were suffering from extensive corrosion.
- As a result the EDPC Policy and Working Group have been re-invigorated and improvements are being seen in the material state of the fleet.

# Continuing & Type Airworthiness Review - Examples

## Life Extension:

- A review of evidence to justify a life extension of a fast jet trainer from the original 6,000 FH/20 year life, found several issues around lifing of equipment:
  - A fuel booster pump was assessed and cleared for continued use to 10,200 hrs provided that the wiring was replaced at the earlier of 6,000 hrs or 20 yrs. The wiring had never been replaced.
  - Flexible hoses found on aircraft during the Condition Survey were fitted in 1976, 40 years after fitment and still on the aircraft with no supporting qualification evidence.
  - A review of the recording of component lifing data found errors in a very small sample between log card records and the platform's Configuration database used to record airframe and equipment lifing, leading to loss of configuration control.



# Condition Survey

# Condition Survey - Overview

- The Condition Survey is a detailed, independent physical examination of the condition and husbandry standards of representative aircraft from the fleet.
- As acknowledged within RA5723 this should be carried out by experienced engineering tradesmen, but whom are not currently employed on aircraft type, highlighting the need for a level independence.
- The results of a Condition Survey can be used for strategies employed by the aircraft's Continued Airworthiness team to inform training, improve the maintenance policy and recommend design improvements.
- A Condition Survey ultimately measures the effectiveness of maintenance standards/policy and will lead to subsequent improvements in Airworthiness and safety.
- At the 2016 AA&S Conference we presented a series of common themes previous Condition Surveys had revealed. These themes continue to emerge during more recent surveys.

# Condition Survey - Themes

## Contamination

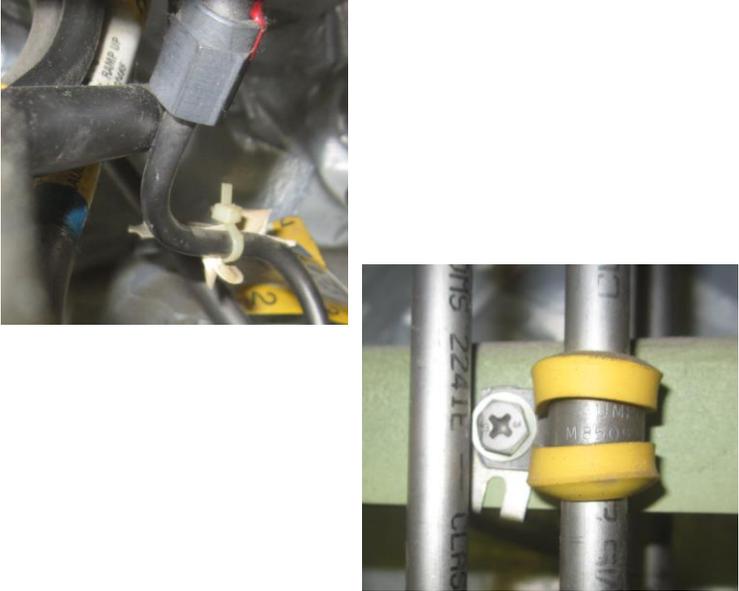
- Fire blankets soaked in oil



Reduction in safety

## Insufficient Pipe Clearance

- Predominantly with hyd system



Loss of availability  
Flammable material [fire hazard]

## EWIS Loom Clearance

- Exposure of conductor



Loss of availability  
Ignition source [fire hazard]

# Condition Survey - Themes

## Pooling of Water

- Attributed to environment and aircraft wash



Reduction in safety

## Corrosion

- Identified on numerous systems



Loss of availability  
Reduction in safety

## Ageing Effects on Connectors

- Corrosion and cracking



Loss of availability  
Reduction in safety



# Zonal Hazard Analysis

# Zonal Hazard Analysis - Overview

- Although not part of the Ageing Aircraft Audit many Project Teams have opted to include a ZHA within the scope of an Ageing Aircraft Programme.

*“A Zonal Hazard Analysis will validate the design for potential undesirable system interactions based on system composition within a zone and/or adjacent zone.” RA5721*

- ZHA is recognised by the UK Military Aviation Authority as an important technique for identifying and analysing credible zonal hazards, and should be used to inform the platform Safety Case.
- At the 2016 AA&S Conference we presented a series of examples previous ZHA projects had revealed. These themes continue to emerge during more recent surveys.

# Recently Identified Zonal Hazards

## Grease Accumulation in LOX Bay

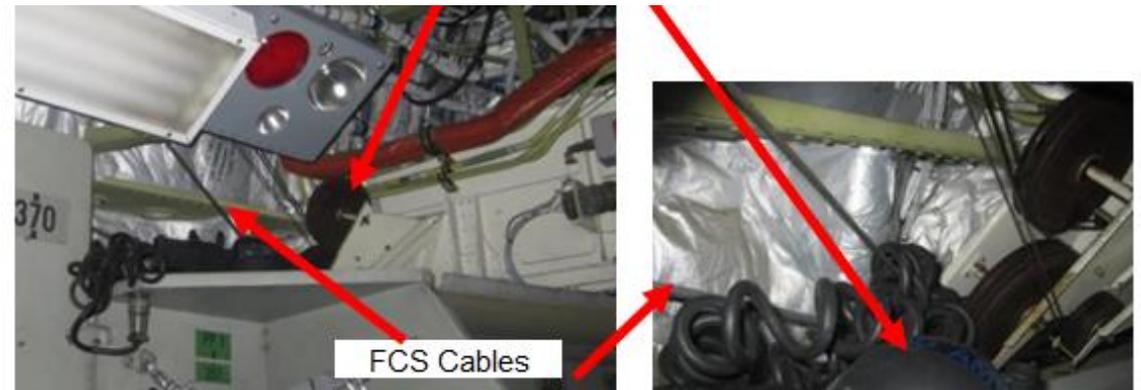


**Threat** – Explosion in LOX bay

### Advice

- Awareness campaign to raise the issue to maintenance
- Issue Urgent Technical Instruction to check the fleet
- Ensure zonal hazard is captured and managed in Haz Log

## Cargo bay light stowed close to FCS cables



**Threat** - Potential control restriction

### Advice

- Engage with DO to establish better stowage location
- Eliminate the zonal hazard

# Recently Identified Zonal Hazards

## Loose Flight Deck Armour

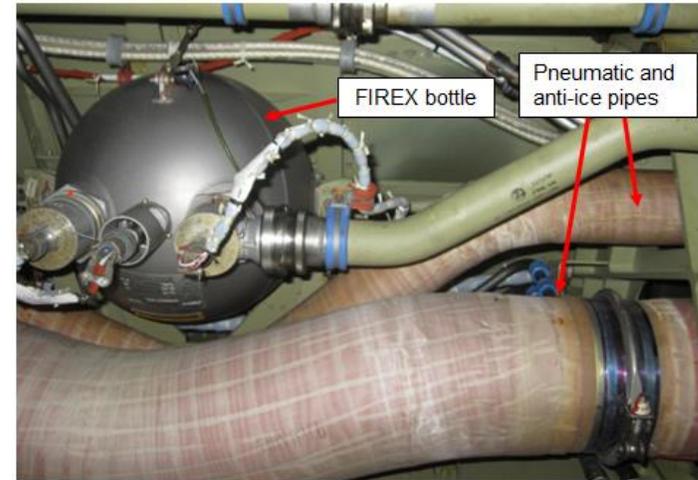


**Threat** – Potential control restriction

### Advice

- Awareness campaign to raise the issue to maintenance
- Issue Urgent Technical Instruction to check the fleet
- Ensure zonal hazard is captured and managed in Haz Log

## Hot Air Pipes Close to FIREX Bottle



**Threat** - Potential release of high energy debris

### Advice

- Engage with DO to establish if leaked hot air from system pipes could impinge on the FIREX bottle causing explosion
- Ensure zonal hazard is captured and managed in Haz Log



# Summary

# So what about Platform Airworthiness Reviews in Australia?

## Why conduct a Review if not mandated?

- Benefits detailed within this presentation:
  - Increase in safety
  - Increase in availability
  - Reduced through life costs

## Why chose independence?

- Advantages that come with a *'fresh pair of eyes'*
- OEMs have accepted recommendations and embraced the opportunity for improvement
- No conflict of interest
- Independence is one of the key principles discussed in Haddon-Cave Nimrod Review *"to ensure an effective safety and airworthiness regime in the future"*

## Why QinetiQ?

- Pedigree attained over 10+ years of Ageing Aircraft Programmes
- Over 20 successful programmes completed covering fast jet, helos and large aircraft
- Approved process endorsed by the UK MAA
- Willingness to share good practice and collaborate with primes

## To Conclude

*“A Platform Airworthiness Review will lead to a better understanding of how the aircraft is ageing. Recommendations aimed at improving: ”*

### Safety

Raising of Special Instructions  
some of them ‘Urgent’, based on  
specific findings during the surveys

Integration of the results of the ZHA  
into the aircraft Hazard Log and  
Loss Model

### Availability

Using the results of the Platform  
Airworthiness Reviews to provide  
material for maintainer awareness  
campaigns

Amendments to Technical  
Publications to enhance  
maintenance procedures

### Cost of Ownership

Anticipated reduction in through-life  
cost of ownership as a result of  
improvements in effectiveness and  
efficiency of maintenance regime

Provide assurance towards the Safety, Airworthiness and Integrity of the aircraft as it Ages

# Forward Plan

- In 2017 QinetiQ Australia and QinetiQ UK will be combining their shared ageing aircraft knowledge and experience, working together to ensure that a best practice approach is available to its customers globally, in collaboration with the commonwealth and where appropriate their respective Primes
- QinetiQ considers the collaborative approach has many benefits:
- The Prime will:
  - Have reach-back to design data
  - Have historical platform knowledge
- Whereas QinetiQ will:
  - Provide the necessary independence
  - Share the experiences and knowledge attained during 10+ years of Programmes
  - Share process, procedures and skillsets for a solution endorsed by the UK MAA

Questions  
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