

## **Tornado Safety Case**

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**Author:** Prepared and managed by the Tornado IPTL on behalf of the RTSA

**Version:** v1.0 - Baseline

**Description:** This safety case (SC) seeks to capture and document the safety rationale underpinning the overall Tornado project safety management arrangements. It shows the contributions of the core project stakeholders and all other safety contributors together with their respective roles in assuring the safety of use of the Tornado weapon system in RAF service and the appropriate discharge of MoD responsibility under the project's tri-national support arrangements.

**Notes:**

- 1) The primary focus of this Goal Structured Network (GSN) of the baseline SC is the representation of the high-level safety case for peacetime, RAF operations in accordance with the RTS. The baseline SC does not embrace operation of service aircraft with service deviations approved by Cmdt Air Warfare Centre or the MoD control of Development flying by contractors.
- 2) At initial issue, the baseline SC case seeks to document, as far as is practicable, all IPT contributions to system safety within a broader, illustrative, framework showing the safety activities of and interfaces with other project safety stakeholders, in particular the RTSA, AOA and operating units.
- 3) Whilst only generalised representations are currently provided for some aspects of the RTSA and AOA safety roles. The intent is that these areas are to be progressively developed and documented by the responsible parties. Once completed the safety case will then inform and support the Tornado Safety Management Panel in managing and co-ordinating the overall project safety management system.
- 4) Where goals are expressed in the past tense, these refer to activities such as the initial design and production of baseline aircraft which has now been completed and which forms part of the legacy safety argument
- 5) At some future date, this Tornado SC may be subsumed into a comprehensive Defence Aviation Safety Case, as part of the ongoing development of the UK's Defence Aviation Safety Management System (DASMS)

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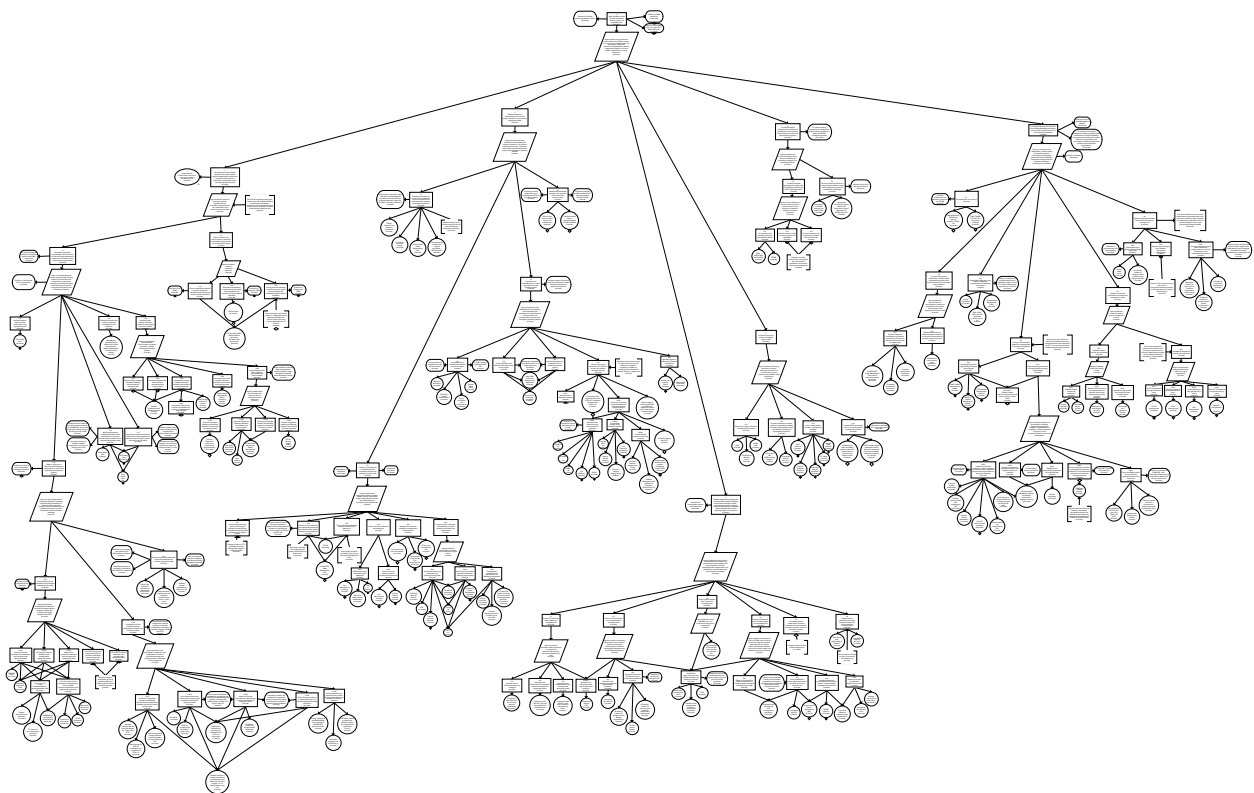
## Overview of Safety Case

The overall argument is structured on the premise that satisfaction of the top-level claim that "MoD operations of the Tornado operational weapon system are acceptably safe" can be demonstrated providing that:

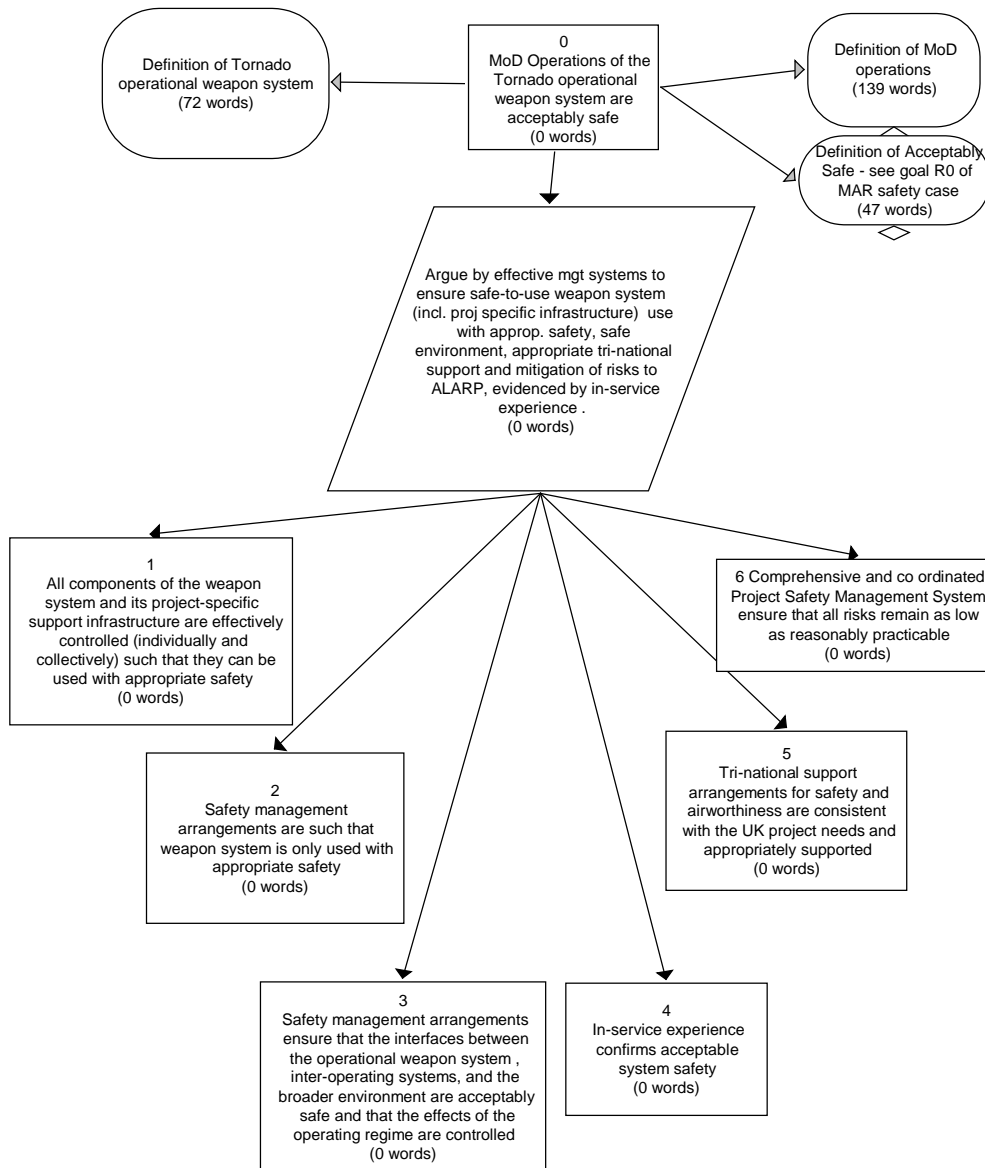
- All components of the weapon system and its project specific support infrastructure are controlled such that they can be used with appropriate safety
- Safety management arrangements are such that the weapon system is only used with appropriate safety
- Safety management arrangements ensure that the interfaces between the operational weapon system and the broader environment are acceptably safe and that the effects of the operating regime are controlled
- Tri-national support arrangements for safety and airworthiness are consistent with UK needs and appropriately supported
- There are comprehensive and co-ordinated Project Safety Management Systems to ensure that all risks remain ALARP

The overall argument is underpinned by a further claim that in-Service experience confirms acceptable system safety which draws upon the extensive flight experience of Tornado in UK, German and Italian service use and the sound safety record.

The following diagram indicates the overall shape and size of the supporting arguments and evidence. Each area is addressed in more detail in subsequent sections.



## Section 0: Top Level (Goal 0)



### Goal 0: MoD Operations of the Tornado operational weapon system are acceptably safe

**Context (Goal 0):** Definition of Tornado operational weapon system

The Tornado operational weapon system comprises the Tornado weapon system, as defined at goal R0 of the MAR safety case, together with associated rigs, simulators and training aids that are specific to the project. It also includes all RAF general purpose equipments, airfield infrastructure, information and management systems, necessary to undertake Tornado operations under the terms of the RTS. For the purposes of this safety case, the operational system is also deemed to include those RAF air and ground crews, support staffs and any contractors involved in the maintenance/support of the aircraft and its wider support environment.

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(This requires all aspects of Human Factors implications (not just those of the man-machine interface) to be addressed as part of the design and operating procedure management arrangements.)

**Context (Goal 0):** Definition of MoD operations

For the purposes of this safety case, MoD operations are deemed to comprise:

*all peacetime flying and operations by RAF service crews (including the loading, carriage, and release/delivery of live weapons and stores for training purposes) as defined at goal R0 of the MAR/RTS safety case*

*all associated repair/maintenance/support activity at 1st to 4th line*

*the through life safety of disposal of equipment and materiel relating to the operational weapon system.*

*In addition to the above national safety responsibilities, MoD responsibilities in the operation of Tornado also embrace the effective discharge of national commitments to the NETMA and the tri-national management programme, as set out in MoUs, contracts and procedures, and the continuing assurance that the tri-national activity contributes to and supports the safety of UK operations.*

*This initial issue of the safety case does not seek to address:*

*The safety of operations of development aircraft (e.g. those operated by Panavia and QinetiQ under MoD airworthiness (AvP67) regulations).*

*The safety responsibilities relating to airworthiness of export aircraft and Italian lease aircraft.*

*Specific safety scenarios and hazards associated with use of Tornado in an operational theatre or other CTW conditions.*

*Any flying for Service trials purposes outside the RTS e.g. with aircraft having SDs approved by Cndt AWC.*

*These additional dimensions of the overall safety case may need to be addressed as part of the ongoing development and maintenance activity.*

**Node Status: Development required to embrace above aspects**

**Context (Goal 0):** Definition of Acceptably Safe - see goal R0 of MAR safety case

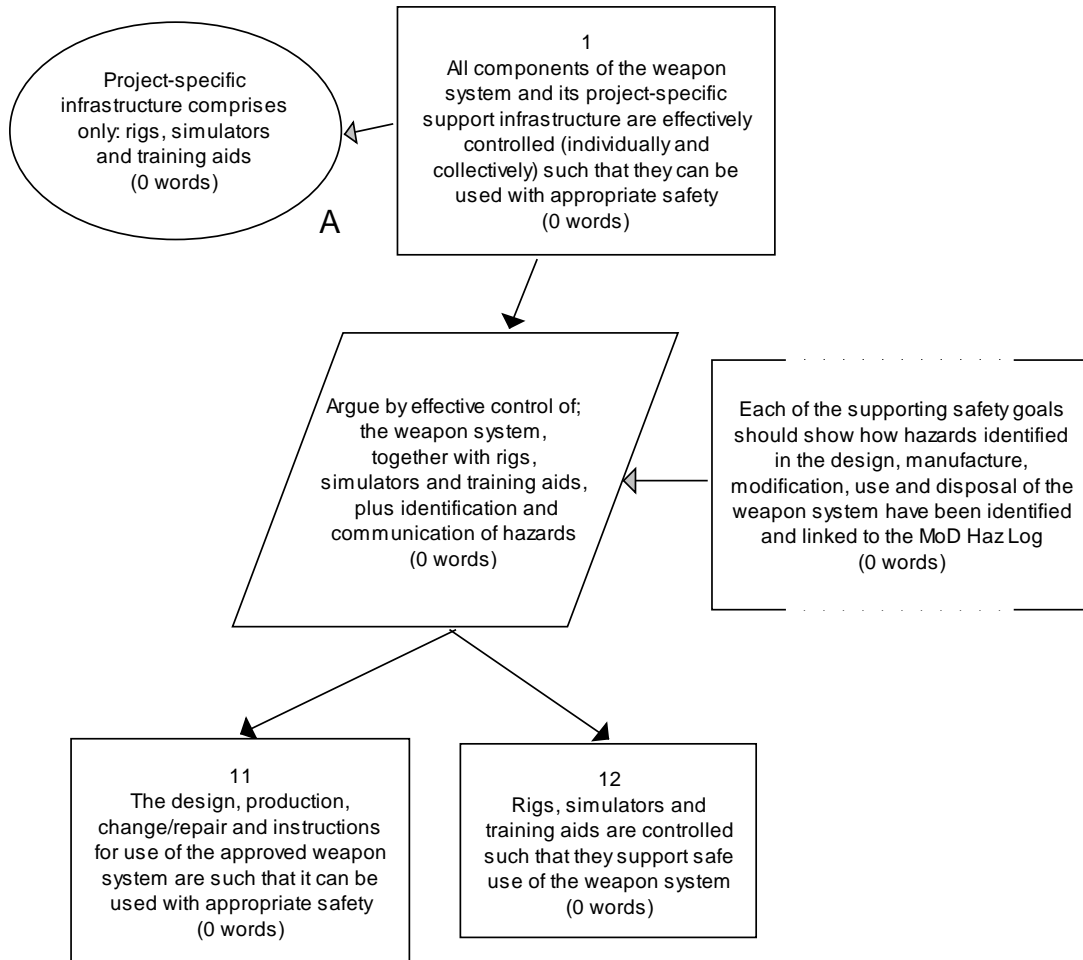
*Project safety targets are still under review by the IPT and TSMP. Once the definition of acceptable safety of the Weapon System has been fully established for the MAR/RTS safety case, there will be a need to consider whether the extended bounds of the operational weapon system as addressed in this safety case require any additional factors or requirements to be considered. For example, it may well be that the targets for control of environmental risk and 2nd/3rd party risks are more appropriate to this higher-level safety case than to the MAR/RTS SC.*

**Node Status: Development required to define agreed safety targets**

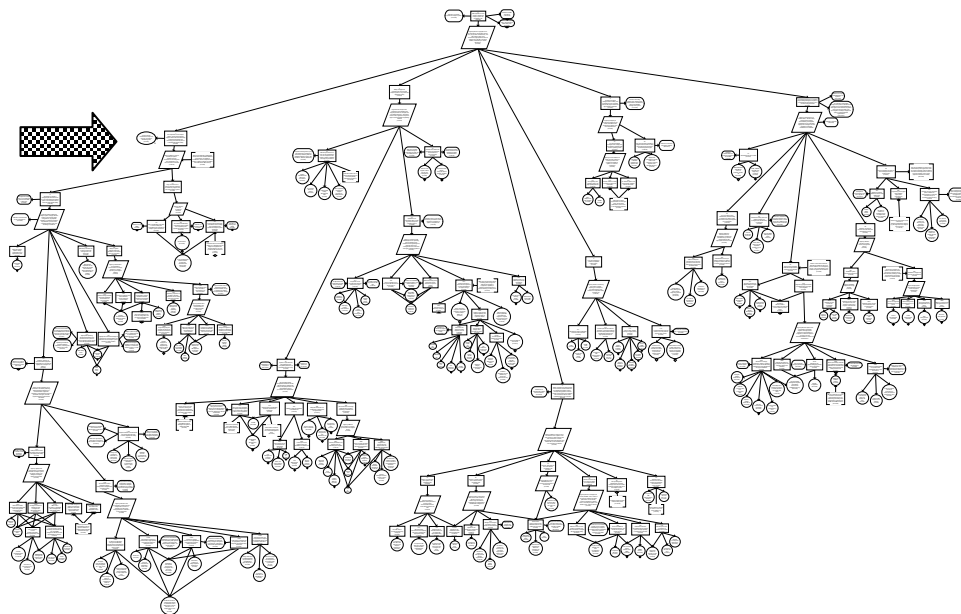
**Strategy (Goal 0):** *Argue by effective mgt systems to ensure safe-to-use weapon system (including project specific infrastructure), use with appropriate safety, safe environment, appropriate tri-national support, mitigation of risks to ALARP, and evidenced by in-service experience.*



# 1 Section 1: Safe Weapon System (Goal 1)



## Location within Safety Case



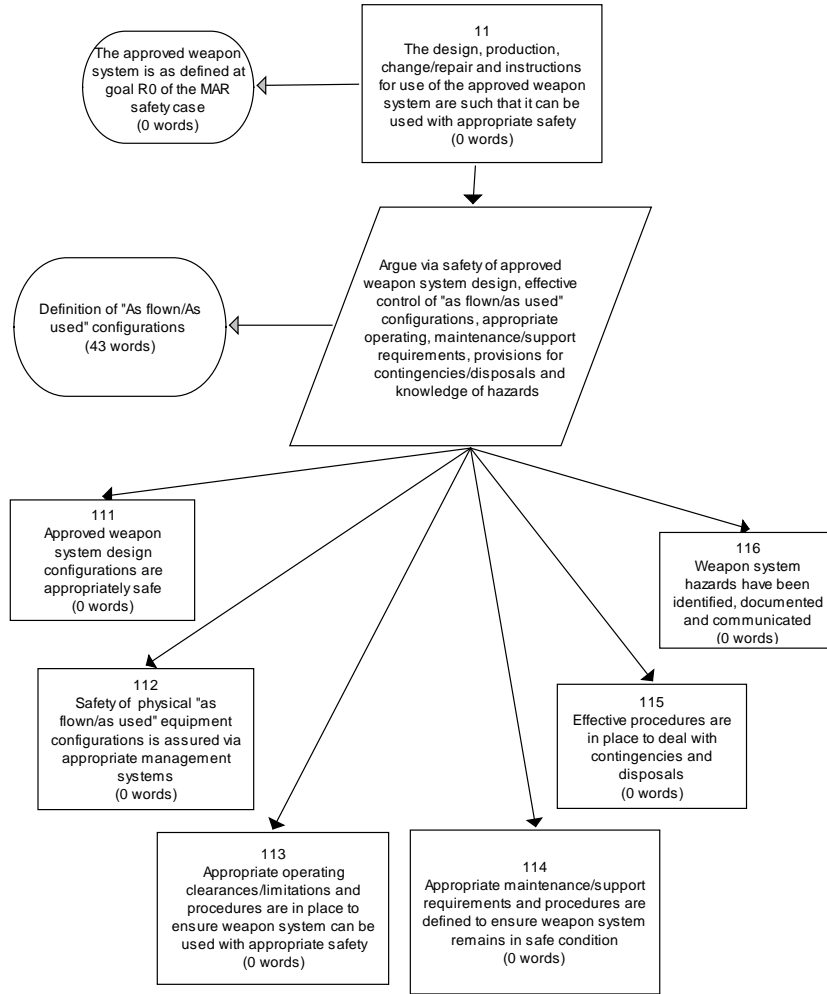
**Goal 1: All components of the weapon system and its project-specific support infrastructure are effectively controlled (individually and collectively) such that they can be used with appropriate safety**

**Assumption (Goal 1):** *Project-specific infrastructure comprises only: rigs, simulators and training aids*

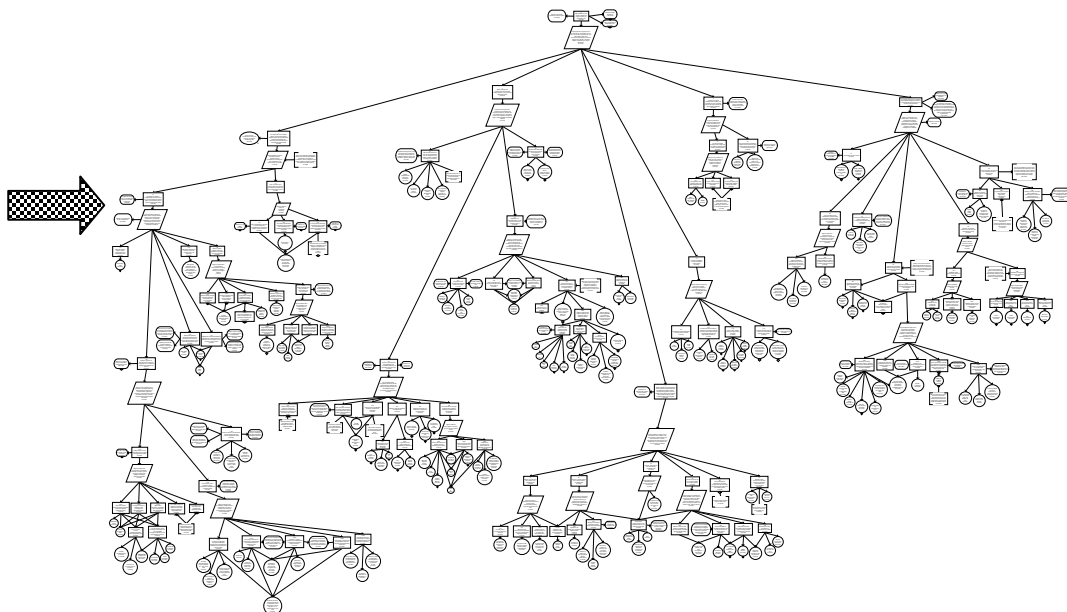
**Strategy (Goal 1):** *Argue by effective control of; the weapon system, together with rigs, simulators and training aids, plus identification and communication of hazards*

**Note (Assumption (Goal 1)):** Each of the supporting safety goals should show how hazards identified in the design, manufacture, modification, use and disposal of the weapon system have been identified and linked to the MoD Haz Log

# 1.1 Design, production and repair (Goal 11)



## Location within Safety Case



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**Goal 11: The design, production, change/repair and instructions for use of the approved weapon system are such that it can be used with appropriate safety**

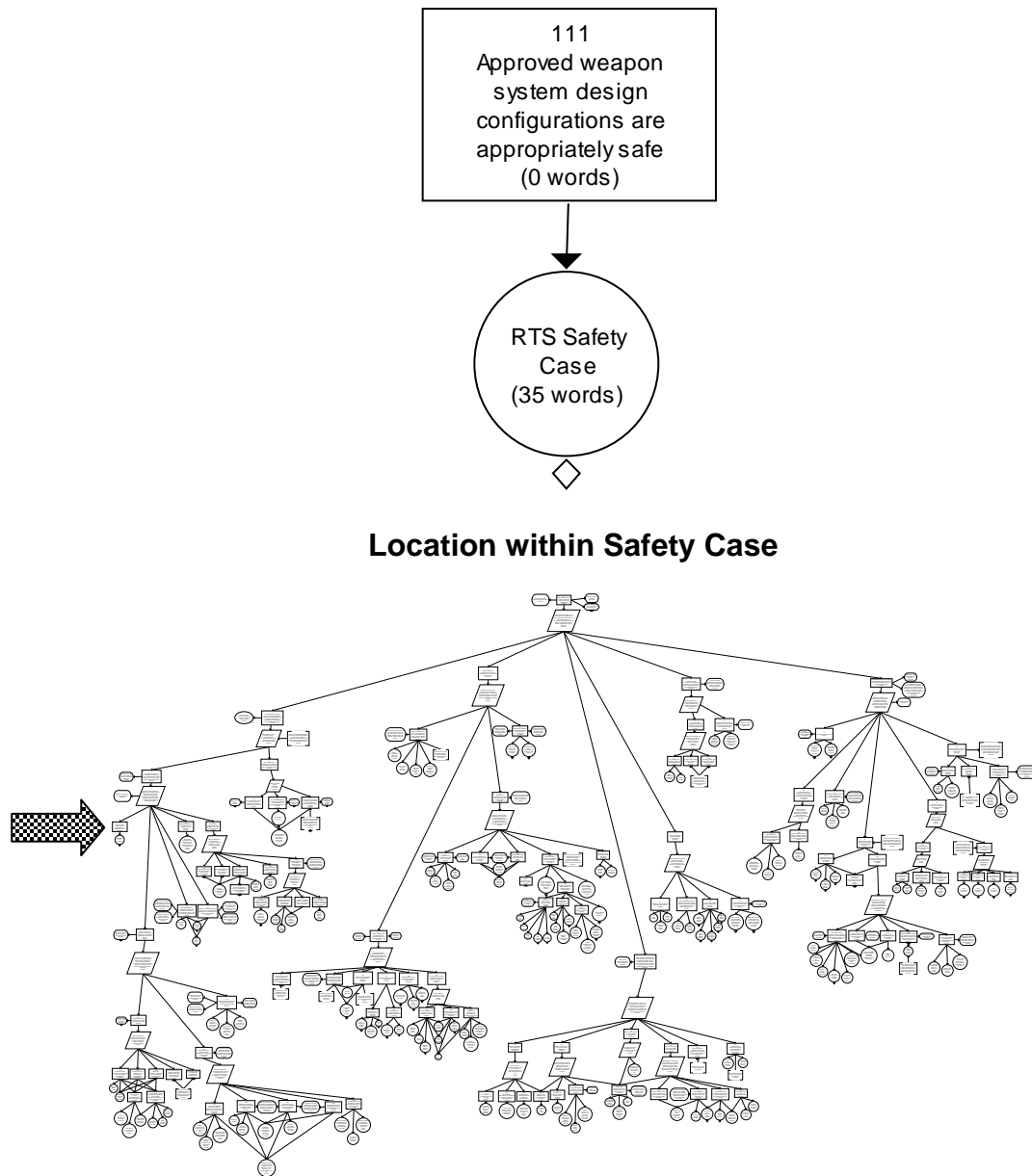
**Context (Goal 11):** *The approved weapon system is as defined at goal R0 of the MAR safety case*

**Strategy (Goal 11):** *Argue via safety of approved weapon system design, effective control of "as flown/as used" configurations, appropriate operating, maintenance/support requirements, provisions for contingencies/disposals and knowledge of hazards*

**Context (Strategy (Goal11):** *Definition of "As flown/As used" configurations*

*As flown/As used configurations are the weapon system standards existing at operational units. They comprise the contractor's initial design/production baseline standards together with all concessions/deviations, approved RBD and RAD modifications, service engineered changes and repairs affecting the air-vehicle (including weapons/stores), plus all project specific ground support infrastructure, software support and other items required to undertake service operations as defined within the ADS.*

## 1.2 Approved design safe (Goal 111)



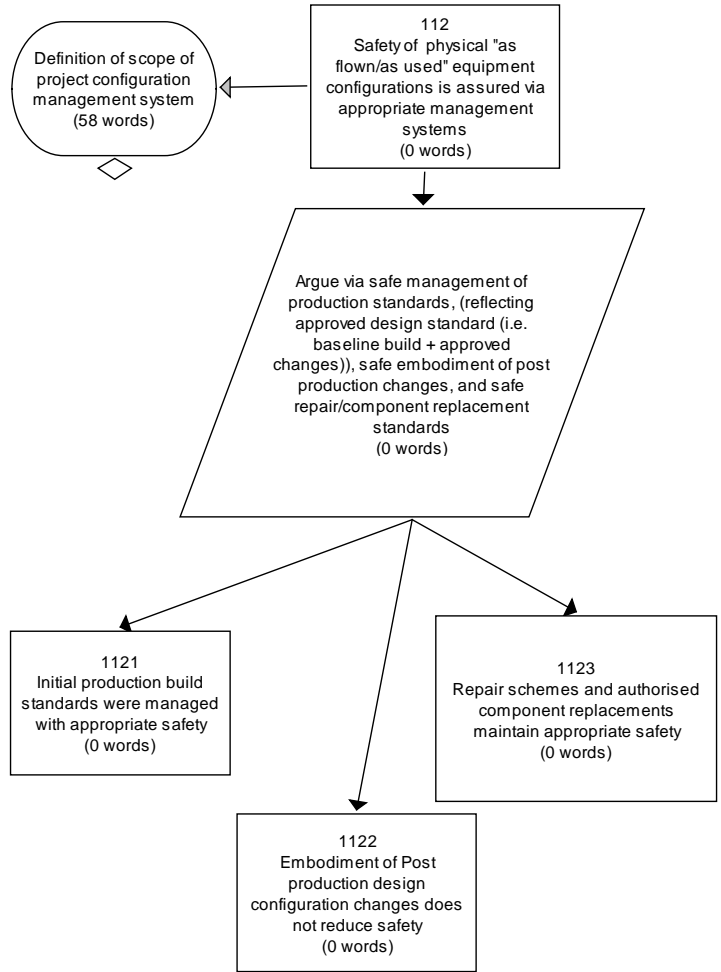
**Goal 111: Approved weapon system design configurations are appropriately safe**

**Solution (Goal 111): RTS Safety Case**

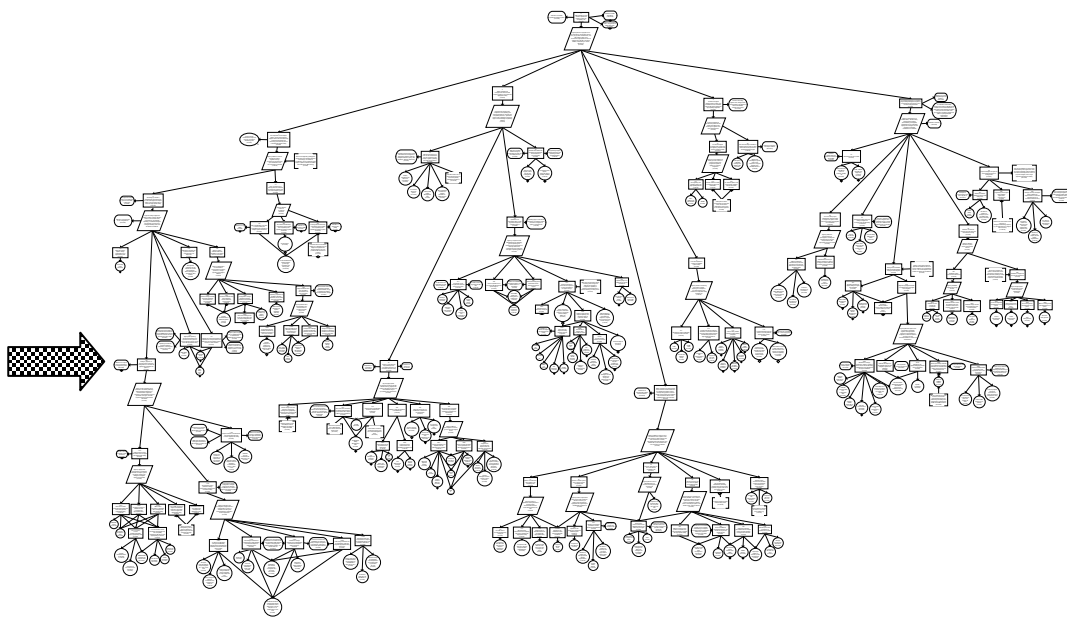
The RTS safety case will comprise the MAR safety case together with the RTSA safety case for Service Deviations and the Aircrew Publications. These RTSA safety responsibilities are yet to be fully analysed and documented

**Node Status: Development required to complete RTS Safety Case**

### 1.3 Safety of "as flown/used" equipment (Goal 112)



#### Location within Safety Case



## **Goal 112: Safety of physical "as flown/as used" equipment configurations is assured via appropriate management systems**

**Context (Goal 112):** Definition of scope of project configuration management system

*The configuration management system comprises and is defined by:*

*IPT - Tornado Configuration Change Management Procedure (LI-BS013)*

*NETMA- Tornado Modification Procedure*

*Panavia Configuration Management process*

*Turbo Union Configuration Management Process*

*Other IPT (e.g. GFE and GSE) Configuration Management Procedures*

*Business Agreements and Customer Supplier Agreements defining the co-ordination of IPT configuration control activity*

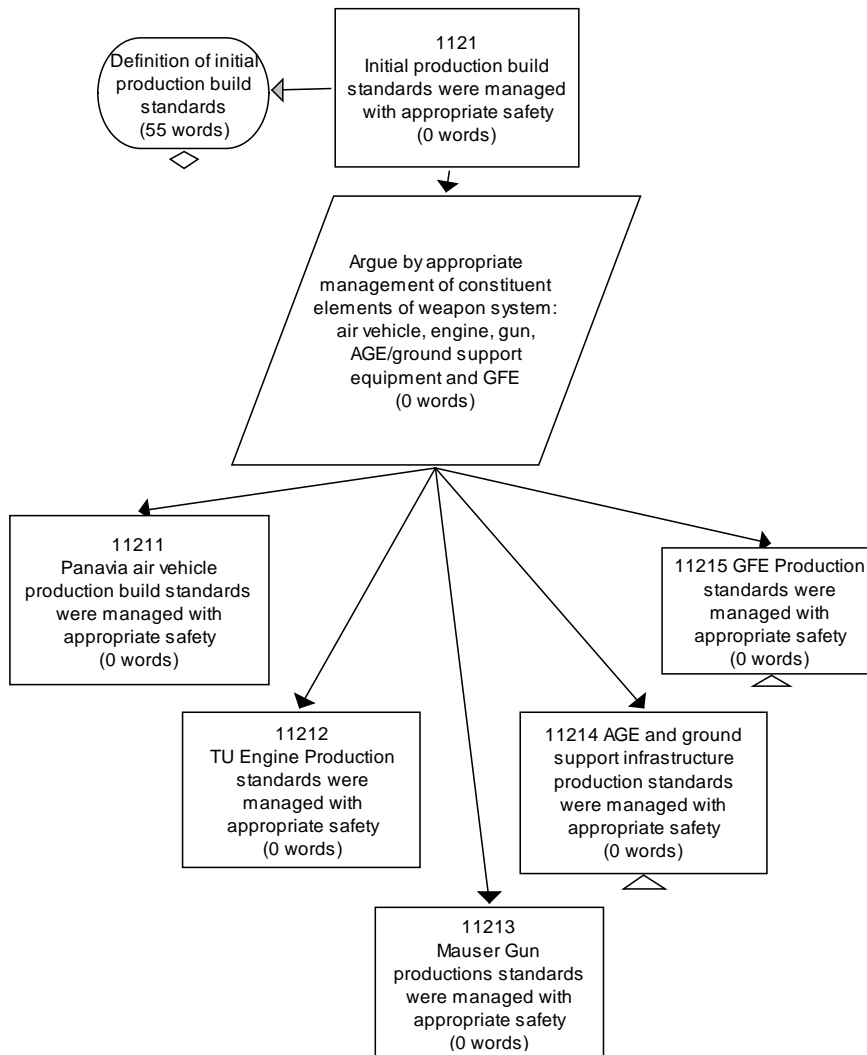
*IPT and AOA Fleet Management arrangements for control of operational and reserve fleet assets*

*References for the above will be added as they are located/identified*

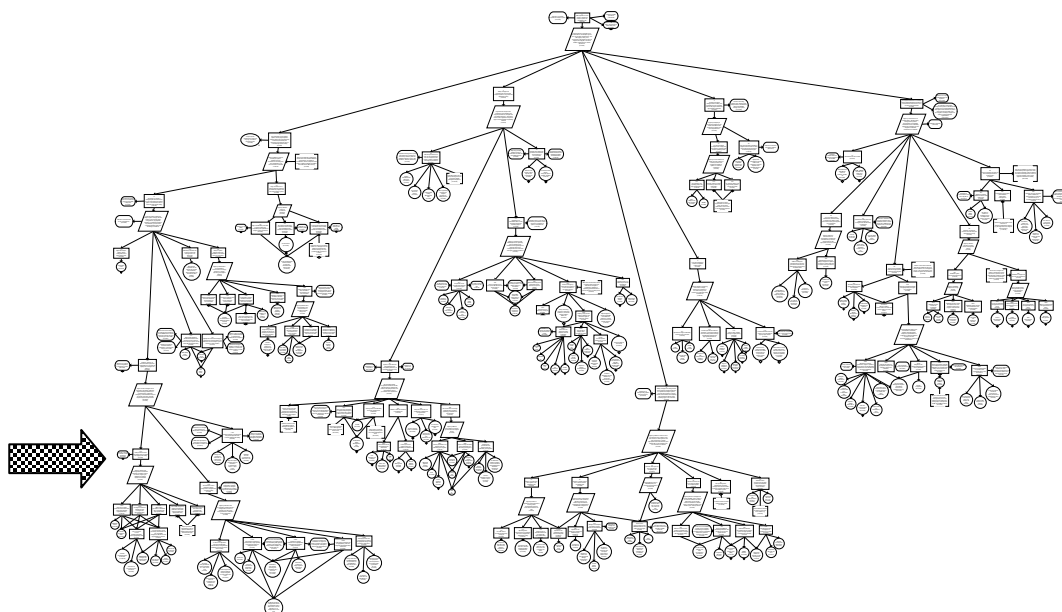
### **Node Status: Development required to complete above references**

**Strategy (Goal 112):** Argue via safe management of production standards, (reflecting approved design standard (i.e. baseline build + approved changes)), safe embodiment of post production changes, and safe repair/component replacement standards

## 1.4 Initial production standards (Goal 1121)



### Location within Safety Case



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**Goal 1121: Initial production build standards were managed with appropriate safety**

**Context (Goal 1121):** Definition of initial production build standards

*Production build standards for the aircraft comprise the production contract baselines together with all approved Retrofit Before Delivery and Deviations/Waivers as defined in the Panavia Modification Registers for the batch/block standards and individual aircraft acceptance standards.*

*Pan Mod Registers are as defined in the Series Aircraft DDPs for IDS/ECR (M/CF/TOR/1423) and FMk2/Mk3(PN1285)*

*Production build standards for the engine MPL 511 (RB199 Mk103) and MPL 521 (RB199 Mk 104)*

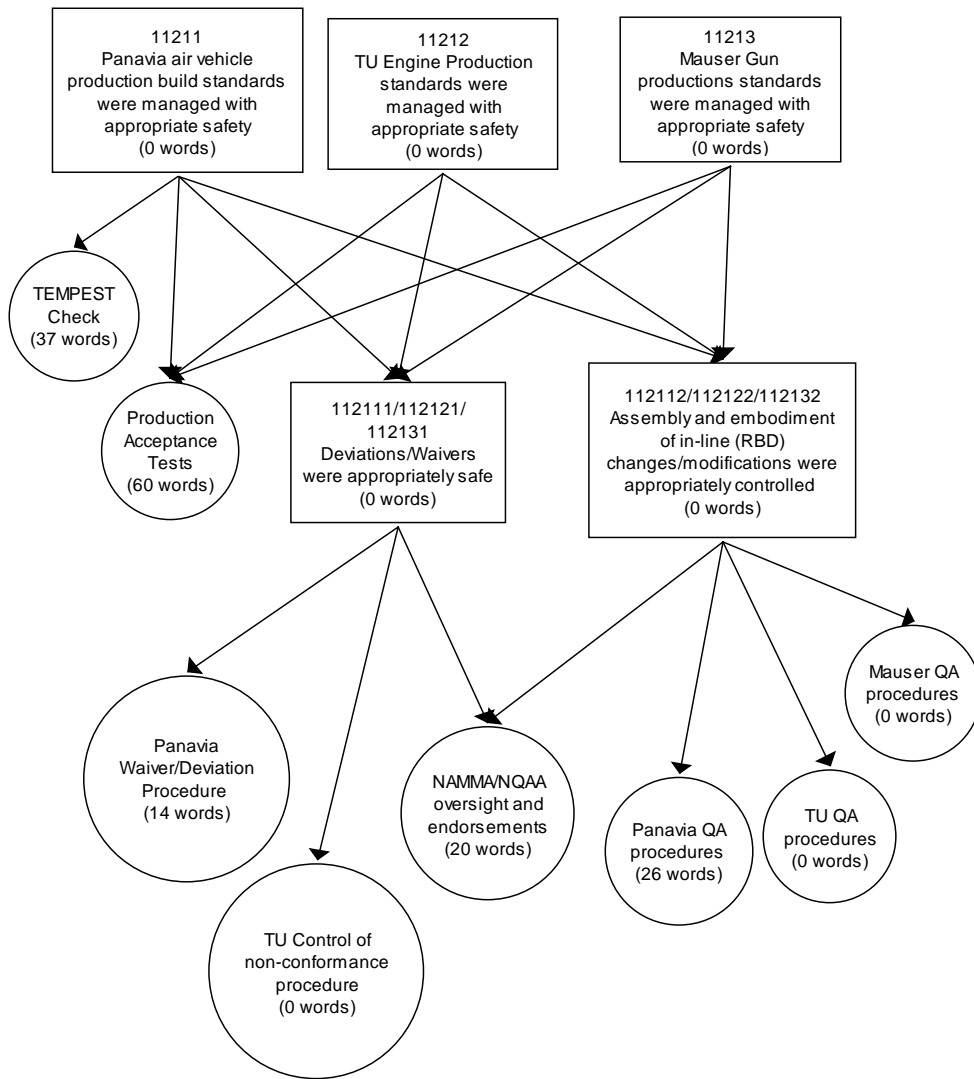
*Production build standards for the AGE are defined in .....*

*Production build standards for the GFE are defined in .....*

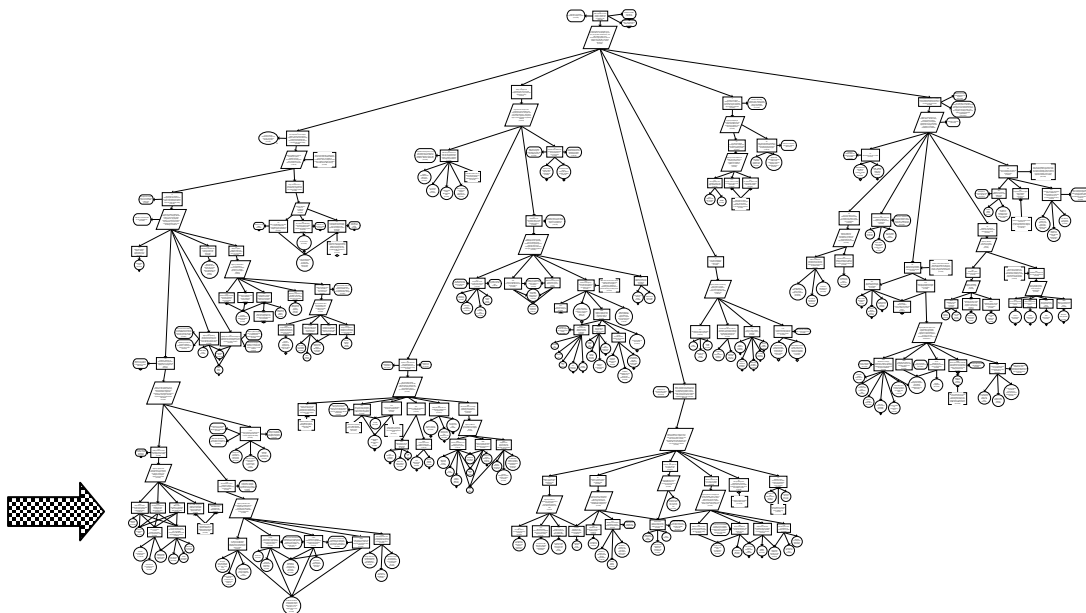
**Node Status: Development required to complete above references**

**Strategy (Goal 1121):** Argue by appropriate management of constituent elements of weapon system: air vehicle, engine, gun, AGE/ground support equipment and GFE

## 1.5 Panavia/TU/Mauser production standards (Goals 11211/2/3)



### Location within Safety Case



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## **Goal 11211: Panavia air vehicle production build standards were managed with appropriate safety**

### **SOLUTION (GOAL 11211): TEMPEST CHECK**

As part of the production acceptance process, UK aircraft were subject to TEMPEST testing in accordance with:

- AP100A-01, Leaflet 234 - Tempest Policy for Communications and Information Systems
- AP100A-01, Leaflet 235 - Tempest Policy for Airborne Systems

### **SOLUTION (GOALS 11211/11212/11213): PRODUCTION ACCEPTANCE TESTS**

A structured programme of acceptance testing was undertaken as agreed between contractors and customers. The testing and results were overseen and accepted by nominated customer representatives (NQARs) in accordance with NAMMA Quality Management System, procedure QA11.

Production Flight Acceptance Testing was undertaken on each aircraft as part of the final acceptance testing in accordance with a customer/contractor agreed schedule.

## **Goal 112111/112121/112131: Deviations/Waivers were appropriately safe**

### **SOLUTION (GOAL 112111/112121/112131): PANAVIA WAIVER/DEVIATION PROCEDURE**

All Panavia concessions were managed by the PPCs in accordance with PQAP 5C-01

### **SOLUTION (GOAL 112111/112121/112131): TU CONTROL OF NON-CONFORMANCE PROCEDURE**

[Node Status: Development required to identify and document reference\(s\)](#)

### **SOLUTION (GOAL 112111/112121/112131 & 112112/112122/112132): NAMMA/NQAA OVERSIGHT AND ENDORSEMENTS**

Customer oversight and control of deviations and waivers was undertaken in accordance with the NAMMA Quality Management System, procedure QA04.

## **Goal 11212: TU Engine Production standards were managed with appropriate safety**

### **Goal 112112/112122/112132: Assembly and embodiment of in-line (RBD) changes/modifications were appropriately controlled**

### **SOLUTION (GOAL 112112/112122/112132): PANAVIA QA PROCEDURES**

The Panavia Quality Management System is summarised in PQAP 01-01. All constituent procedures were subject to review and oversight by NAMMA and national quality specialists.

### **SOLUTION (GOAL 112112/112122/112132): TU QA PROCEDURES**

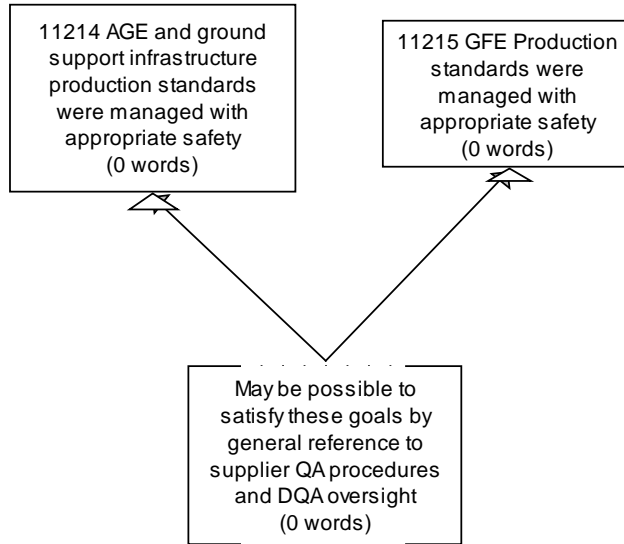
[Node Status: Development required to identify and document reference\(s\)](#)

**SOLUTION (GOAL 112112/112122/112132): MAUSER QA PROCEDURES**

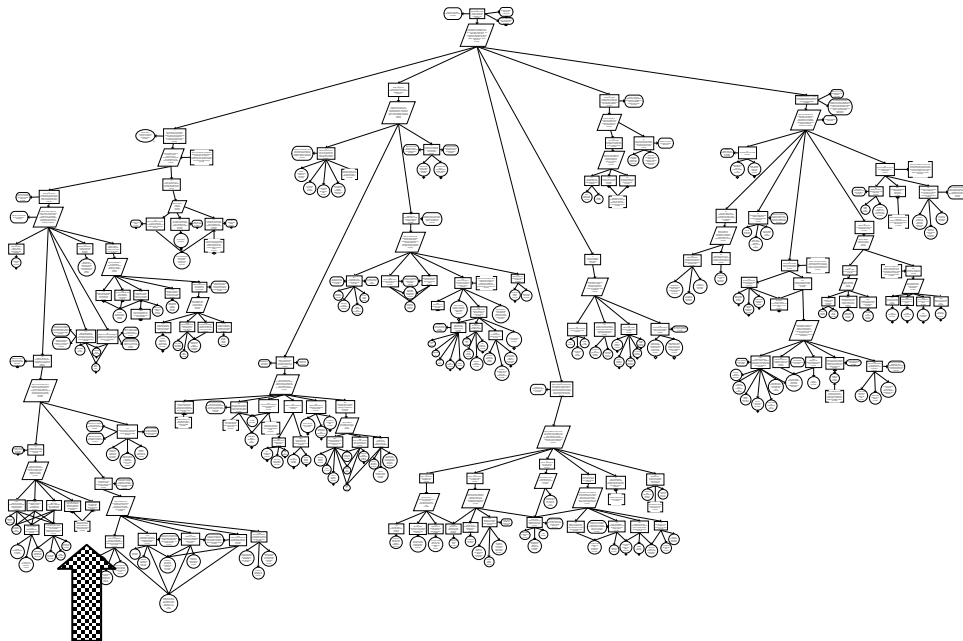
Node Status: Development required to identify and document reference(s)

**Goal 11213: Mauser Gun productions standards were managed with appropriate safety**

**1.6 AGE, ground support and GFE production standards (Goals 11214/5)**



**Location within Safety Case**



**Goal 11214: AGE and ground support infrastructure production standards were managed with appropriate safety**

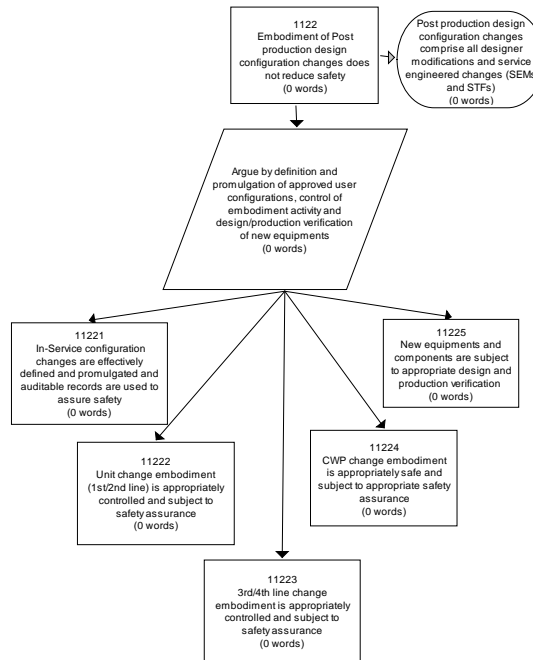
Node Status: Instantiation required to develop and document supporting argument/evidence

# Goal 11215: GFE Production standards were managed with appropriate safety

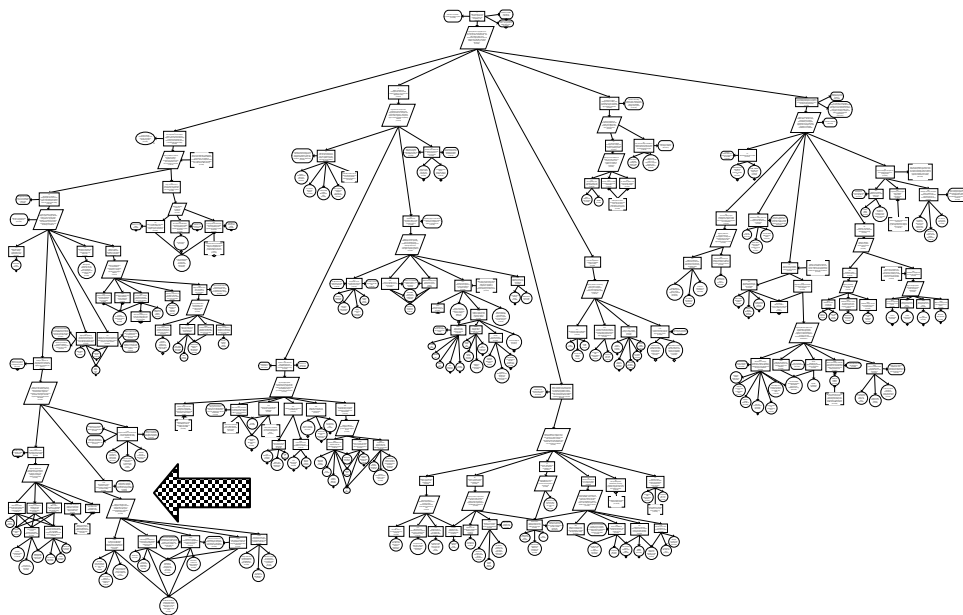
Node Status: Instantiation required to develop and document supporting argument/evidence

**Note (Goals 11214 and 11215):** May be possible to satisfy these goals by general reference to supplier QA procedures and DQA oversight

## 1.7 Post production changes (Goal 1122)



### Location within Safety Case

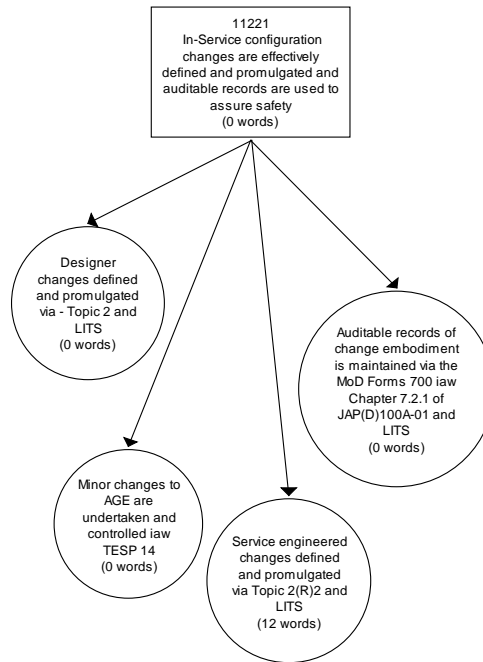


## Goal 1122: Embodiment of Post-production design configuration changes does not reduce safety

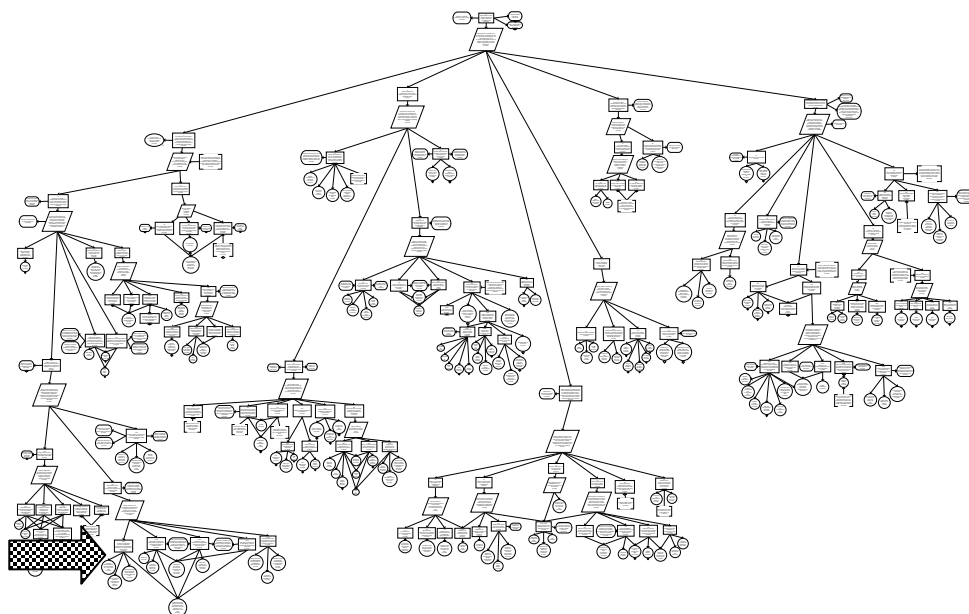
**Context (Goal 1122):** Post-production design configuration changes comprise all designer modifications and service engineered changes (SEMs and STFs)

**Strategy (Goal 1122):** Argue by definition and promulgation of approved user configurations, control of embodiment activity and design/production verification of new equipments

### 1.8 In-Service Configuration changes effectively managed (Goal 11221)



#### Location within Safety Case



**Goal 11221: In-Service configuration changes are effectively defined and promulgated and auditable records are used to assure safety**

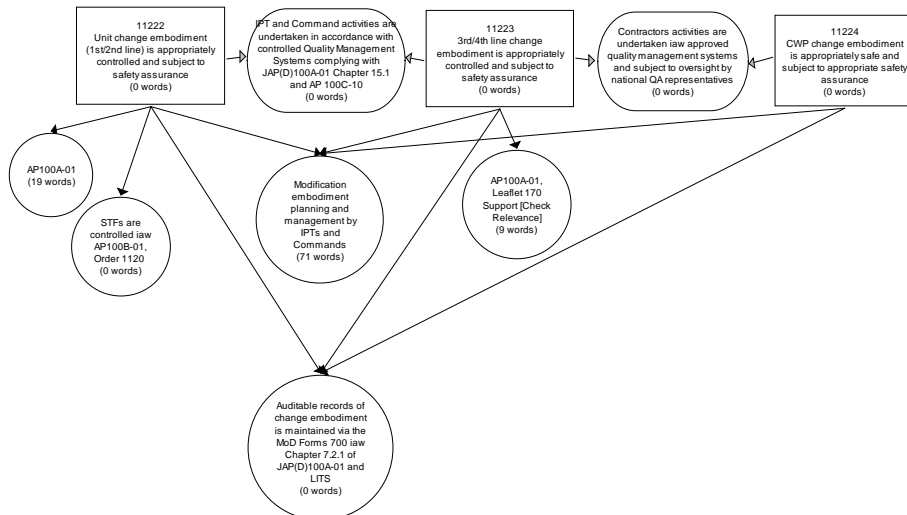
**SOLUTION (GOAL 11221): SERVICE ENGINEERED CHANGES DEFINED AND PROMULGATED VIA TOPIC 2(R)2 AND LITS**

Topic 2(R)2 - RAF Engineering Authority General Orders and Special Instructions.

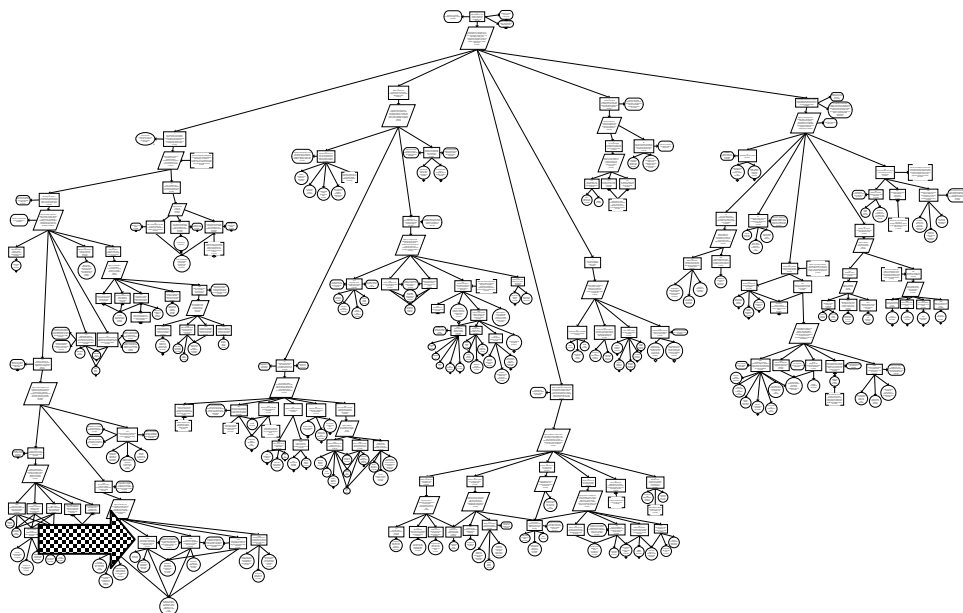
**SOLUTION (GOAL 11221): MINOR CHANGES TO AGE ARE UNDERTAKEN AND CONTROLLED IAW TESP 14**

**SOLUTION (GOAL 11221): DESIGNER CHANGES DEFINED AND PROMULGATED VIA - TOPIC 2 AND LITS**

**1.9 Change embodiment effectively managed (Goals 11222/3/4)**



**Location within Safety Case**



## **Goal 11222: Unit change embodiment (1st/2nd line) is appropriately controlled and subject to safety assurance**

*Context (Goals 11222 & 11223): IPT and Command activities are undertaken in accordance with controlled Quality Management Systems complying with JAP(D)100A-01 Chapter 15.1 and AP 100C-10*

### **SOLUTION (GOAL 11222): AP100A-01**

Leaflet 175 " Modifications to Equipment operated by the RAF"

Leaflet 171 "Management and Support of Equipment for Ground Training"

### **SOLUTION (GOAL 11222): STFS ARE CONTROLLED IAW AP100B-01, ORDER 1120**

**SOLUTION (GOALS 11221, 11222, 11223 & 11224): AUDITABLE RECORDS OF CHANGE EMBODIMENT IS MAINTAINED VIA THE MOD FORMS 700 IAW CHAPTER 7.2.1 OF JAP(D)100A-01 AND LITS**

**SOLUTION (GOALS 11222, 11223 & 11224): MODIFICATION EMBODIMENT PLANNING AND MANAGEMENT BY IPTS AND COMMANDS**

Embodiment planning is undertaken in accordance with JAP(D) 100A-01 Chapter 10.2

Controls within the TCCMP ensure that embodiment schedules are co-ordinated with the MAR/RTS approval process.

Designer Modification Leaflets are subject to technical editing and control in accordance with ES(Air) BP 1211.

Service Engineered Modifications are prepared and managed in accordance with AP 100B-04 (previously AP101B-4100-2(R)1 Leaflet 060 - now superseded)

## **Goal 11223: 3rd/4th line change embodiment is appropriately controlled and subject to safety assurance**

*Context (Goals 11223 & 11224): Contractors activities are undertaken iaw approved quality management systems and subject to oversight by national QA representatives*

### **SOLUTION (GOAL 11223): AP100A-01, LEAFLET 170 SUPPORT [CHECK RELEVANCE]**

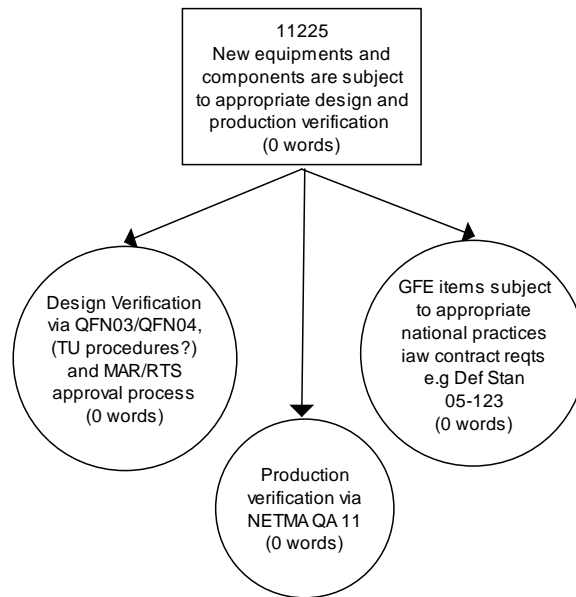
Engineering support to Aircraft and Equipment in the RAF

**Node Status: Development required to confirm appropriateness of leaflet/evidence**

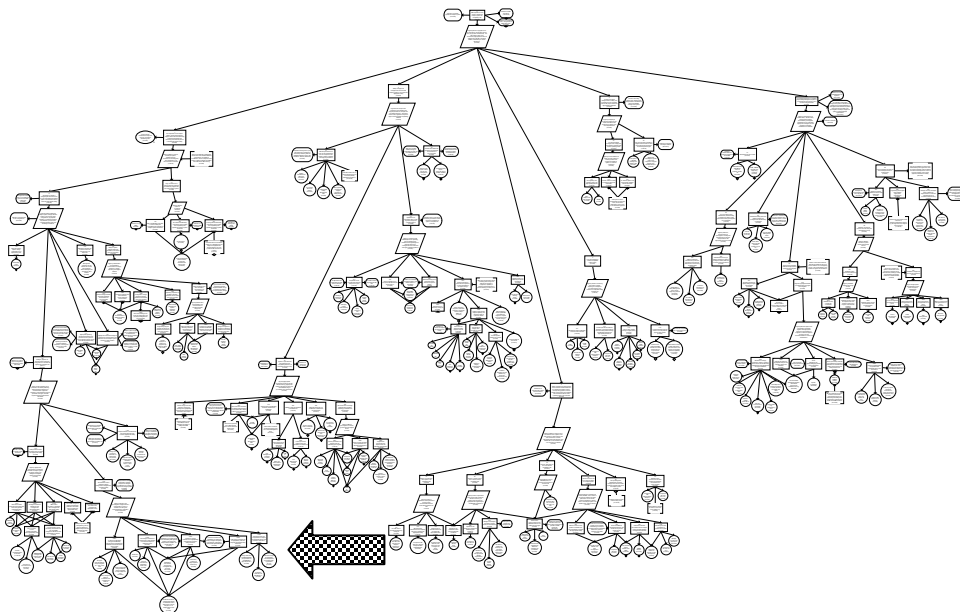
## **Goal 11224 CWP: change embodiment is appropriately safe and subject to appropriate safety assurance**



## 1.10 Design/production verification of new equipment (Goal 11225)



### Location within Safety Case



**Goal 11225: New equipments and components are subject to appropriate design and production verification**

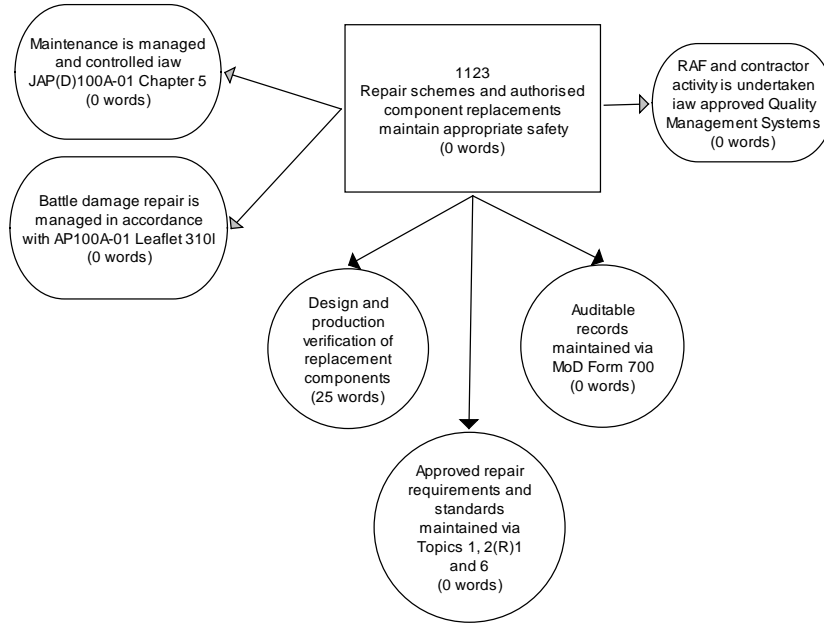
**SOLUTION (GOAL 11225): DESIGN VERIFICATION VIA QFN03/QFN04, (TU PROCEDURES?) AND MAR/RTS APPROVAL PROCESS**

**Node Status: Development required to establish TU procedures**

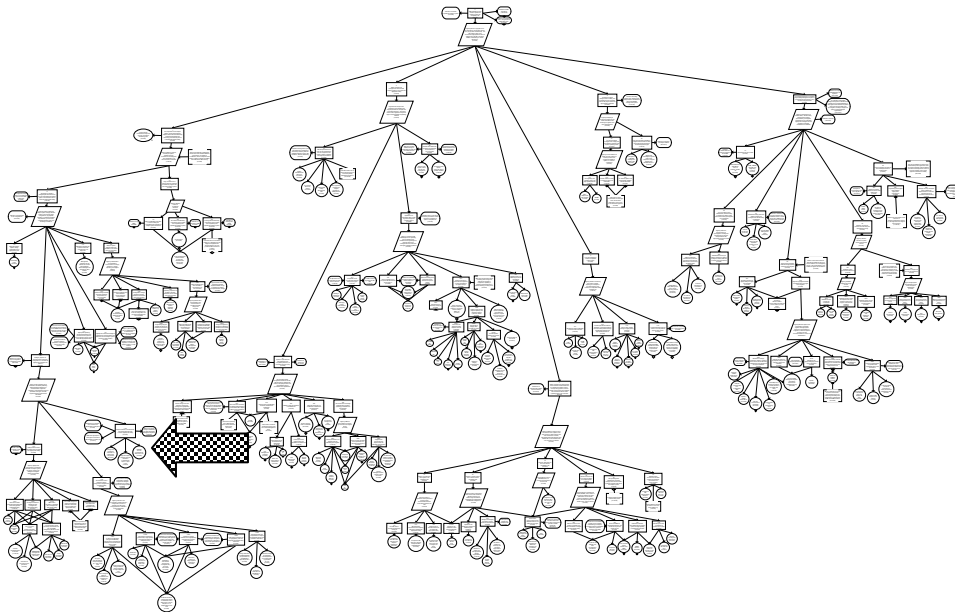
**SOLUTION (GOAL 11225): PRODUCTION VERIFICATION VIA NETMA QA 11**

**SOLUTION (GOAL 11225): GFE ITEMS SUBJECT TO APPROPRIATE NATIONAL PRACTICES IAW CONTRACT REQTS E.G DEF STAN 05-123**

## 1.11 Repair Schemes (Goal 1123)



### Location within Safety Case



## Goal 1123: Repair schemes and authorised component replacements maintain appropriate safety

**Context (Goal 1123):** Maintenance is managed and controlled iaw JAP(D)100A-01 Chapter 5

**Context (Goal 1123):** Battle damage repair is managed in accordance with AP100A-01 Leaflet 310I

**Context (Goal 1123):** RAF and contractor activity is undertaken iaw approved Quality Management Systems

**SOLUTION (GOAL 1123): DESIGN AND PRODUCTION VERIFICATION OF REPLACEMENT COMPONENTS**

Design verification is maintained iaw QFN03 and QFN04 (*What are TU equivalents?*)

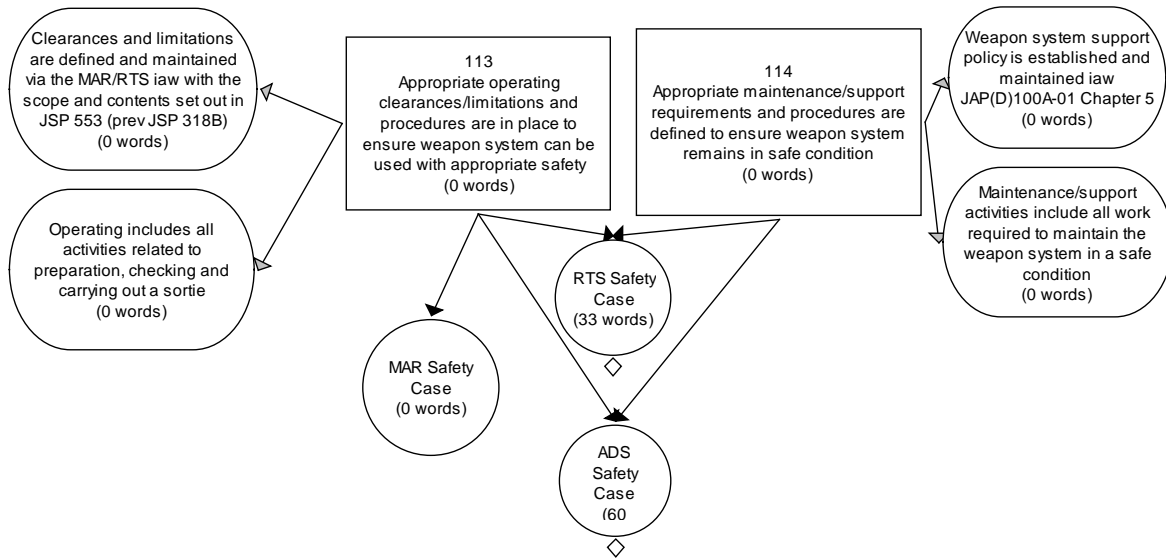
Production verification is undertaken in accordance with the NETMA QMS procedure QA 11.

**Node Status: Development required to establish TU procedures**

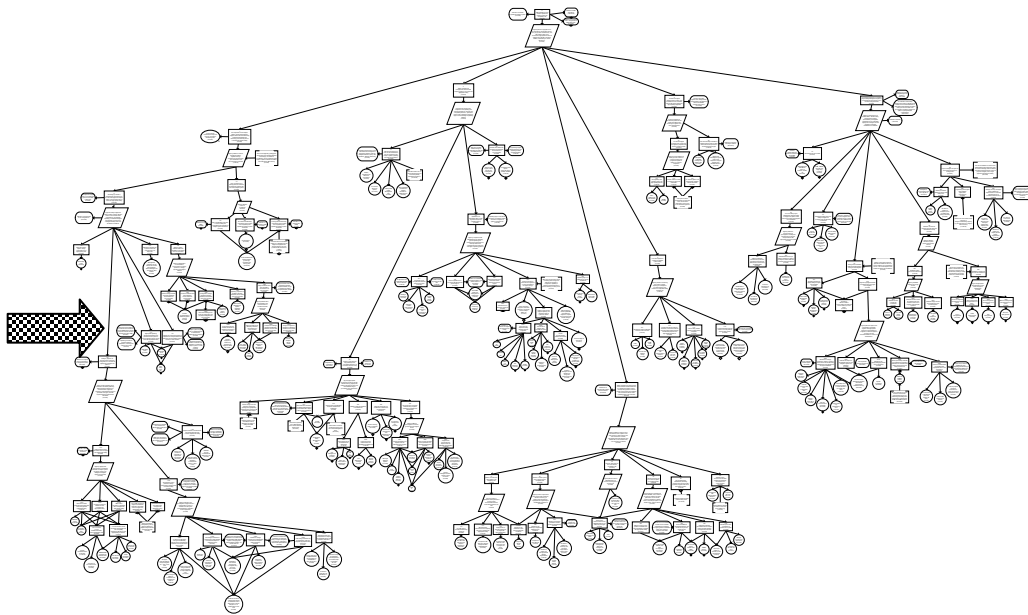
**SOLUTION (GOAL 1123): APPROVED REPAIR REQUIREMENTS AND STANDARDS MAINTAINED VIA TOPICS 1, 2(R)1 AND 6**

**SOLUTION (GOAL 1123): AUDITABLE RECORDS MAINTAINED VIA MOD FORM 700**

## 1.12 Operating clearances and maintenance req'ts (Goals 113 & 114)



### Location within Safety Case



### Goal 113: Appropriate operating clearances/limitations and procedures are in place to ensure weapon system can be used with appropriate safety

**Context (Goal 113):** Clearances and limitations are defined and maintained via the MAR/RTS iaw with the scope and contents set out in JSP 553 (prev JSP 318B)

**Context (Goal 113):** Operating includes all activities related to preparation, checking and carrying out a sortie

## **SOLUTION (GOALS 113): MAR SAFETY CASE**

## **SOLUTION (GOALS 113 & 114): RTS SAFETY CASE**

It should be noted that this currently exists in concept only and that some further work is required to develop the extant MAR safety case into a complete and comprehensive RTS safety case

**Node Status: Development required to finalise RTS safety case**

## **Goal 114: Appropriate maintenance/support requirements and procedures are defined to ensure weapon system remains in safe condition**

*Context (Goal 114): Weapon system support policy is established and maintained iaw JAP(D)100A-01 Chapter 5*

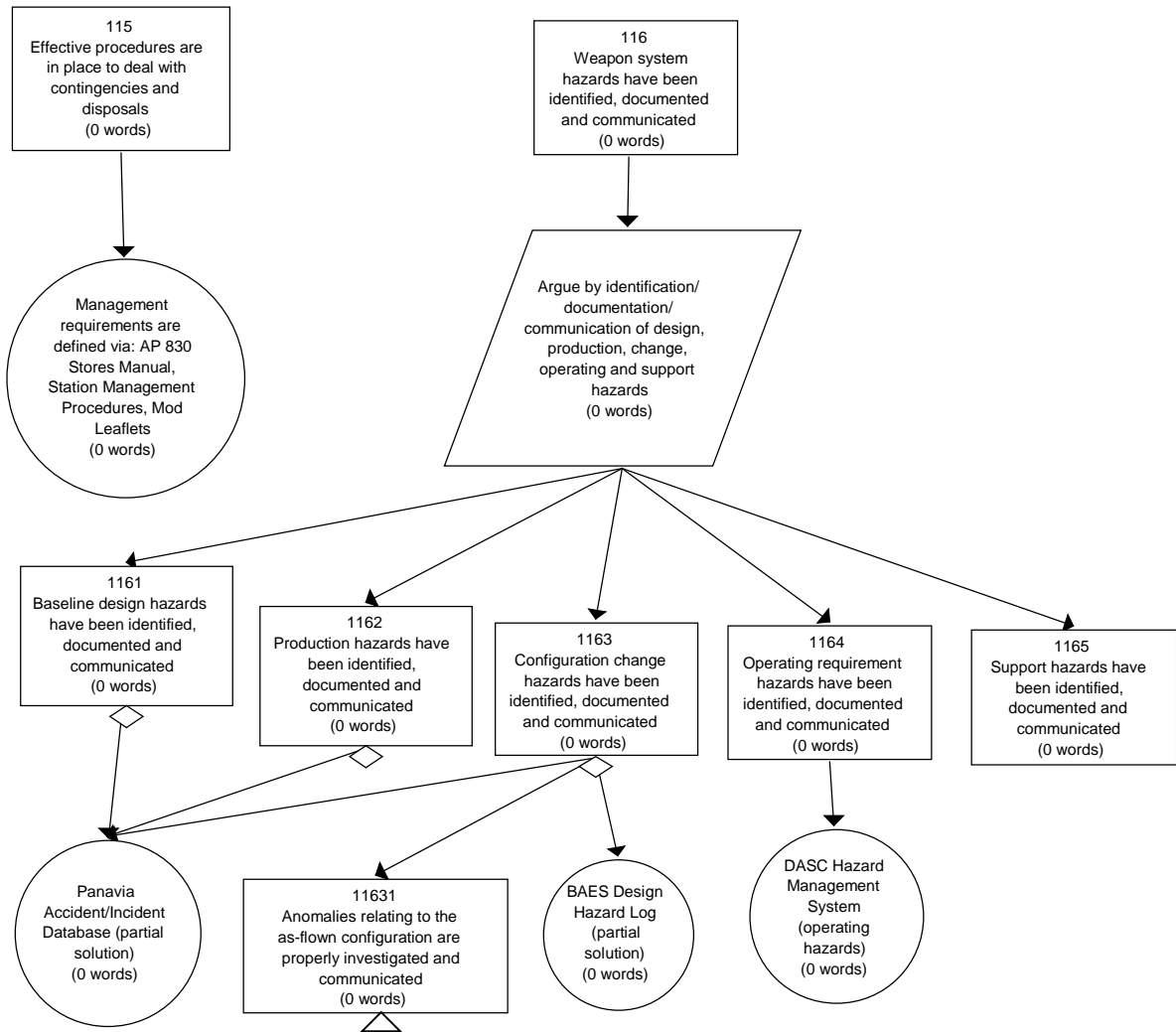
*Context (Goal 114): Maintenance/support activities include all work required to maintain the weapon system in a safe condition*

## **SOLUTION (GOALS 113 & 114): ADS SAFETY CASE**

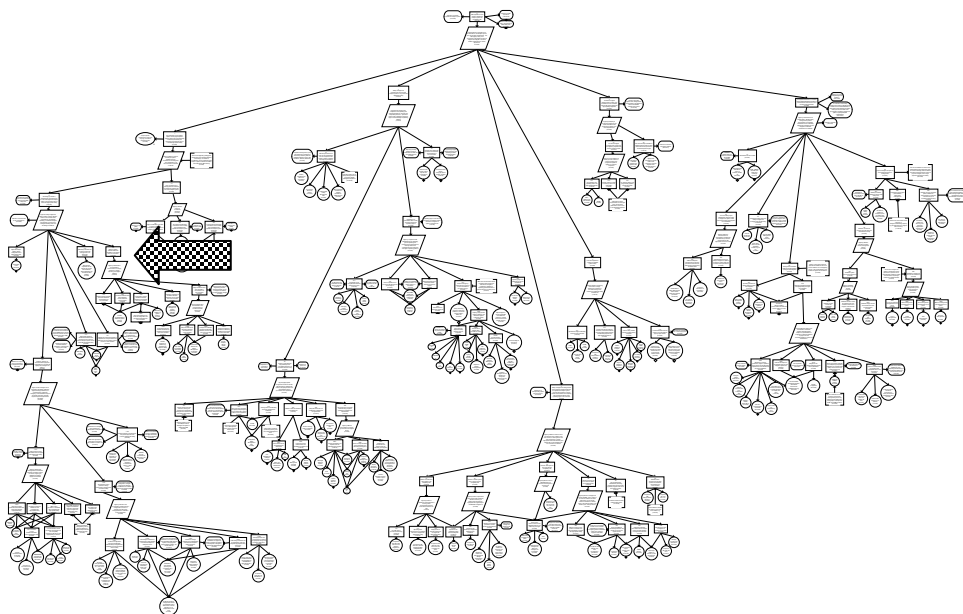
It should be noted that this currently exists in concept only. A comprehensive safety argument has been developed for the aircrew publications but would need some further refinement and documentation to constitute an acceptable aircrew publications safety case. Little work has been undertaken or documented in respect of the non-aircrew publications that make up the balance of the ADS

**Node Status: Development required to evaluate and document ADS safety case**

## 1.13 Contingencies and hazards (Goals 115 & 116)



### Location within Safety Case



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**Goal 115: Effective procedures are in place to deal with contingencies and disposals**

**SOLUTION (GOAL 115): MANAGEMENT REQUIREMENTS ARE DEFINED VIA: AP 830 STORES MANUAL, STATION MANAGEMENT PROCEDURES, MOD LEAFLETS**

**Goal 116: Weapon system hazards have been identified, documented and communicated**

**STRATEGY (GOAL 116): ARGUE BY IDENTIFICATION/ DOCUMENTATION/ COMMUNICATION OF DESIGN, PRODUCTION, CHANGE, OPERATING AND SUPPORT HAZARDS**

**Goal 1161: Baseline design hazards have been identified, documented and communicated**

**SOLUTION (GOAL 1161): PANAVIA ACCIDENT/INCIDENT DATABASE AND OTHER DESIGN INFORMATION**

See solution to Goal 6422 for indication of range of documents containing potential design hazard data)

**Goal 1162: Production hazards have been identified, documented and communicated**

**Node Status: Development required to establish and document the means by which these hazards were communicated.**

**Goal 1163 Configuration change hazards have been identified, documented and communicated**

**Node Status: Development required to establish and document the means by which these hazards were communicated.**

**SOLUTION (GOAL 1163): BAES DESIGN HAZARD LOG (PARTIAL SOLUTION)**

**Node Status: Development required to ensure that a full solution is identified**

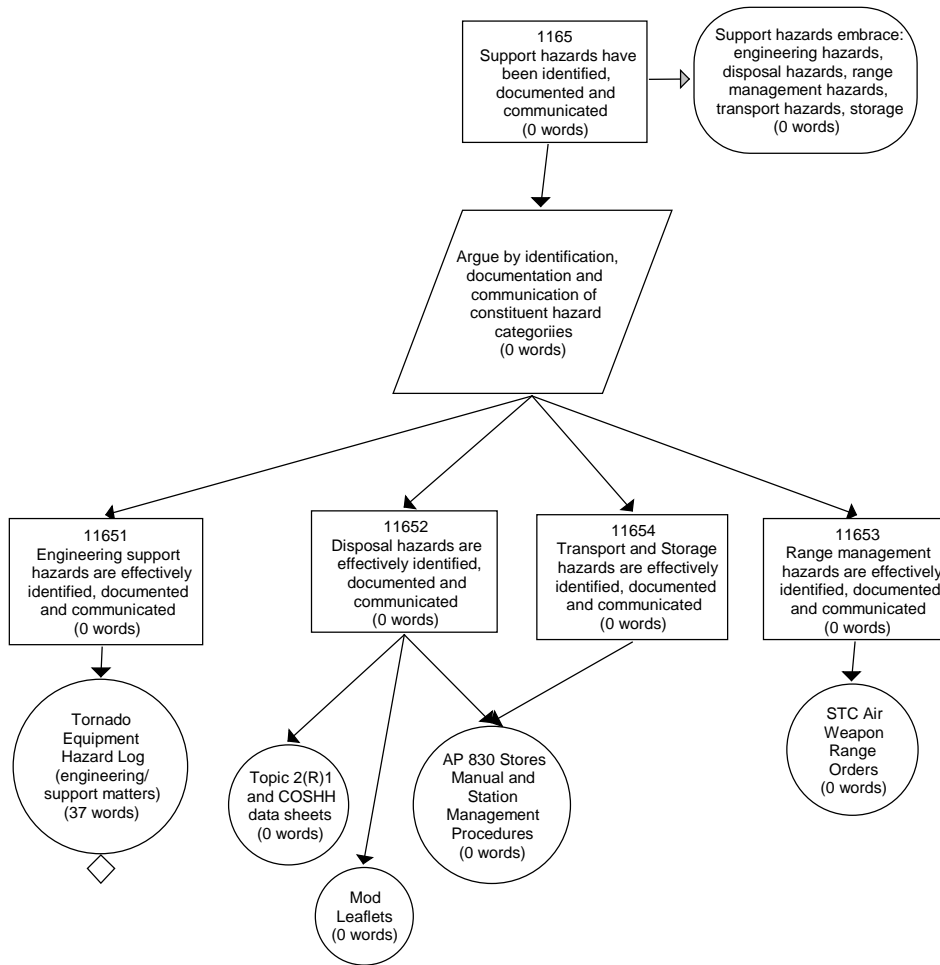
**Goal 11631: Anomalies relating to the as-flown configuration are properly investigated and communicated**

**Node Status: Instantiation required to document the manner in which this is done**

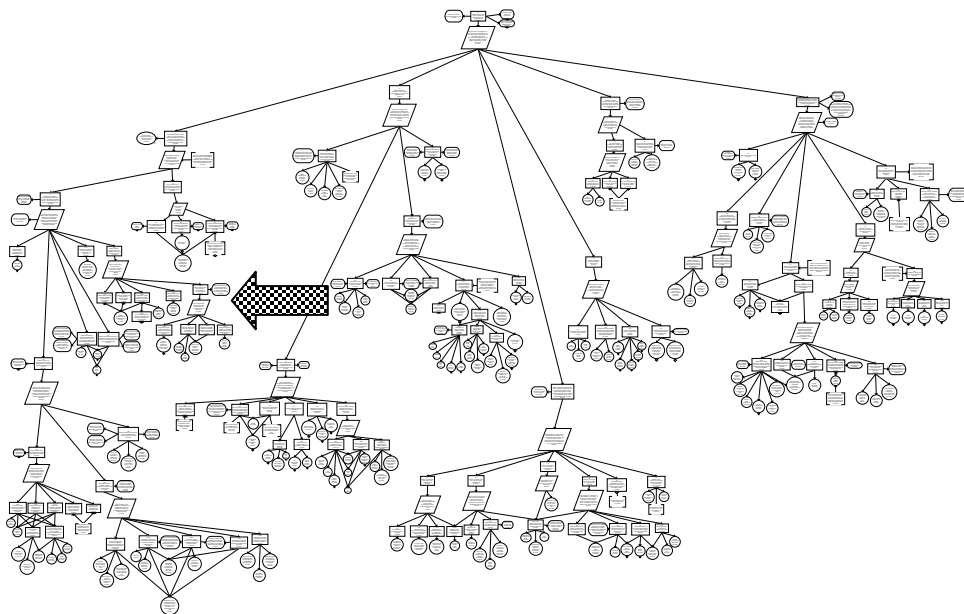
**Goal 1164: Operating requirement hazards have been identified, documented and communicated**

**SOLUTION (GOAL 1164): DASC HAZARD MANAGEMENT SYSTEM (OPERATING HAZARDS)**

## 1.14 Support hazards (Goal 1165)



### Location within Safety Case





## **Goal 1165: Support hazards have been identified, documented and communicated**

*Context (Goal 1165): Support hazards embrace: engineering hazards, disposal hazards, range management hazards, transport hazards, storage*

*Strategy (Goal 1165): Argue by identification, documentation and communication of constituent hazard categories*

## **Goal 11651: Engineering support hazards are effectively identified, documented and communicated**

### **SOLUTION (GOAL 11651): TORNADO EQUIPMENT HAZARD LOG (ENGINEERING/SUPPORT MATTERS)**

Log is currently under development and population but needs further work to incorporate all known occurrences and to interpret these in respect of the related hazards.

Additional information is provided to users via the Engineering Air Publications

**Node Status: Development required to establish hazard log and to identify any other means necessary to capture all engineering/support hazards**

## **Goal 11652: Disposal hazards are effectively identified, documented and communicated**

**SOLUTION (GOAL 11652): TOPIC 2(R)1 AND COSHH DATA SHEETS**

**SOLUTION (GOAL 11652): MOD LEAFLETS**

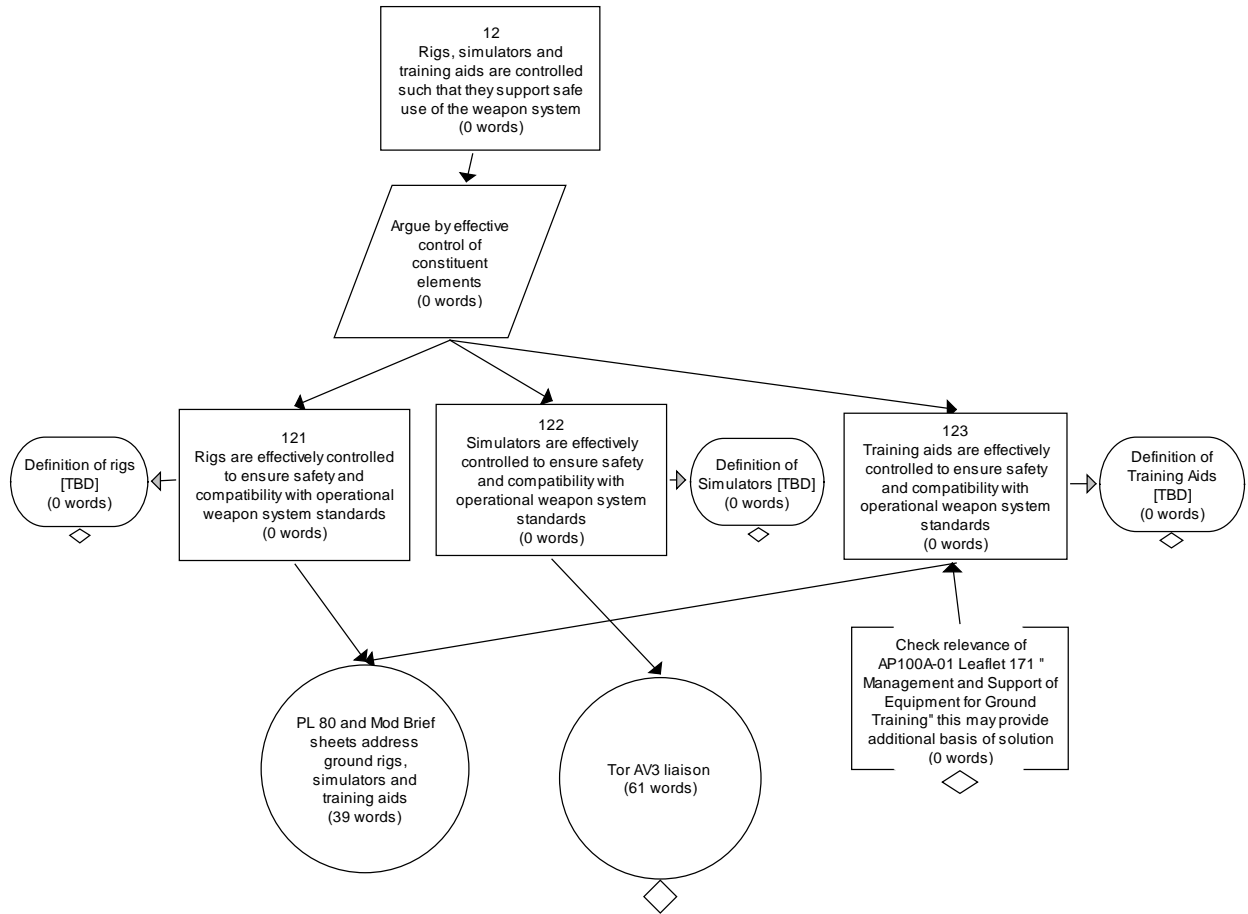
**SOLUTION (GOALS 11652 & 11654): AP 830 STORES MANUAL AND STATION MANAGEMENT PROCEDURES**

## **Goal 11654: Transport and Storage hazards are effectively identified, documented and communicated**

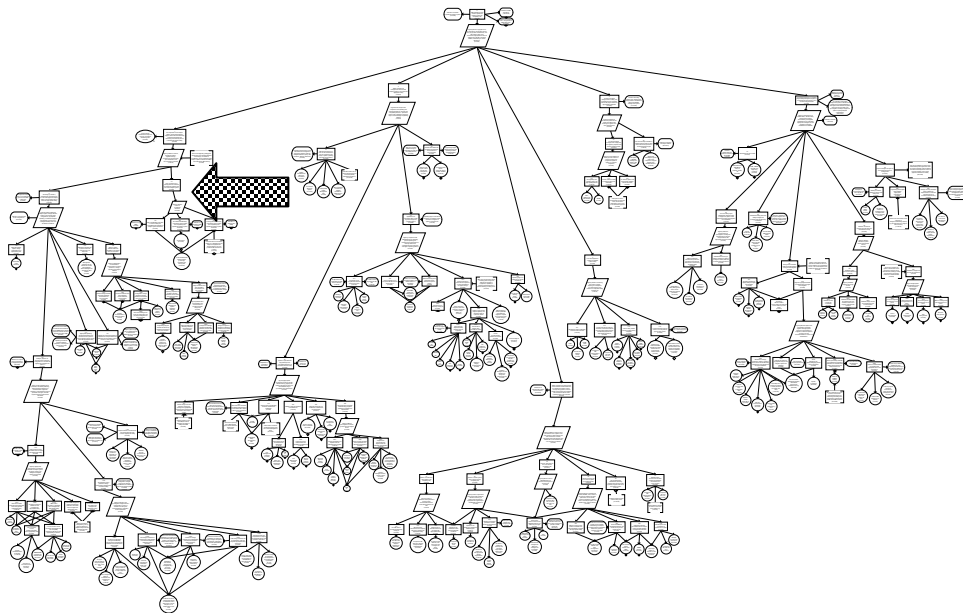
## **Goal 11653: Range management hazards are effectively identified, documented and communicated**

**SOLUTION (GOAL 11653): STC AIR WEAPON RANGE ORDERS**

## 1.15 Rigs, simulators, training aids and infrastructure (Goals 12)



### Location within Safety Case



## **Goal 12: Rigs, simulators and training aids are controlled such that they support safe use of the weapon system**

*Strategy (Goal 12): Argue by effective control of constituent elements*

## **Goal 121: Rigs are effectively controlled to ensure safety and compatibility with operational weapon system standards**

*Context (Goal 121): Definition of rigs [TBD]*

**Node Status: Development required to finalise definition**

### **SOLUTION (GOALS 121 AND 123): PL 80 AND MOD BRIEF SHEETS ADDRESS GROUND RIGS, SIMULATORS AND TRAINING AIDS**

The Tornado modification procedure provides for Panavia, TU and Mauser appropriate change co-ordination of all air vehicle and prime contractor rigs and training aids.

Simulators are managed via a parallel arrangement with Thales, co-ordinated via Tor AV3.

## **Goal 122: Simulators are effectively controlled to ensure safety and compatibility with operational weapon system standards**

*Context (Goal 122): Definition of Simulators [TBD]*

**Node Status: Development required to finalise definition**

### **SOLUTION (GOAL 122) TOR AV3 LIAISON**

#### **F3**

Tor AV3 provides the focus for liaison between the Tor IPT, Thales MERLIN, acting via the FSAST IPT.

#### **GR4**

Tor AV3 provides a direct relationship with Thales ACE.

For both variants, quarterly copies of the mods database are prepared by Tor ESM3 and passed via Tor AV3 to the respective simulator companies. Thales review the mods and identify those which may affect the simulators, advising Tor AV3 accordingly. Tor AV3 then liaises with customer 2 to decide on the action desired and engages the appropriate EAs as necessary.

All activities are undertaken in accordance with a CSA [Ref TBD].

**Node Status: Development required to establish CSA arrangements**

## **Goal 123: Training aids are effectively controlled to ensure safety and compatibility with operational weapon system standards**

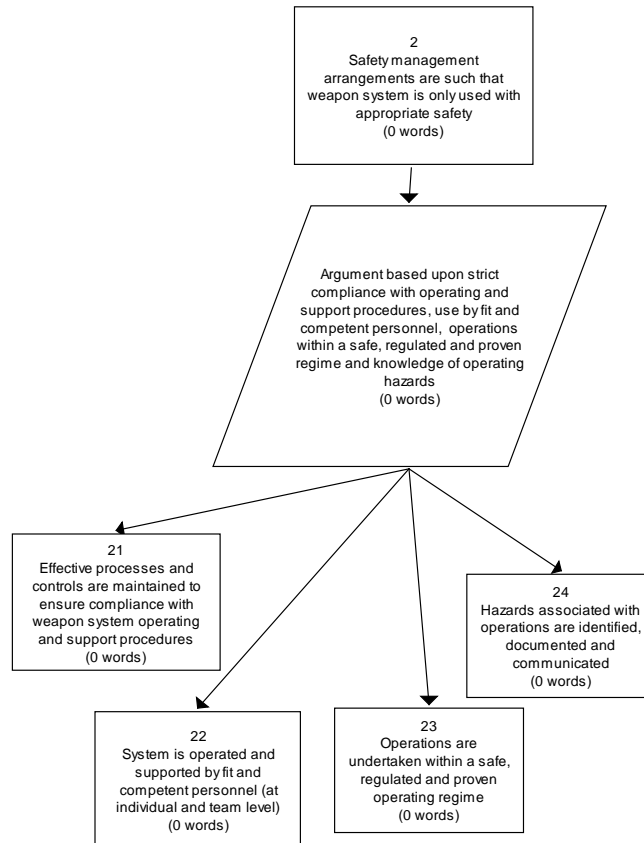
*Context (Goal 123): Definition of Training Aids [TBD]*

**Node Status: Development required to finalise definition**

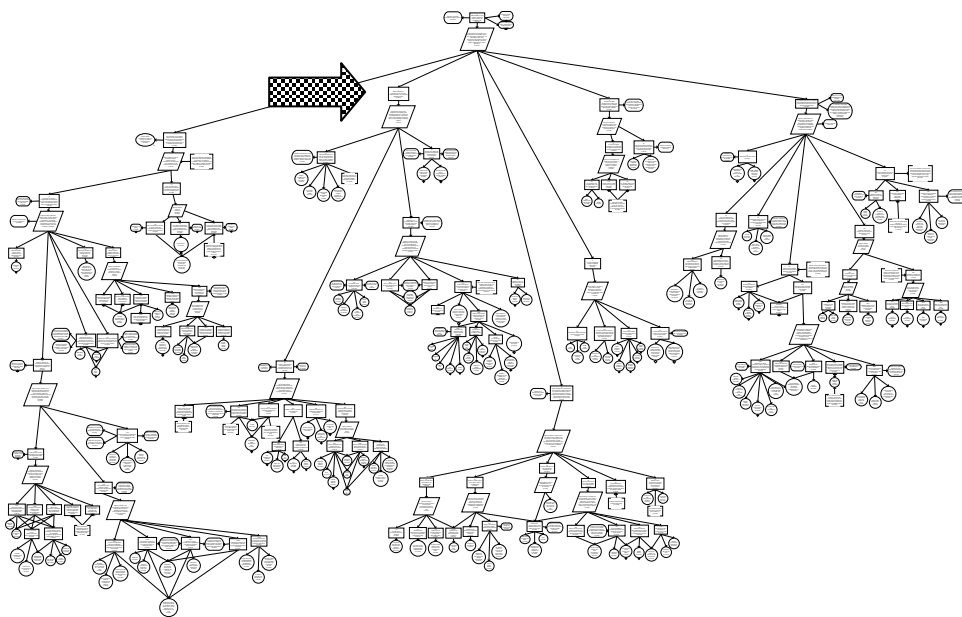
**Note (Goal 123):** Check relevance of AP100A-01 Leaflet 171 " Management and Support of Equipment for Ground Training" this may provide additional basis of solution

**Node Status: Development required to establish relevance**

## 2 Section 2: Safe Use (Goal 2)



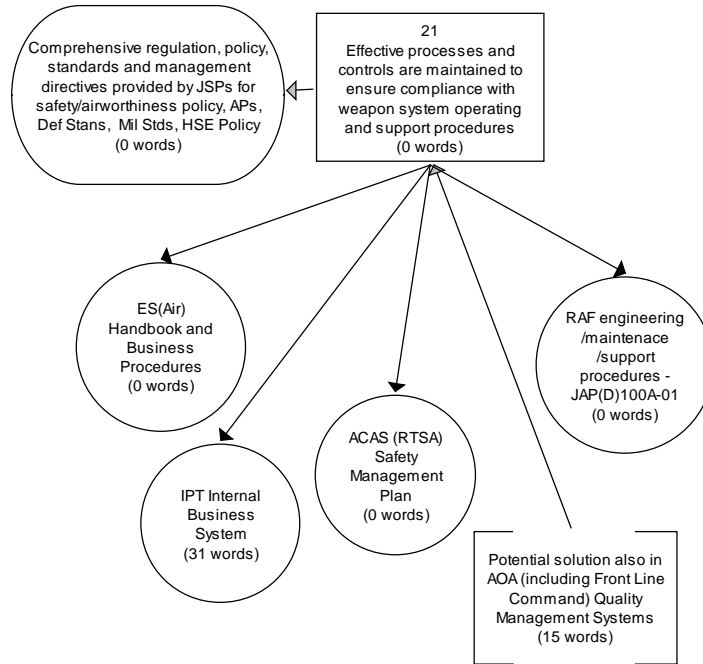
### Location within Safety Case



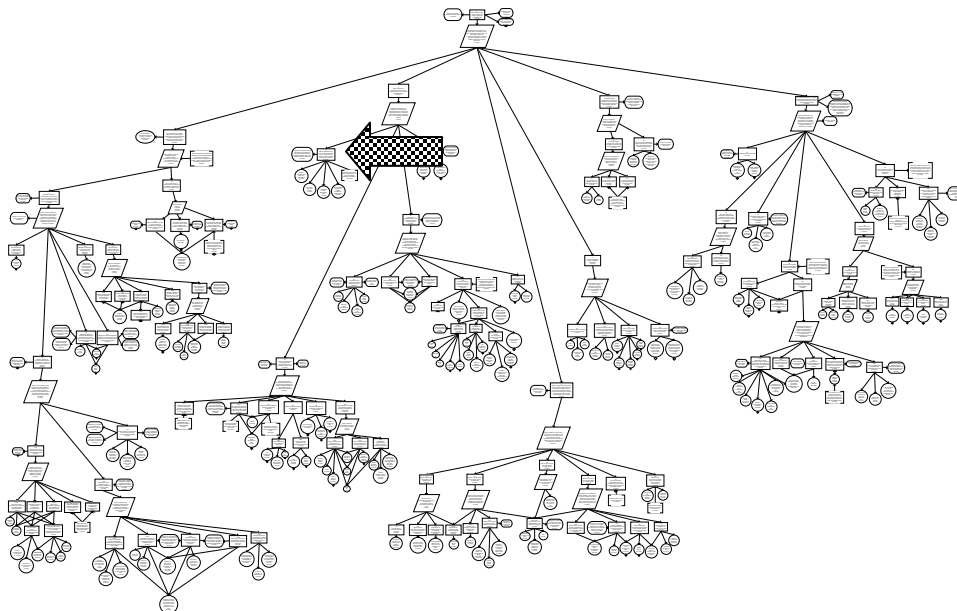
**Goal 2: Safety management arrangements are such that weapon system is only used with appropriate safety**

*Strategy (Goal 2): Argument based upon strict compliance with operating and support procedures, use by fit and competent personnel, operations within a safe, regulated and proven regime and knowledge of operating hazards*

**2.1 Effective processes (Goal 21)**



**Location within Safety Case**



**Goal 21: Effective processes and controls are maintained to ensure compliance with weapon system operating and support procedures**

*Context (Goal 21): Comprehensive regulation, policy, standards and management directives provided by JSPs for safety/airworthiness policy, APs, Def Stans, Mil Stds, HSE Policy*

**SOLUTION (GOAL 21): ES(AIR) HANDBOOK AND BUSINESS PROCEDURES**

**SOLUTION (GOAL 21): IPT INTERNAL BUSINESS SYSTEM**

The IBS embraces the TLMP, TESMP and all supporting supplemental business procedures, local instructions and working practices defining the IPT role as engineering and support authority for the Tornado weapon system.

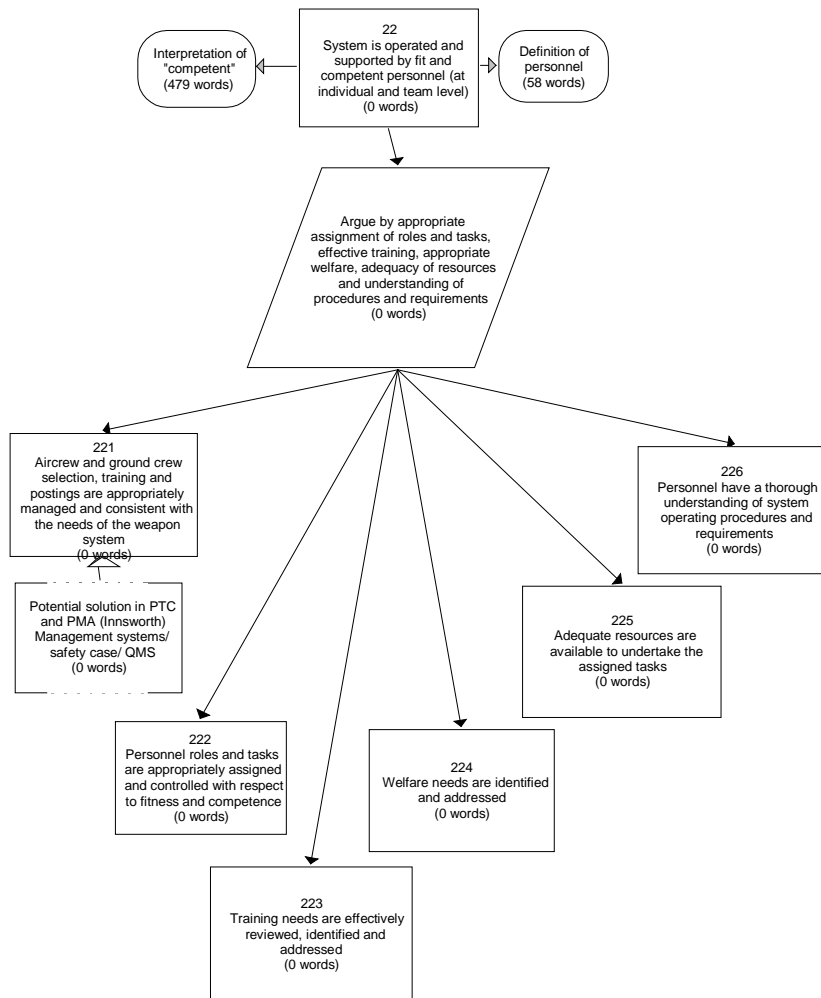
**SOLUTION (GOAL 21): ACAS (RTSA) SAFETY MANAGEMENT PLAN**

**SOLUTION (GOAL 21): RAF ENGINEERING /MAINTENANCE /SUPPORT PROCEDURES - JAP(D)100A-01**

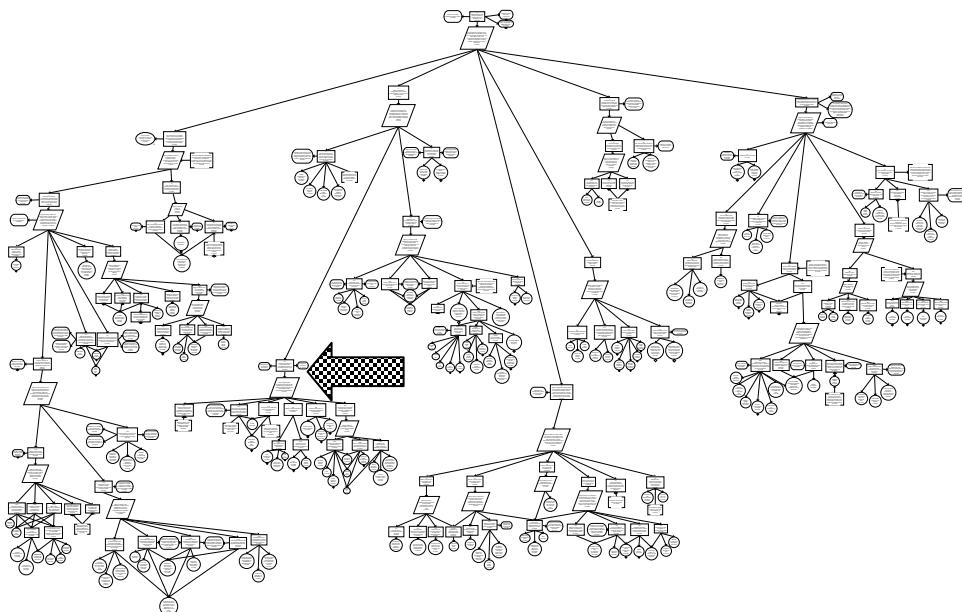
**Note (Goal 21):** Potential solution also in AOA (including Front Line Command) Quality Management Systems

AOA and FLC QMS should embrace all aircrew activities and 1st/2nd line support activity

## 2.2 Competent personnel (Goal 22)



### Location within Safety Case



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## **Goal 22: System is operated and supported by fit and competent personnel (at individual and team level)**

### **Context (Goal 22): Interpretation of "competent"**

*It has not been possible to find a comprehensive definition of "competent" within extant MoD publications. However, any judgement regarding the competence of safety or other management actions in respect of Tornado will be conditioned by the extant civil standards and practices and reference should therefore be made to the following sources that are considered to represent accepted best practice.*

*The following paragraphs are extracted from the Management of Health and Safety at Work Regulations 1992 – Approved Code of Practice.*

*(1) Every employer shall, subject paragraphs (6) and (7), appoint one or more competent persons to assist him in undertaking the measures he needs to take to comply with the requirements and prohibitions imposed upon him by or under the relevant statutory provisions.*

*(2) Where an employer appoints persons in accordance with paragraph (1), he shall make arrangements for ensuring adequate co-operation between them.*

*(5) A person shall be regarded as competent for the purposes of paragraph (1) where he has sufficient training and experience or knowledge and other qualities to enable him properly to assist in undertaking the measures referred to in that paragraph.*

*(35) Employers may appoint one or more of their own employees to do all that is necessary or may enlist help or support from outside the organisation, or they may do both. Employers who are sole traders, or are members of partnerships, may appoint themselves (or other partners) to carry out health and safety measures, so long as they are competent. Large employers may well appoint a whole department with specific health and safety responsibilities including specialists in such matters as occupational hygiene or safety engineering. In any case where external support is brought in, its activities must be co-ordinated by the employer to manage the health and safety measures.*

*(36) External services employed usually will be appointed in an advisory capacity only. They will often be specialists or general consultants on health and safety matters.*

*(37) The appointment of such health and safety assistants, departments or advisers does not absolve the employer from responsibilities for health and safety under the Health and Safety at Work Act and other relevant statutory provisions. It can do no more than give added assurance that these responsibilities will be discharged adequately.*

*(38) Employers are solely responsible for ensuring that those they appoint to assist them with health and safety measures are competent to carry out whatever tasks they are assigned and given adequate information and support. In making their decisions employers should take into account the need for:*

*(a) a knowledge and understanding of the work involved, the principles of risk assessment and prevention, and current health and safety applications;*

*(b) the capacity to apply this to the task required by the employer which might include identifying the health and safety problems, assessing the need for action, designing and developing strategy and plans, implementing these strategies and plans, evaluating their effectiveness and promoting and communicating health and safety and welfare advances and practices.*



*(39) Competence in the sense it is used in these Regulations does not necessarily depend on the possession of particular skills or qualifications. Simple situations may require only the following:*

- (a) an understanding of relevant current best practice;*
- (b) awareness of the limitations of one's own experience and knowledge; and*
- (c) the willingness and ability to supplement existing experience and knowledge.*

*(40) The provision of effective health and safety measures in more complex or highly technical situations will call for specific applied knowledge and skills which can be offered by appropriately qualified specialists. In the case of specific knowledge and skills in occupational health and safety, membership of a professional body or similar organisation at an appropriate level and in an appropriate part of health and safety, or possession of an appropriate qualification in health and safety, can help to guide employers. Competence based qualifications accredited by the National Council for Vocational Qualifications and SCOTVEC ( the Scottish Vocational Education Council), which are being developed for most occupations, may also provide a guide.*

*The Construction Design and Management Regulations 1994 – Approved Code of Practice extends the above definition to include:*

*adequate training, knowledge and experience;*

*an understanding of the hazards involved in an activity;*

*an appreciation of the precautions to be taken to control the risks posed by the hazards; and*

*the ability to identify when it is safe to continue an activity.*

*In addition to competence, the above regulations require adequate resources to be demonstrated by a proposed duty holder to fulfil their given task safely. Resources include:*

*employees with appropriate training and skills;*

*finances;*

*time;*

*equipment;*

*technical facilities; and*

*competent sources of advice.*

*Whilst the above definitions cover most of the accepted attributes associated with competence, physical ability and motivation are also important. However, in the final analysis, a good track record complemented by proactive measures that can be taken (e.g. staff feedback, questionnaires, auditing, performance reviews, needs analysis) would represent best practice.*

**Context (Goal 22): Definition of personnel**

*Personnel comprise the aircrew, ground-crew and support teams who have a direct interface with the weapon system (e.g in support of users or maintainers) and those other staff having an indirect role in activities which contribute to the airworthiness and safety of the system (e.g. Air Traffic Control, Mission Planners, Airfield support staff, IPT, RTSA)*

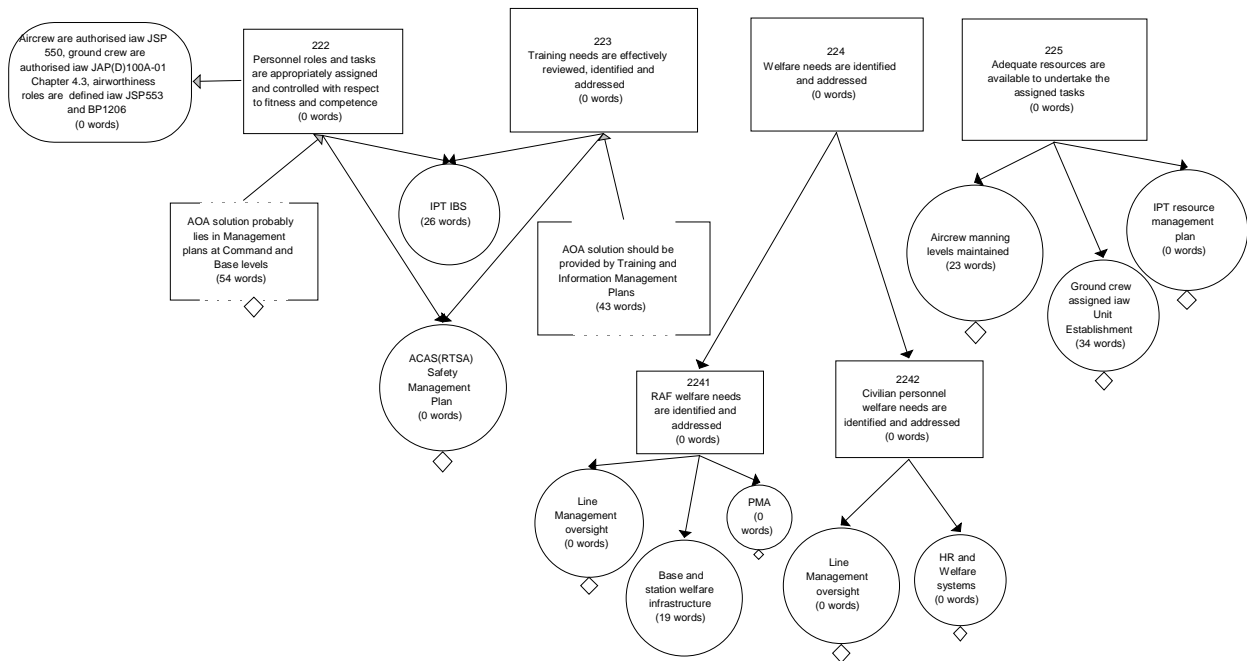
**Strategy (Goal 22):** Argue by appropriate assignment of roles and tasks, effective training, appropriate welfare, adequacy of resources and understanding of procedures and requirements

**Goal 221: Aircrew and ground crew selection, training and postings are appropriately managed and consistent with the needs of the weapon system**

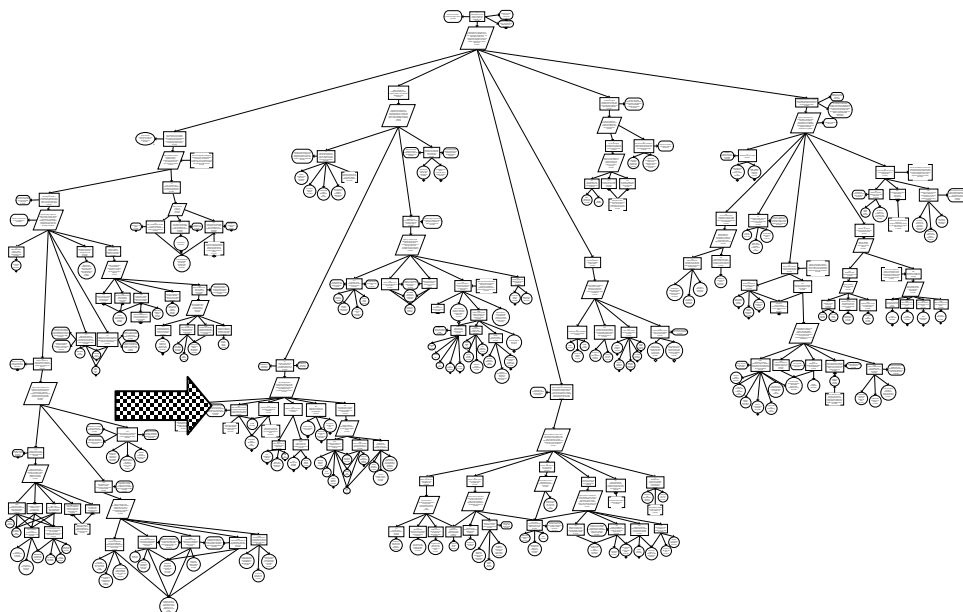
Node Status: Instantiation required

**Note (Goal 221):** Potential solution in PTC and PMA (Innsworth) Management systems/ safety case/ QMS

**2.3 Personnel roles, needs and resources are managed (Goals 222/3/4/5)**



**Location within Safety Case**



## **Goal 222: Personnel roles and tasks are appropriately assigned and controlled with respect to fitness and competence**

**Context (Goal 222):** *Aircrew are authorised iaw JSP 550, ground crew are authorised iaw JAP(D)100A-01 Chapter 4.3, airworthiness roles are defined and authorised iaw JSP553 and BP1206*

**Note (Goal 222):** AOA solution probably lies in Management plans at Command and Base levels. This needs to be confirmed.

This should embrace OCU and Strike evaluations together with the PMA contributions in ensuring that assignments and postings in/out are managed to maintain acceptable dilution rates and team capability.

Aspects to be addressed include:

Monitoring and assessment of individual capabilities and experience

Monitoring and assessment of team capabilities and experience

Inspections and Audits

**Node Status: Development required to establish and document the AOA arrangements**

### **SOLUTION (GOALS 222 & 223): ACAS(RTSA) SAFETY MANAGEMENT PLAN**

### **SOLUTION (GOALS 222 & 223): IPT IBS**

Key elements comprise:

- IPT Airworthiness roles and Individual Letters of Delegation managed iaw BP1206
- IPT Training Plan
- Internal audits plus peer reviews and line management review

## **Goal 223: Training needs are effectively reviewed, identified and addressed**

**Note (Goal 223):** AOA solution should be provided by Training and Information Management Plans

Aspects to be addressed include:

Aircrew - Training on type (via OCU), Continuation flying and refresher training (via simulators/rigs), OEU advice and support on tactics/doctrine

Ground crew - A/C managers course (for Eng Offs), Q courses (for technicians)

Crew Qualification Process

Information sources embrace:

OEU inputs

Mod Leaflets

Tactics and Aircraft Manuals

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Weapon Instructor conferences and other fora

**Goal 224: Welfare needs are identified and addressed**

**Goal 2241: RAF welfare needs are identified and addressed**

**SOLUTION (GOAL 2241): LINE MANAGEMENT OVERSIGHT**

Node Status: Development required

**SOLUTION (GOAL 2241): BASE AND STATION WELFARE INFRASTRUCTURE**

This embraces formal and informal arrangements and networks to provide:

- Families Support Unit
- Help/Information Voluntary Exchange
- Medical
- Padre

**SOLUTION (GOAL 2241): PMA**

**Goal 2242: Civilian personnel welfare needs are identified and addressed**

**SOLUTION (GOAL 2242): LINE MANAGEMENT OVERSIGHT**

Node Status: Development required

**SOLUTION (GOAL 2242): HR AND WELFARE SYSTEMS**

Node Status: Development required

**Goal 225: Adequate resources are available to undertake the assigned tasks**

**SOLUTION (GOAL 225): AIRCREW MANNING LEVELS MAINTAINED**

Factors to be considered include:

- Dilution rate
- Skills retention
- Matching of influx and out-postings
- Balance of training standards vs Sqn training burden

Node Status: Development required

**SOLUTION (GOAL 225): GROUND CREW ASSIGNED IAW UNIT ESTABLISHMENT**

This should show that QMS levels reflect LSAR

Other factors to be considered include management of:

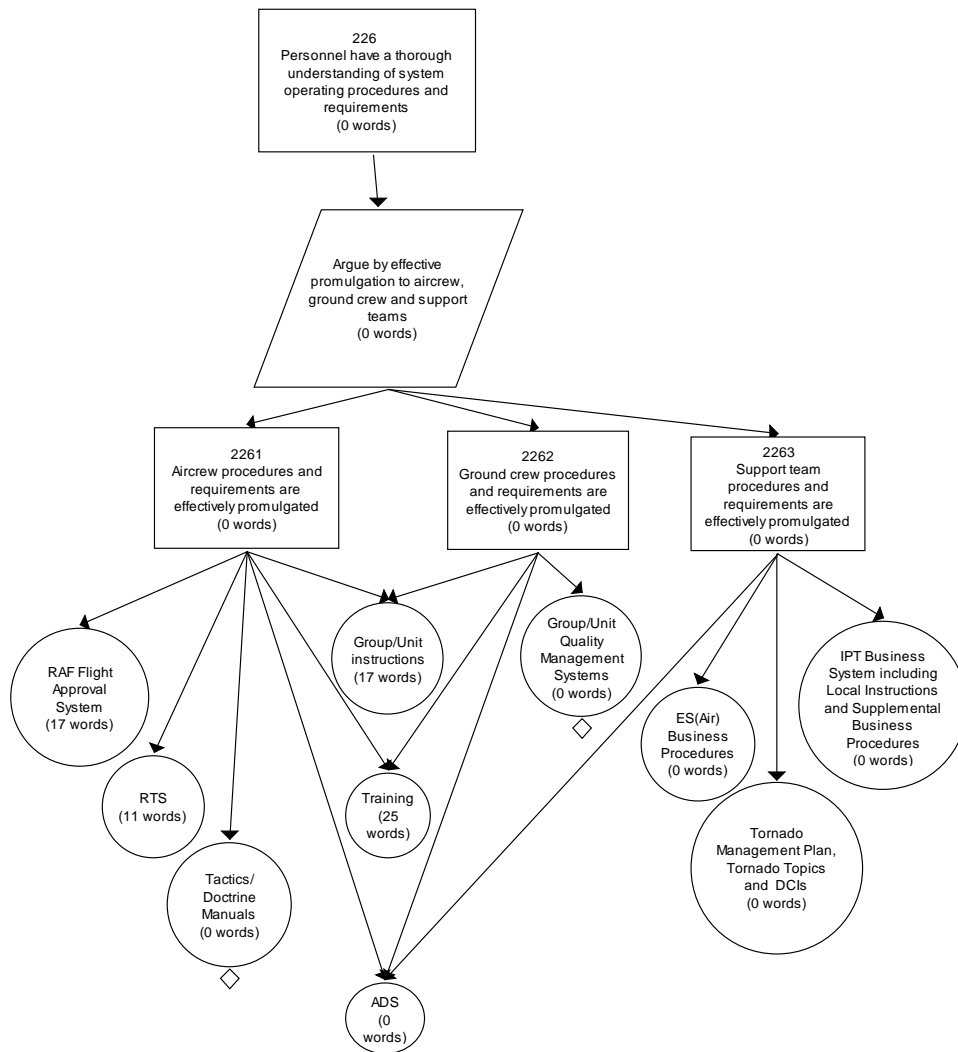
- Dilution rate
- Skills retention
- Matching of influx and out-postings
- Balance of training standards vs Sqn training burden

**Node Status: Development required**

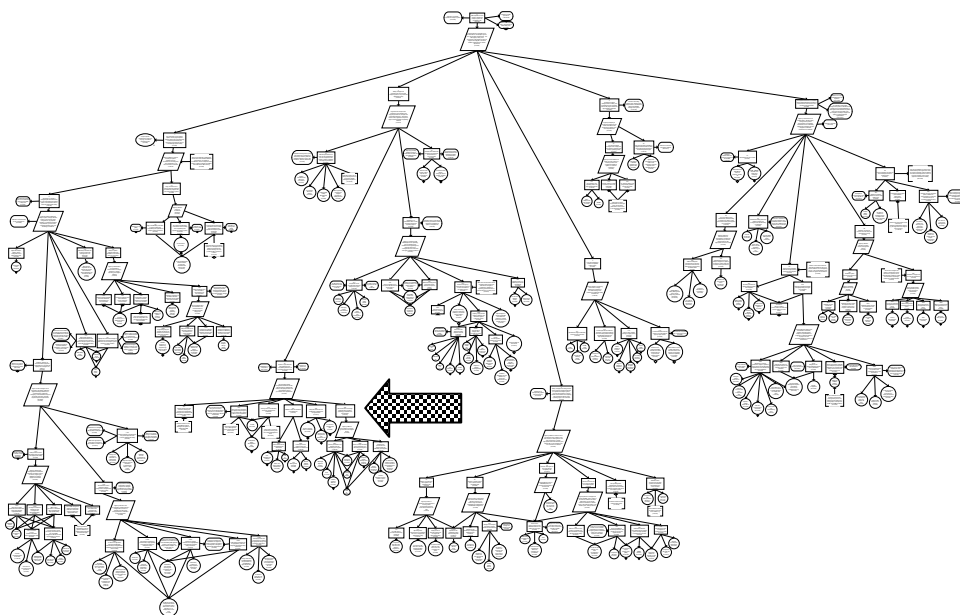
**SOLUTION (GOAL 225): IPT RESOURCE MANAGEMENT PLAN**

**Node Status: Development required**

## 2.4 Personnel understand procedures and requirements (Goal 226)



### Location within Safety Case



Tornado Safety Case (v1.0) - Baseline - created February 2004

**Goal 226: Personnel have a thorough understanding of system operating procedures and requirements**

*Strategy (Goal 226): Argue by effective promulgation to aircrew, ground crew and support teams*

**Goal 2261: Aircrew procedures and requirements are effectively promulgated**

**SOLUTION (GOAL 2261): RAF FLIGHT APPROVAL SYSTEM**

Approval system ensures that all updates to RTS and aircrew procedures are brought to attention of staff.

**SOLUTION (GOAL 2261): RTS**

Interpretation and application supported by QF!/QWI advice at squadron level

**SOLUTION (GOAL 2261): TACTICS/ DOCTRINE MANUALS**

Node Status: Development required to establish scope/references

**SOLUTION (GOALS 2261, 2262 & 2263): ADS**

**SOLUTION (GOALS 2261, 2262 & 2263): GROUP/UNIT INSTRUCTIONS**

Instructions are used as appropriate to bring attention to the more significant changes in procedures and requirements

**SOLUTION (GOALS 2261, 2262 & 2263): TRAINING**

Training syllabus is continually revised to reflect changes in procedures and requirements.

- OCU training for aircrew provides comprehensive notes to complement RTS and system descriptions

**Goal 2262: Ground crew procedures and requirements are effectively promulgated**

**SOLUTION (GOAL 2262): GROUP/UNIT QUALITY MANAGEMENT SYSTEMS**

Node Status: Development required to identify and document relevant systems

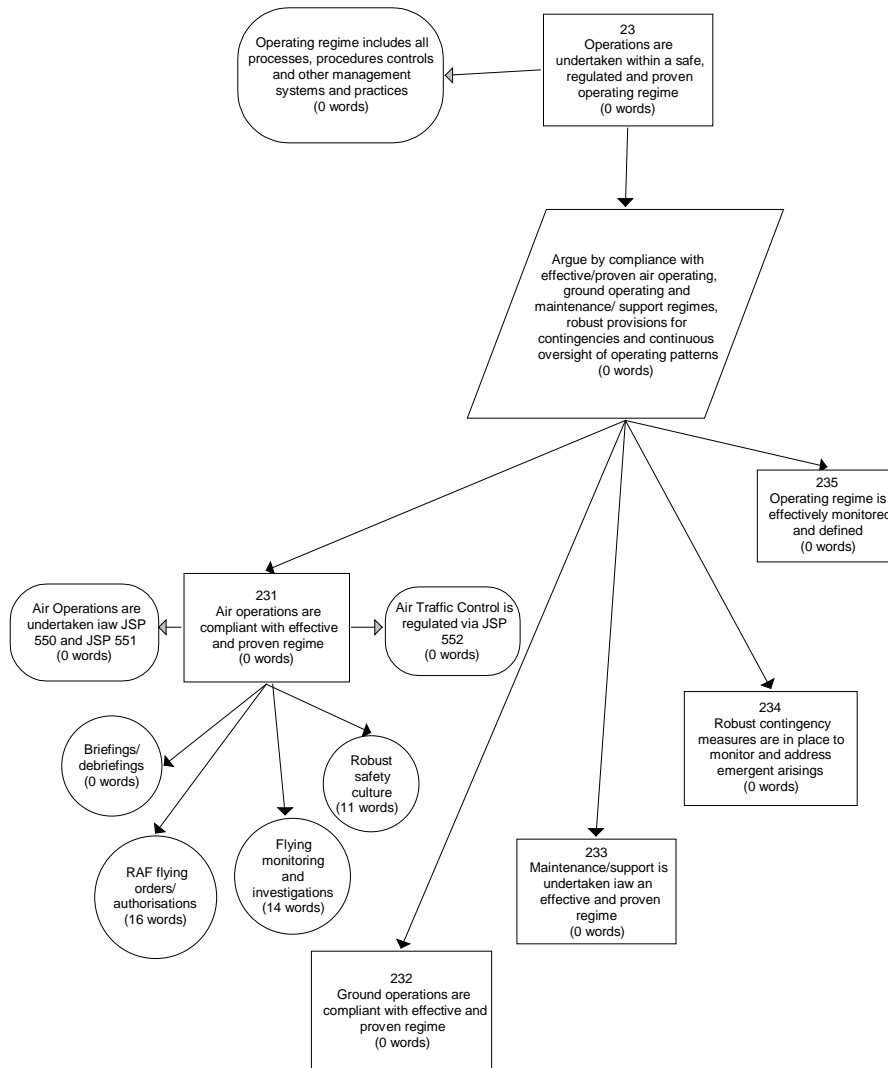
**Goal 2263: Support team procedures and requirements are effectively promulgated**

**SOLUTION (GOAL 2263): ES(AIR) BUSINESS PROCEDURES**

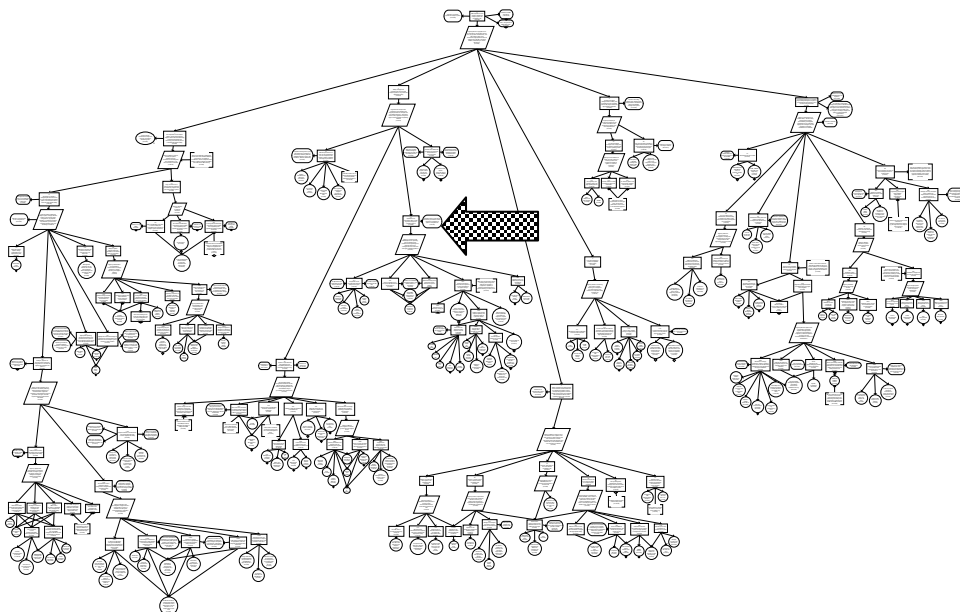
**SOLUTION (GOAL 2263): TORNADO MANAGEMENT PLAN, TORNADO TOPICS AND DCIS**

**SOLUTION (GOAL 2263): IPT BUSINESS SYSTEM INCLUDING LOCAL INSTRUCTIONS AND SUPPLEMENTAL BUSINESS PROCEDURES**

## 2.5 Safe operating regime (Goal 23)



### Location within Safety Case



Tornado Safety Case (v1.0) - Baseline - created February 2004



## **Goal 23: Operations are undertaken within a safe, regulated and proven operating regime**

*Context (Goal 23): Operating regime includes all processes, procedures controls and other management systems and practices*

*Strategy (Goal 23): Argue by compliance with effective/proven air operating, ground operating and maintenance/ support regimes, robust provisions for contingencies and continuous oversight of operating patterns*

### **Goal 231: Air operations are compliant with effective and proven regime**

*Context (Goal 231): Air Operations are undertaken iaw JSP 550 and JSP 551*

*Context (Goal 231): Air Traffic Control is regulated via JSP 552*

#### **SOLUTION (GOAL 231): BRIEFINGS/ DEBRIEFINGS**

#### **SOLUTION (GOAL 231): RAF FLYING ORDERS/ AUTHORISATIONS**

Need to check if there is also need to recognise role of GASOs.

RTSA to advise

**Node Status: Development required to resolve above areas of uncertainty**

#### **SOLUTION (GOAL 231): FLYING MONITORING AND INVESTIGATIONS**

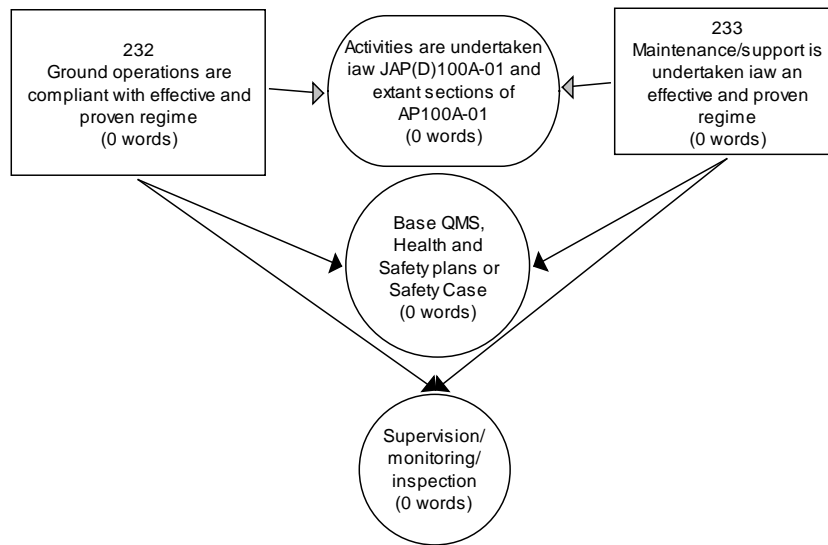
The process includes:

- Air Prox reports
- Complaint investigations (e.g. low-flying)
- Radar oversight

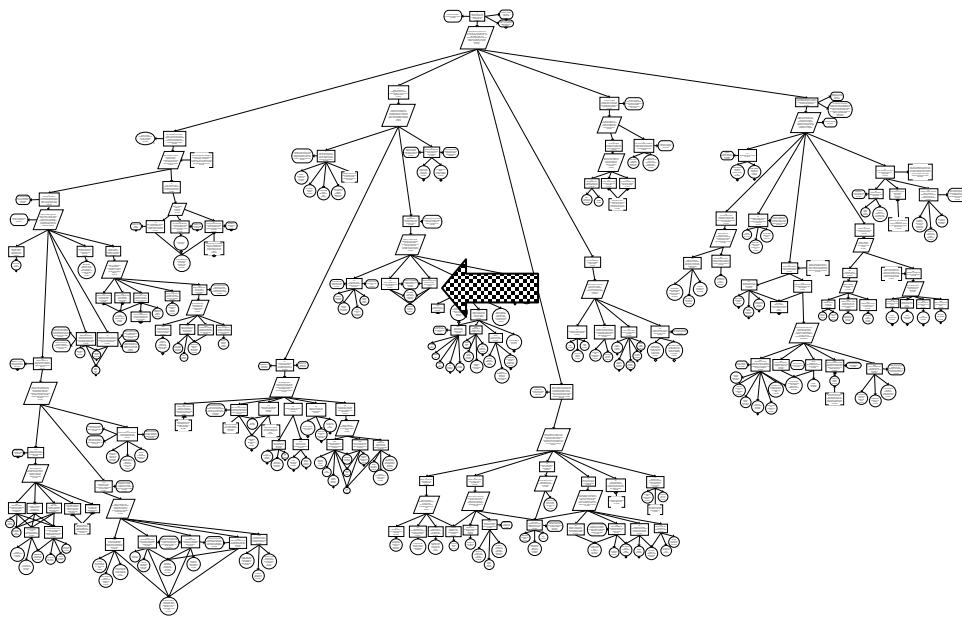
#### **SOLUTION (GOAL 231): ROBUST SAFETY CULTURE**

This is maintained and constantly reinforced by training, seminars and briefings

## 2.6 Ground operations and support follow effective regime (Goals 232/3)



### Location within Safety Case



### Goal 232: Ground operations are compliant with effective and proven regime

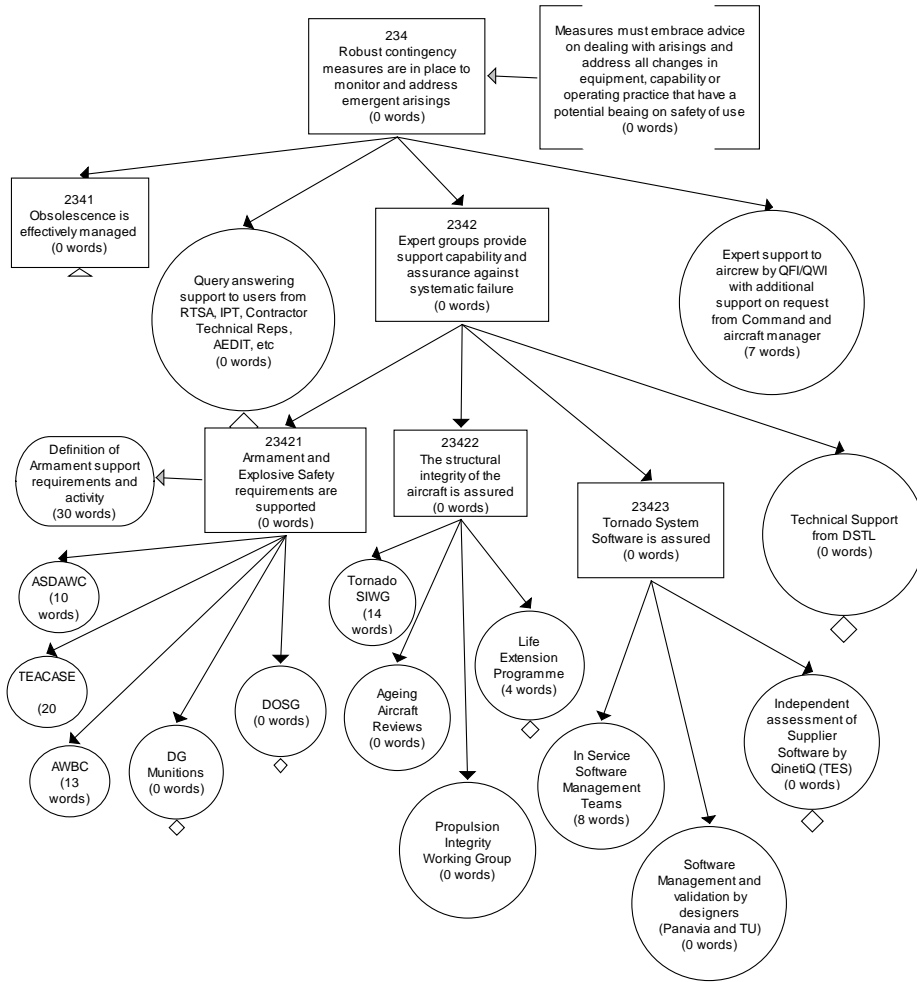
*Context (Goals 232 & 233): Activities are undertaken iaw JAP(D)100A-01 and extant sections of AP100A-01*

**SOLUTION (GOAL 232 & 233): BASE QMS, HEALTH AND SAFETY PLANS OR SAFETY CASE**

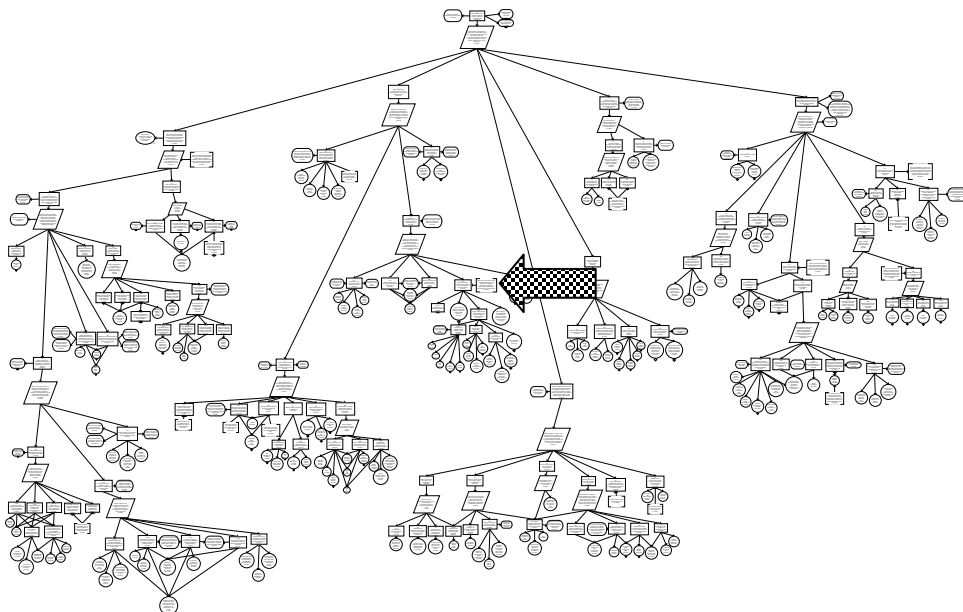
**SOLUTION (GOAL 232 & 233): SUPERVISION/ MONITORING/ INSPECTION**

# Goal 233 Maintenance/support is undertaken iaw an effective and proven regime

## 2.7 Robust contingency measure (Goal 234)



### Location within Safety Case



Tornado Safety Case (v1.0) - Baseline - created February 2004

## **Goal 234: Robust contingency measures are in place to monitor and address emergent arisings**

**Note (Goal 234):** Measures must embrace advice on dealing with arisings and address all changes in equipment, capability or operating practice that have a potential bearing on safety of use

### **Goal 2341: Obsolescence is effectively managed**

**Node Status: Instantiation required to demonstrate how this aspect is managed**

**SOLUTION (GOAL 234): QUERY ANSWERING SUPPORT TO USERS FROM RTSA, IPT, CONTRACTOR TECHNICAL REPS, AEDIT, ETC**

**Node Status: Development required to identify respective management arrangements**

### **Goal 2342: Expert groups provide support capability and assurance against systematic failure**

#### **Goal 23421: Armament and Explosive Safety requirements are supported**

*Context (Goal 23421): Definition of Armament support requirements and activity*

*AP 100A-01, Leaflet 177 Arms and Explosives Safety in the RAF*

*AP 100A-01, Leaflet 346 Management of Aircraft Arms Suspension Equipment*

*JSP 553, Ch 4, Para 4.44*

#### **SOLUTION (GOAL 23421): ASDAWC**

Aircraft Self Damage from Weapons Committee

Aircraft Self Damage Manual

#### **SOLUTION (GOAL 23421): TEACASE**

The Thermal Effects on Airborne Conventional Armament Stores and Equipment Committee

Defines carriage limitations of weapons and explosive release equipment.

#### **SOLUTION (GOAL 23421): AWBC**

Aircraft Weapons Ballistic Committee

Provides information for ballistics tables for aircraft weapon aiming

#### **.SOLUTION (GOAL 23421): DG MUNITIONS**

**Node Status: Development required to identify and document management relationship and arrangements**

#### **SOLUTION (GOAL 23421): DOSG**

**Node Status: Development required to identify and document management relationship and arrangements**

Tornado Safety Case (v1.0) - Baseline - created February 2004

**Goal 23422: The structural integrity of the aircraft is assured**

**SOLUTION (GOAL 23422): TORNADO SIWG**

Arrangements for management of structural integrity are described in Annex N of the TESMP

**SOLUTION (GOAL 23422): AGEING AIRCRAFT REVIEWS**

**SOLUTION (GOAL 23422): PROPULSION INTEGRITY WORKING GROUP**

**SOLUTION (GOAL 23422): LIFE EXTENSION PROGRAMME**

Life Extension Working Group

[Node Status: Development required to capture and document arrangements and outcome](#)

**Goal 23423: Tornado System Software is assured**

**SOLUTION (GOAL 23423): IN SERVICE SOFTWARE MANAGEMENT TEAMS**

GR4/4A - TISMT

FMk3 - ADV Software Management Team

**SOLUTION (GOAL 23423): SOFTWARE MANAGEMENT AND VALIDATION BY DESIGNERS (PANAVIA AND TU)**

**SOLUTION (GOAL 23423): INDEPENDENT ASSESSMENT OF SUPPLIER SOFTWARE BY QINETIQ (TES)**

[Node Status: Development required to capture and document working arrangements and assessment criteria.](#)

**SOLUTION (GOAL 2342): TECHNICAL SUPPORT FROM DSTL**

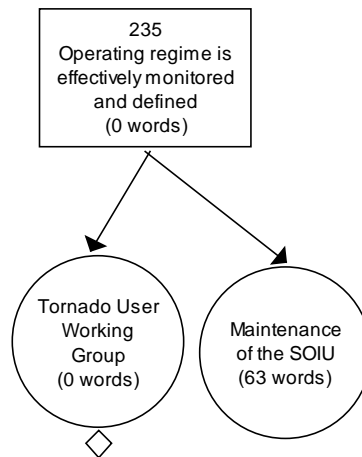
[Node Status: Development required to identify and document arrangements](#)

**SOLUTION (GOAL 234): EXPERT SUPPORT TO AIRCREW BY QFI/QWI WITH ADDITIONAL SUPPORT ON REQUEST FROM COMMAND AND AIRCRAFT MANAGER**

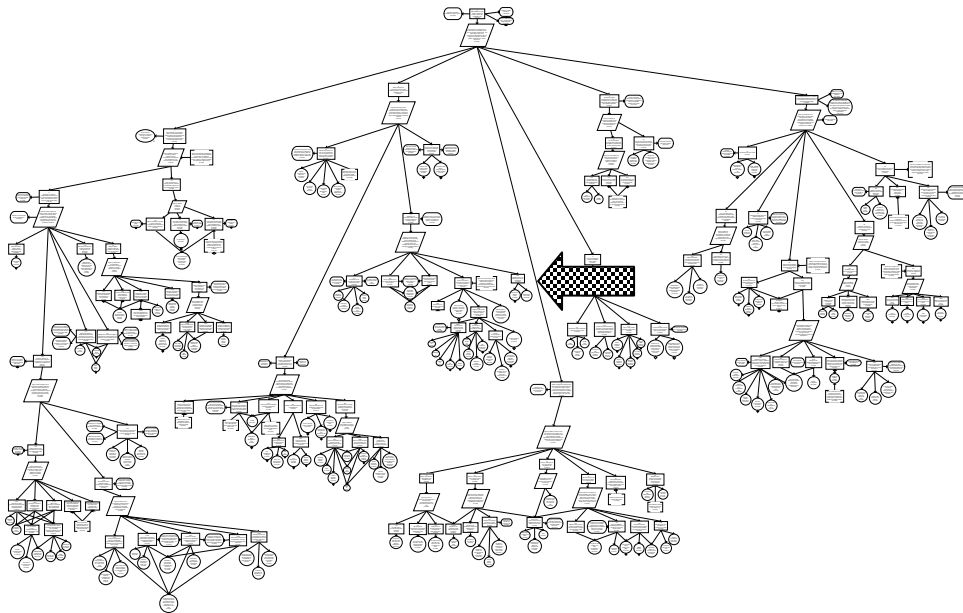
Information accessible from:

- OEU
- AWC
- Staneval
- CFS

## 2.8 Operating regime monitored and defined (Goal 235)



### Location within Safety Case



### Goal 235 Operating regime is effectively monitored and defined

#### SOLUTION (GOAL 235): TORNADO USER WORKING GROUP

Node Status: Development required to capture and document group arrangements

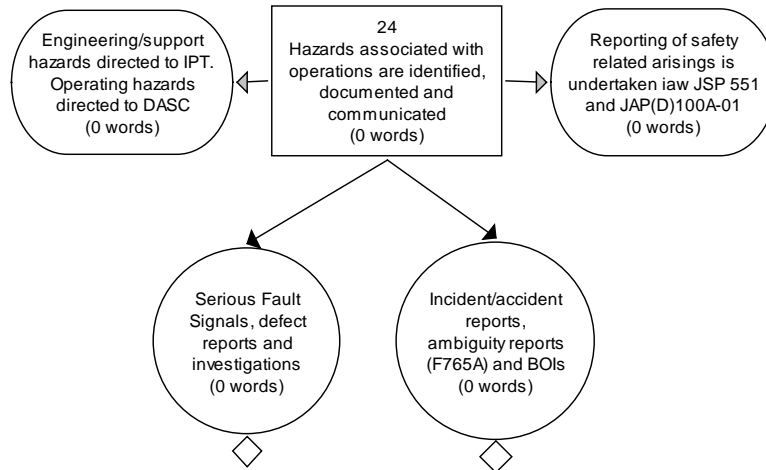
#### SOLUTION (GOAL 235): MAINTENANCE OF THE SOIU

The SOIU is periodically reviewed and updated to reflect evolving operating practice and to inform structures managers and others needing information on usage patterns and practice.

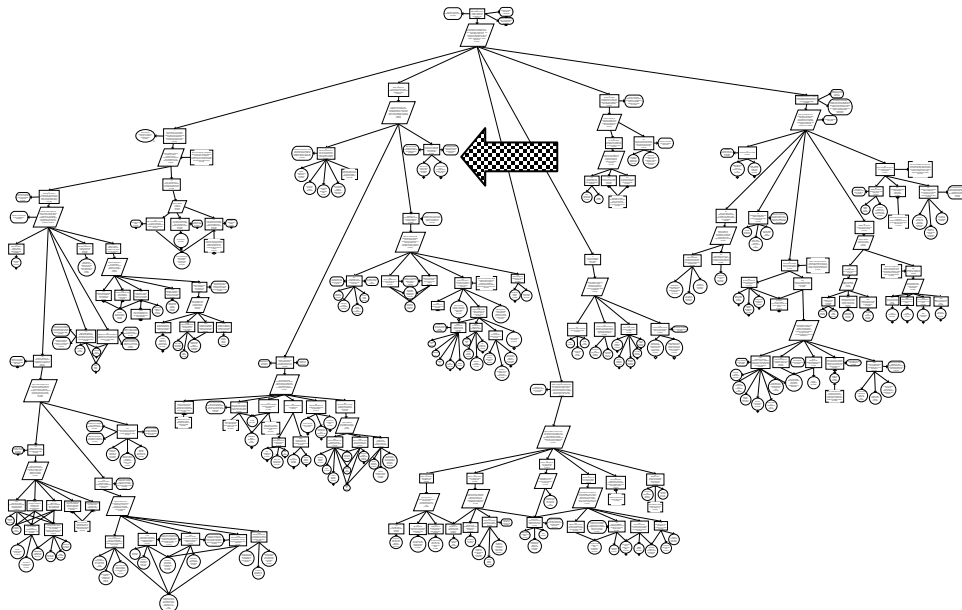
The information of the SOIU may also be complemented as appropriate by management oversight of other information that can give an insight on user activities and intent. This includes:

- Tactics & Doctrine
- Operating bases (esp. detachments)
- Roles

## 2.9 Hazards of operation (Goal 24)



### Location within Safety Case



### Goal 24: Hazards associated with operations are identified, documented and communicated

**Context (Goal 24):** Reporting of safety related arisings is undertaken iaw JSP 551 and JAP(D)100A-01

**Context (Goal 24):** Engineering/support hazards directed to IPT. Operating hazards directed to DASC

### SOLUTION (GOAL 24): SERIOUS FAULT SIGNALS, DEFECT REPORTS AND INVESTIGATIONS

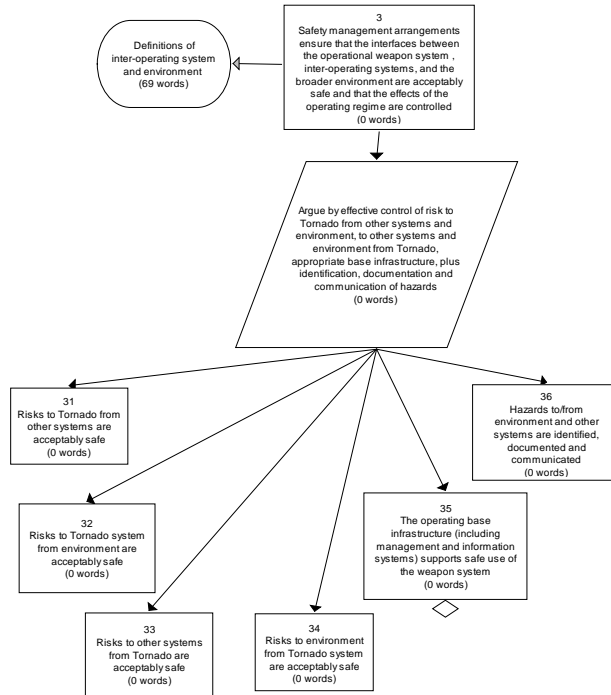
Tornado Safety Case (v1.0) - Baseline - created February 2004

Node Status: Development required to capture and document management process

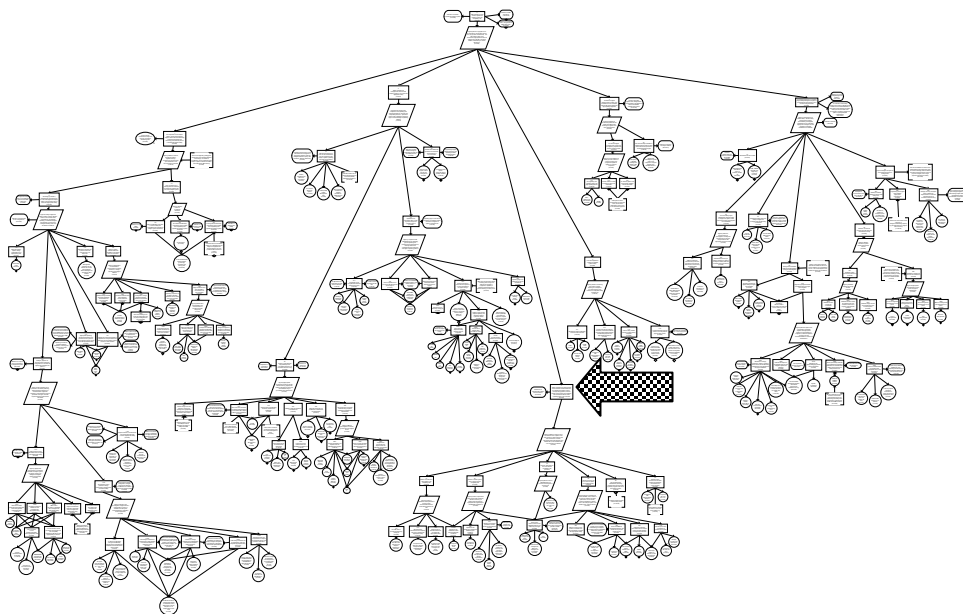
**SOLUTION (GOAL 24): INCIDENT/ACCIDENT REPORTS, AMBIGUITY REPORTS (F765A) AND BOARDS OF INQUIRY**

Node Status: Development required to capture and document management process

**3 Section 3: Environmental safety (Goal 3)**



**Location within Safety Case**





**Goal 3 Safety management arrangements ensure that the interfaces between the operational weapon system , inter-operating systems, and the broader environment are acceptably safe and that the effects of the operating regime are controlled**

**Context (Goal 3):** *Definitions of inter-operating system and environment*

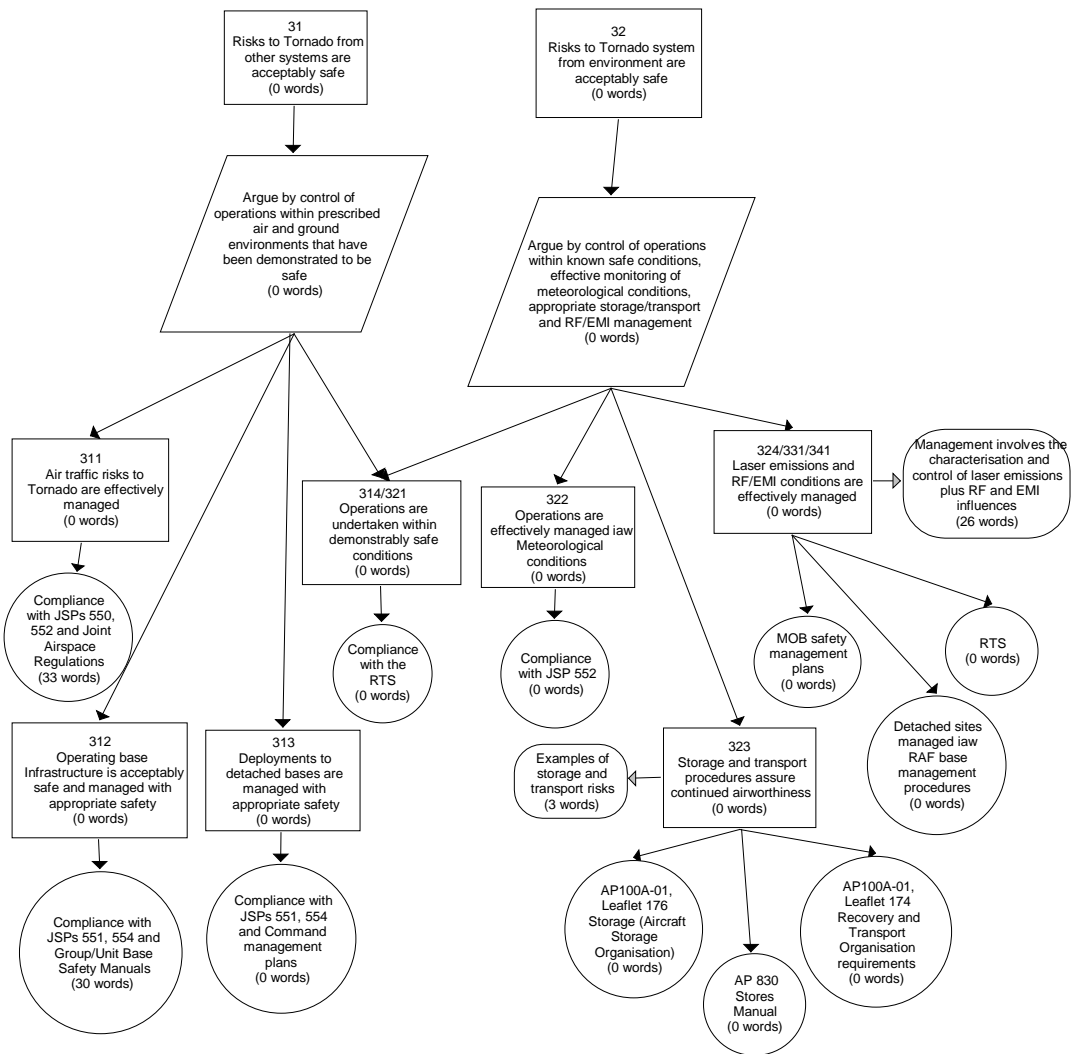
*Inter-operating systems include all elements of the air and ground environment that are required to undertake or support operations of the Tornado Weapon System. Examples of these are: Non-Tornado specific ground support equipment, weapon loaders, fuel tankers, other weapon systems, aerial refuellers, other aircraft, radar/ILS/landing aids, barriers, arrester gears, etc.*

*Environment includes: Natural surface environment, natural air environment, non-military air traffic, electromagnetic radiation, etc*

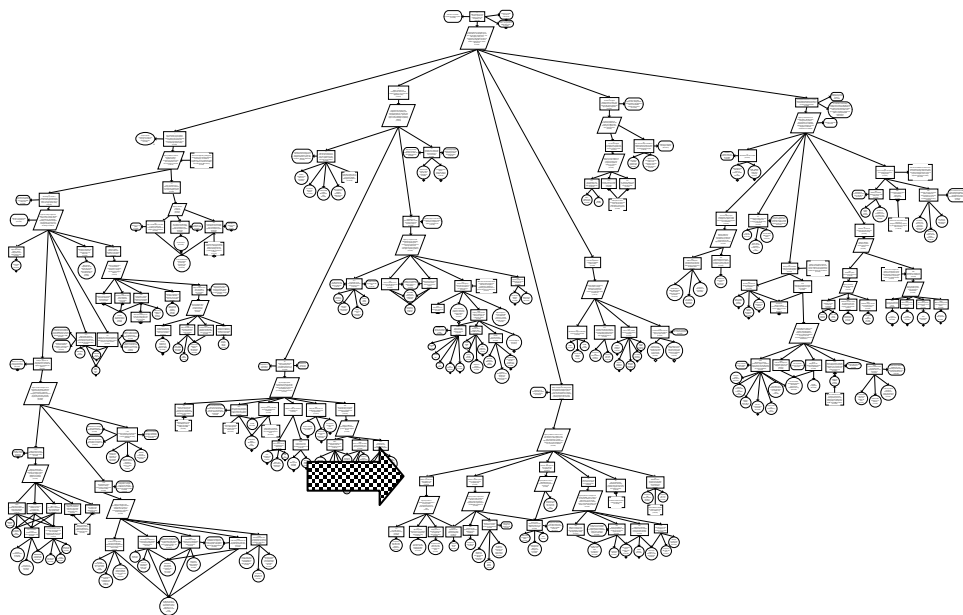
*Particular attention is given to the management of societal expectations in respect of the risk to third parties and third party establishments such as schools, hospitals and areas of high population density where the consequences of any adverse event could have a devastating impact.*

**Strategy (Goal 3):** *Argue by effective control of risk to Tornado from other systems and environment, to other systems and environment from Tornado, appropriate base infrastructure, plus identification, documentation and communication of hazards*

### 3.1 Risks to Tornado (Goals 31 & 32)



### Location within Safety Case



## **Goal 31: Risks to Tornado from other systems are acceptably safe**

*Strategy (Goal 31): Argue by control of operations within prescribed air and ground environments that have been demonstrated to be safe*

### **Goal 311: Air traffic risks to Tornado are effectively managed**

#### **SOLUTION (GOAL 311): COMPLIANCE WITH JSPS 550, 552 AND JOINT AIRSPACE REGULATIONS**

Flying to be considered includes:

- UK Airspace
- RAF Low Flying areas using normal booking arrangements
- RAF North Sea operating areas and other range areas

Managed via JSP and RAF flying orders and regulations

### **Goal 312: Operating base Infrastructure is acceptably safe and managed with appropriate safety**

#### **SOLUTION (GOAL 312): COMPLIANCE WITH JSPS 551, 554 AND GROUP/UNIT BASE SAFETY MANUALS**

Safety manuals embrace such matters as:

- the provision of appropriate consumables, such as fuels, oils, lubricants to the the weapon system.
- Provisions for bird-scaring, runway sweeping, de-icing, etc

### **Goal 313: Deployments to detached bases are managed with appropriate safety**

#### **SOLUTION (GOAL 313): COMPLIANCE WITH JSPS 551, 554 AND COMMAND MANAGEMENT PLANS**

### **Goals 314/321: Operations are undertaken within demonstrably safe conditions**

#### **SOLUTION (GOALS 314/321): COMPLIANCE WITH THE RTS**

## **Goal 32: Risks to Tornado system from environment are acceptably safe**

*Strategy (Goal 32): Argue by control of operations within known safe conditions, effective monitoring of meteorological conditions, appropriate storage/transport and RF/EMI management*

### **Goal 322: Operations are effectively managed iaw meteorological conditions**

#### **SOLUTION (GOAL 322): COMPLIANCE WITH JSP 552**

## **Goal 323: Storage and transport procedures assure continued airworthiness**

*Context (Goal 323): Examples of storage and transport risks*

*Damage*

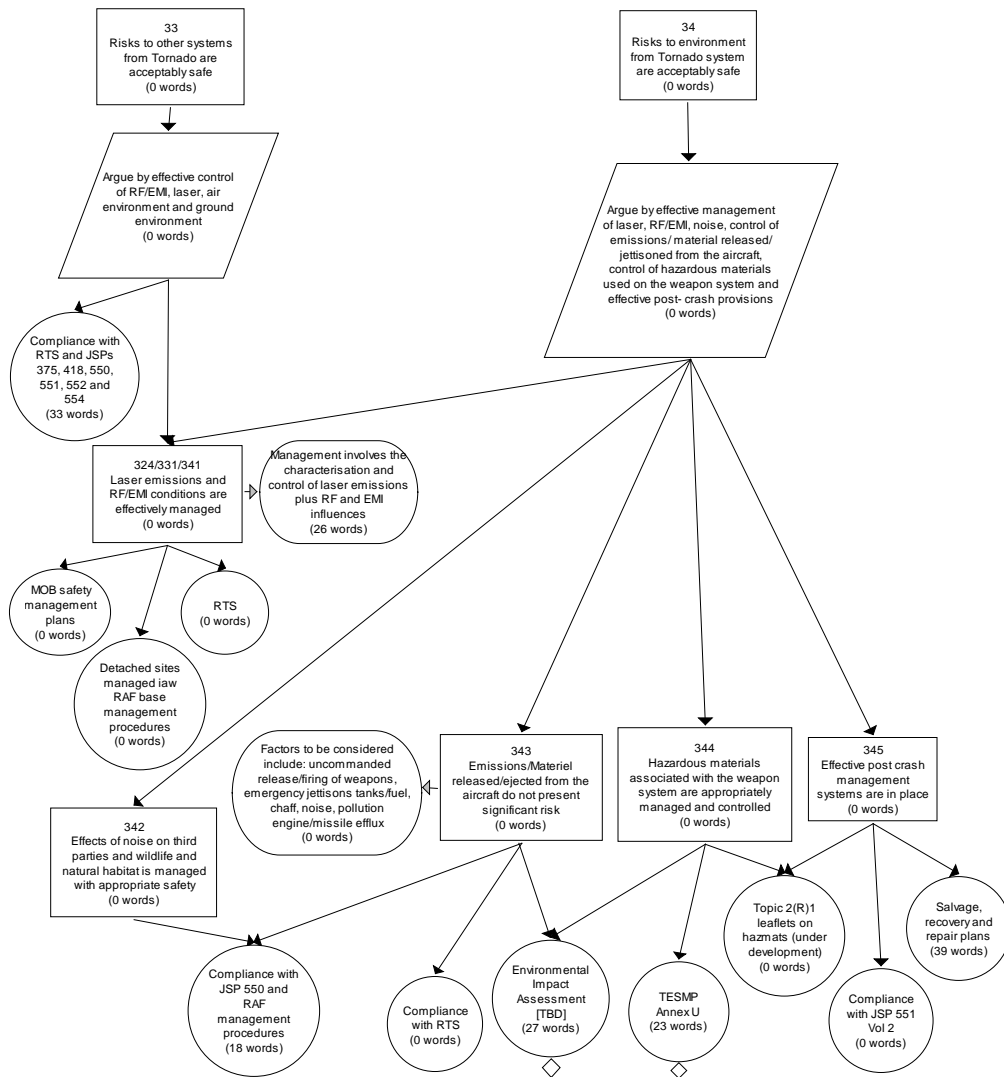
*Environmental degradation.*

**SOLUTION (GOAL 323): AP100A-01, LEAFLET 176 STORAGE (AIRCRAFT STORAGE ORGANISATION)**

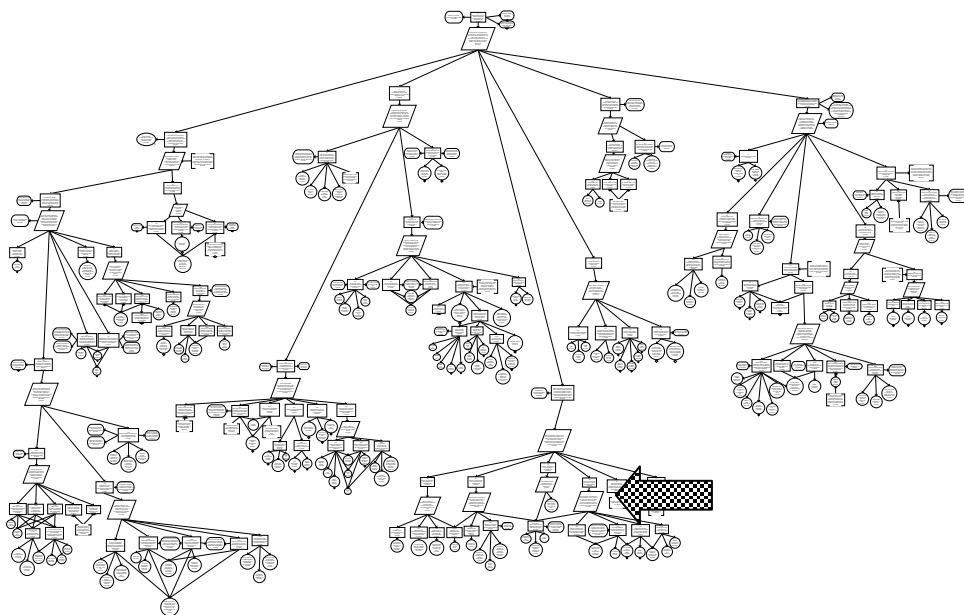
**SOLUTION (GOAL 323): AP 830 STORES MANUAL**

**SOLUTION (GOAL 323): AP100A-01, LEAFLET 174 RECOVERY AND TRANSPORT ORGANISATION REQUIREMENTS**

### 3.2 Risks from Tornado (Goals 33 & 34)



### Location within Safety Case



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### **Goal 33: Risks to other systems from Tornado are acceptably safe**

*Strategy (Goal 33): Argue by effective control of RF/EMI, laser, air environment and ground environment*

#### **SOLUTION (GOAL 33): COMPLIANCE WITH RTS AND JSPS 375, 418, 550, 551, 552 AND 554**

Flying to be considered includes:

- UK Airspace
- RAF Low Flying areas using normal booking arrangements
- RAF North Sea operating areas and other range areas

Managed via JSP and RAF flying orders and regulations

### **Goal 324/331/341: Laser emissions and RF/EMI conditions are effectively managed**

*Context (Goal 324/331/341): Management involves the characterisation and control of laser emissions plus RF and EMI influences*

*Example:*

*Requires risk to non-Tornado systems and third parties to be acceptable/mitigated for example by system operating procedures (e.g. radar in close formation)*

#### **SOLUTION (GOALS 324/331/341): MOB SAFETY MANAGEMENT PLANS**

#### **SOLUTION (GOALS 324/331/341): DETACHED SITES MANAGED IAW RAF BASE MANAGEMENT PROCEDURES**

#### **SOLUTION (GOALS 324/331/341): RTS**

### **Goal 34: Risks to environment from Tornado system are acceptably safe**

*Strategy (Goal 34): Argue by effective management of laser, RF/EMI, noise, control of emissions/ material released/ jettisoned from the aircraft, control of hazardous materials used on the weapon system and effective post- crash provisions*

### **Goal 342: Effects of noise on third parties, wildlife and natural habitat is managed with appropriate safety**

#### **SOLUTION (GOAL 342 & 343): COMPLIANCE WITH JSP 550 AND RAF MANAGEMENT PROCEDURES**

Embraces air/ground operating procedures and control of activities in safe areas for all planned and emergency releases

## **Goal 343: Emissions/Material released/ejected from the aircraft do not present significant risk**

*Context (Goal 343): Factors to be considered include: uncommanded release/firing of weapons, emergency jettisons tanks/fuel, chaff, noise, pollution e.g. engine exhaust/missile efflux*

### **SOLUTION (GOAL 343): COMPLIANCE WITH RTS**

### **SOLUTION (GOALS 343 & 344): ENVIRONMENTAL IMPACT ASSESSMENT [TBD]**

This will need to take account of:

- Materials used and characters of emissions/release
- Recovery and remediation procedures
- Third party risk determined in ASSAR to be acceptable

**Node Status: Development required when EIA undertaken**

## **Goal 344: Hazardous materials associated with the weapon system are appropriately managed and controlled**

### **SOLUTION (GOAL 344): TESMP ANNEX U**

Annex U and associated processes still in early stage of development and require more work to establish an effective and compliant management system

**Node Status: Development required as TESMP matures**

### **SOLUTION (GOALS 344 & 345): TOPIC 2(R)1 LEAFLETS ON HAZMATS (UNDER DEVELOPMENT)**

**Node Status: Development required to update/complete Topic 2(R)1**

## **Goal 345: Effective post crash management systems are in place**

### **SOLUTION (GOAL 345): COMPLIANCE WITH JSP 551 VOL 2**

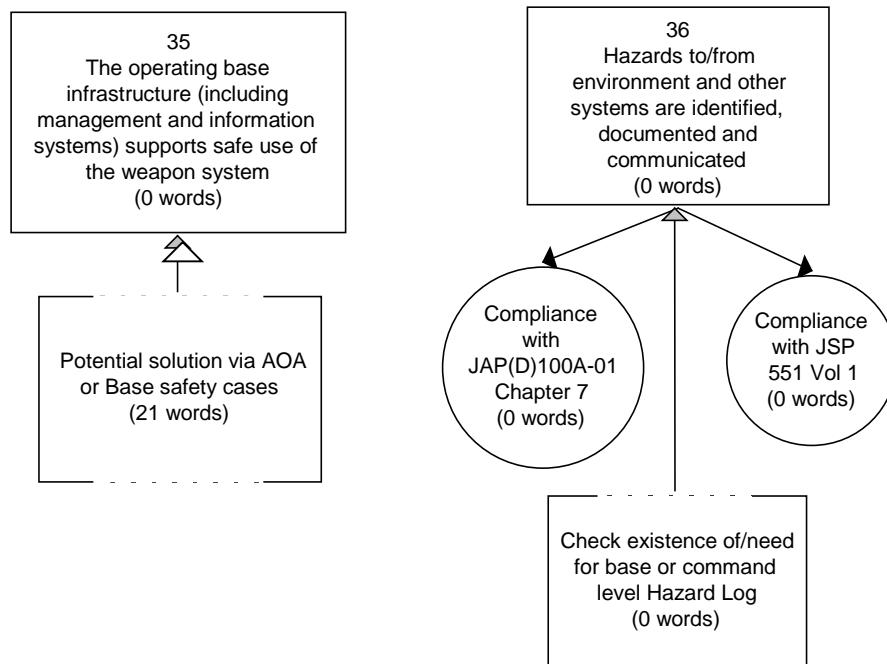
### **SOLUTION (GOAL 345): SALVAGE, RECOVERY AND REPAIR PLANS**

These include:

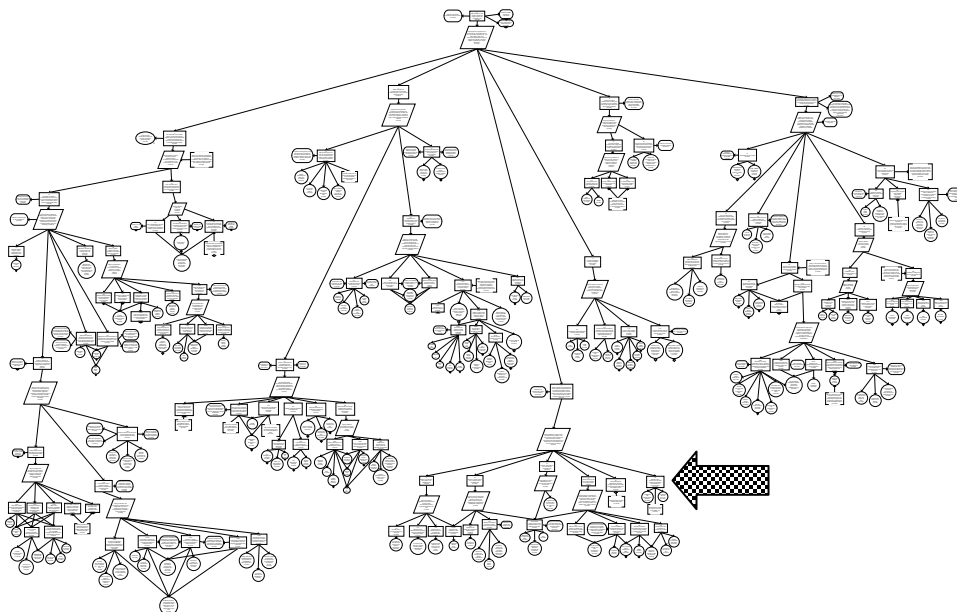
- MOB management plans
- RAF Leeming practices apply for wider UK

A key factor to be considered is that recovery of wreckage removes the risk to general public but involves risks to recovery teams that must be managed

### 3.3 Base infrastructure and environmental hazards (Goals 35 & 36)



#### Location within Safety Case



#### Goal 35: The operating base infrastructure (including management and information systems) supports safe use of the weapon system

Node Status: Instantiation required to establish supporting argument and evidence

**Note (Goal 35):** Potential solution via AOA or Base safety cases

The safety case must also take account of any operation from detached sites and the effectiveness of managing the attendant hazards



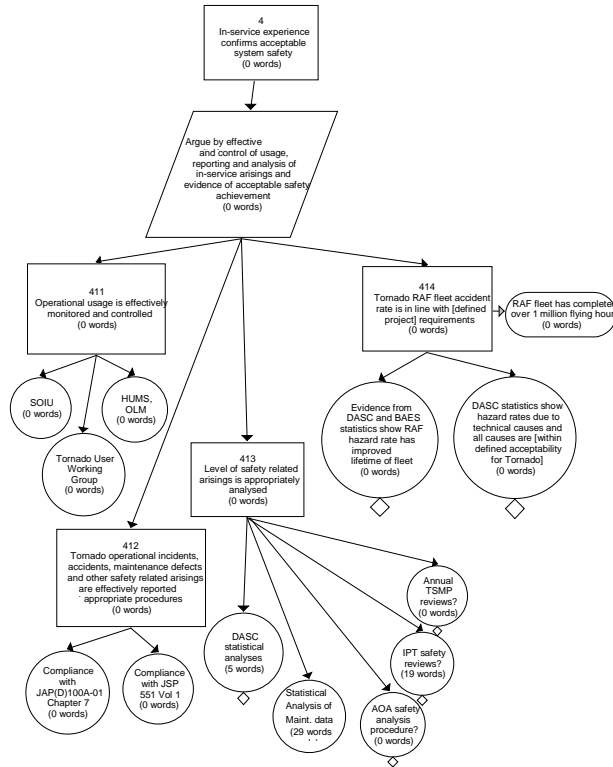
**Goal 36: Hazards to/from environment and other systems are identified, documented and communicated**

**SOLUTION (GOAL 36): COMPLIANCE WITH JAP(D)100A-01 CHAPTER 7**

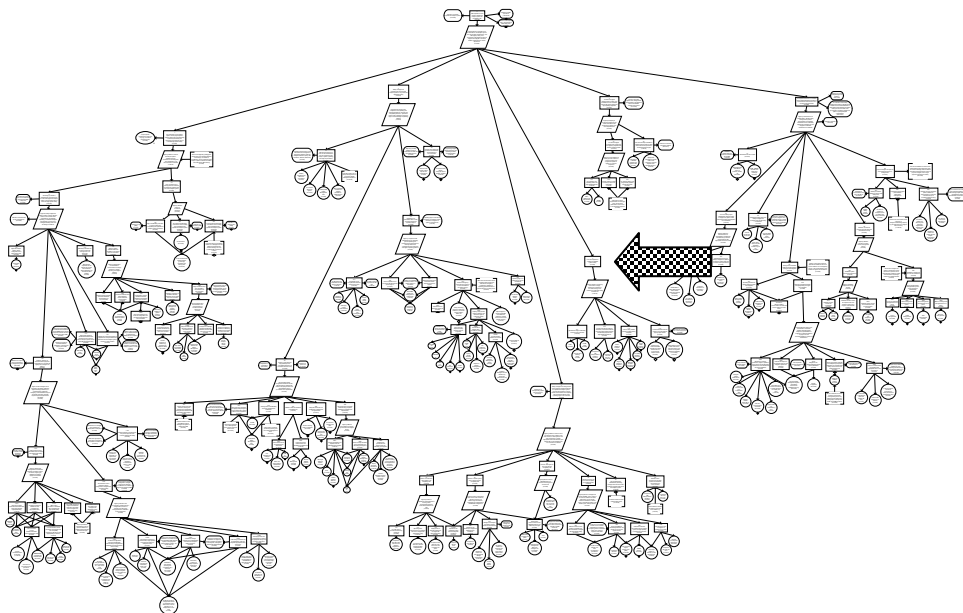
**SOLUTION (GOAL 36): COMPLIANCE WITH JSP 551 VOL 1**

**Note (Goal 36):** Check existence of/need for base or command level Hazard Log

**4 Section 4: In-Service experience (Goal 4)**



**Location within Safety Case**



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#### **Goal 4: In-service experience confirms acceptable system safety**

*Strategy (Goal 4): Argue by effective monitoring and control of usage, reporting and analysis of in-service arisings and evidence of acceptable safety achievement*

#### **Goal 411: Operational usage is effectively monitored and controlled**

**SOLUTION (GOAL 411): SOIU**

**SOLUTION (GOAL 411): TORNADO USER WORKING GROUP**

**SOLUTION (GOAL 411): HUMS, OLM**

#### **Goal 412: Tornado operational incidents, accidents, maintenance defects and other safety related arisings are effectively reported via appropriate procedures**

**SOLUTION (GOAL 412): COMPLIANCE WITH JAP(D)100A-01 CHAPTER 7**

**SOLUTION (GOAL 412): COMPLIANCE WITH JSP 551 VOL 1**

#### **Goal 413: Level of safety related arisings is appropriately analysed**

**SOLUTION (GOAL 413): DASC STATISTICAL ANALYSES**

Annual reports provided to [TBD]

**Node Status: Development required**

**SOLUTION (GOAL 413): STATISTICAL ANALYSIS OF MAINTENANCE DATA**

Annual statistical reviews of engineering performance of systems undertaken by DLO Logistics Applications IPT using maintenance data system reports. Results promulgated to all IPT members and other project stakeholders.

**SOLUTION (GOAL 413): AOA SAFETY ANALYSIS PROCEDURE?**

**Node Status: Development required to establish and document AOA practice**

**SOLUTION (GOAL 413): IPT SAFETY REVIEWS?**

These can be considered as embracing the TSM/THMWG activity, EA and contractor requested support activity

**Node Status: Development required to document/reference processes and procedures**

**SOLUTION (GOAL 413): ANNUAL TSMP REVIEWS?**

**Node Status: Development required to document process/procedure**

#### **Goal 414: Tornado RAF fleet accident rate is in line with [defined project] requirements**

*Context (Goal 414): RAF fleet has completed over 1 million flying hours*

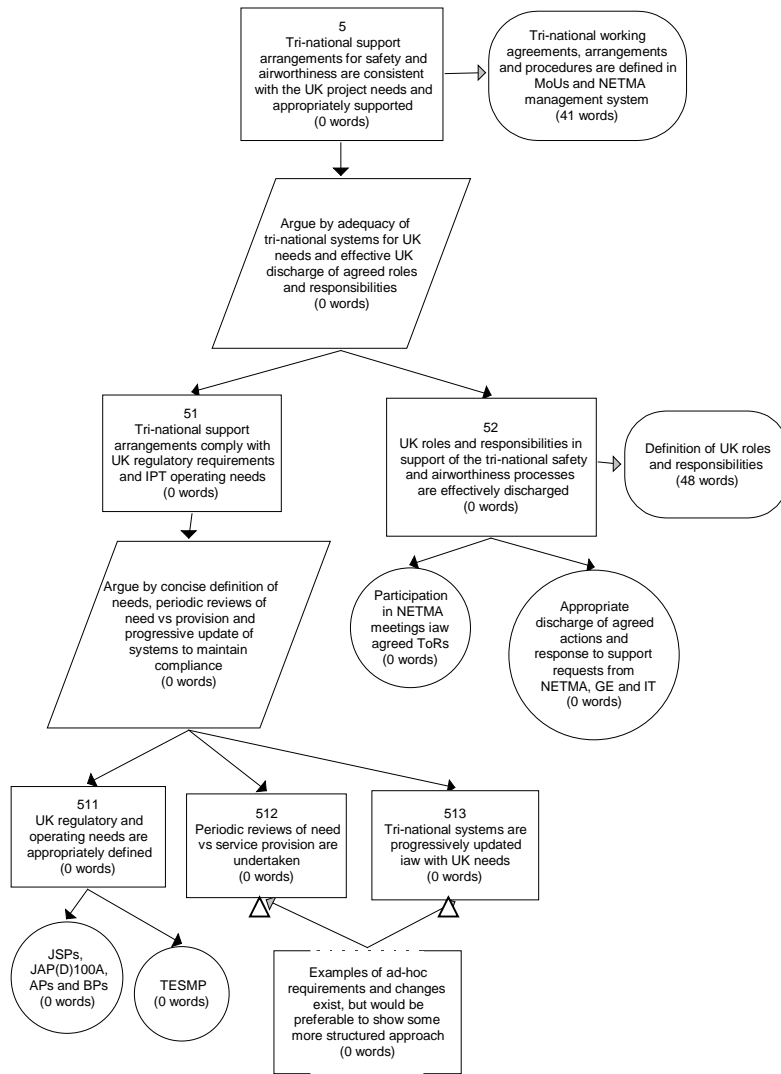
**SOLUTION (GOAL 414): EVIDENCE FROM DASC AND BAES STATISTICS SHOW RAF HAZARD RATE HAS IMPROVED OVER LIFETIME OF FLEET**

**Node Status: Development required to locate and record the necessary evidence references.**

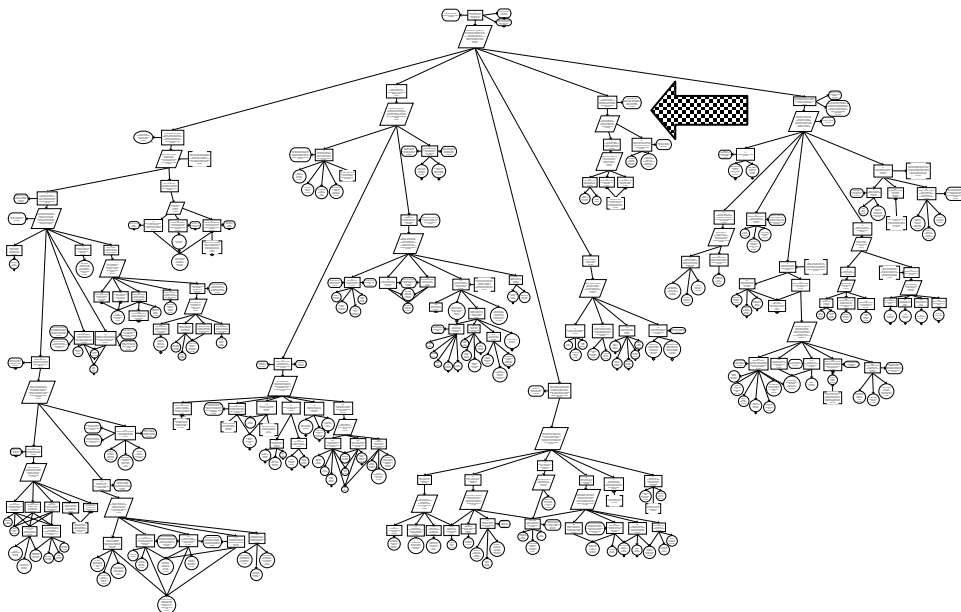
**SOLUTION (GOAL 414): DASC STATISTICS SHOW HAZARD RATES DUE TO TECHNICAL CAUSES AND ALL CAUSES ARE [WITHIN DEFINED ACCEPTABILITY FOR TORNADO]**

**Node Status: Development required to assemble and document evidence in logical format for audit trail purposes.**

## 5 Section 5: Tri-national support (Goal 5)



### Location within Safety Case



Tornado Safety Case (v1.0) - Baseline - created February 2004

## **Goal 5: Tri-national support arrangements for safety and airworthiness are consistent with the UK project needs and appropriately supported**

*Context (Goal 5): Tri-national working agreements, arrangements and procedures are defined in MoUs and NETMA management system*

*To maximum extent possible the tri-national arrangements are founded upon the extant national systems for safety and airworthiness and the concept of reciprocity in which approvals granted iaw such national systems are deemed to satisfy the standards of all partners*

*Strategy (Goal 5): Argue by adequacy of tri-national systems for UK needs and effective UK discharge of agreed roles and responsibilities*

## **Goal 51: Tri-national support arrangements comply with UK regulatory requirements and IPT operating needs**

*Strategy (Goal 51): Argue by concise definition of needs, periodic reviews of need vs provision and progressive update of systems to maintain compliance*

### **Goal 511: UK regulatory and operating needs are appropriately defined**

**SOLUTION (GOAL 511): JSPS, JAP(D)100A, APS AND BPS**

**SOLUTION (GOAL 511): TESMP**

### **Goal 512: Periodic reviews of need vs service provision are undertaken**

**Node Status: Instantiation required to identify a structured approach to reviewing and maintaining the tri-national system.**

**Note (Goals 512 & 513):** Examples of ad-hoc requirements and changes exist, but would be preferable to show some more structured approach

### **Goal 513: Tri-national systems are progressively updated iaw with UK needs**

**Node Status: Instantiation required to identify a structured approach to reviewing and maintaining the tri-national system.**

## **Goal 52: UK roles and responsibilities in support of the tri-national safety and airworthiness processes are effectively discharged**

*Context (Goal 52): Definition of UK roles and responsibilities*

*UK support to the tri-national processes comprises:*

*NDA/NDAAR support to engine and air vehicle qualification and certification*

*PONO and national specialist support the Tornado Modification Board*

*National OTC and IPT support to the Service Release Panel and NAMMO Release for ECR/IDS aircraft*

*National specialist support to the SMG*

*National specialist support to the RAM*

*Exchange of flight safety information iaw STANAGS 3101 & 3531*

*Application and compliance with TESP's*

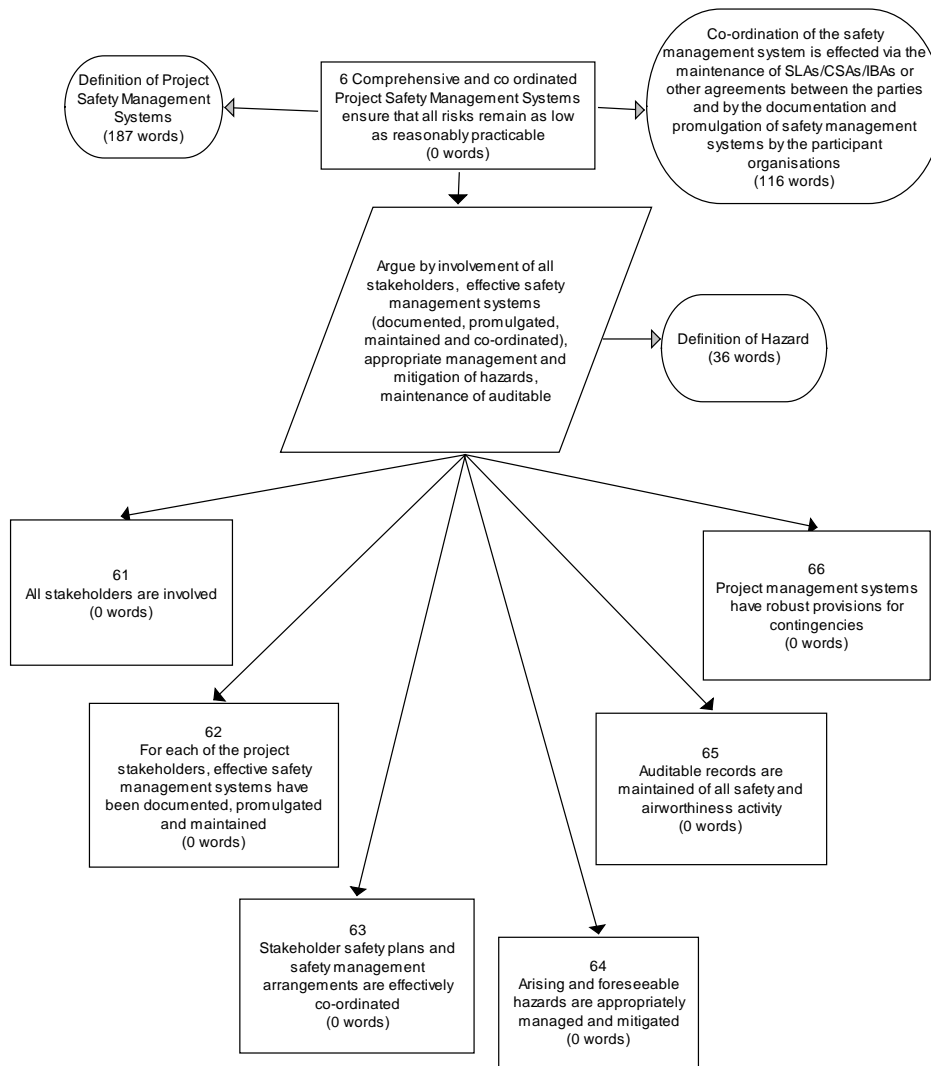
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*Others TBD*

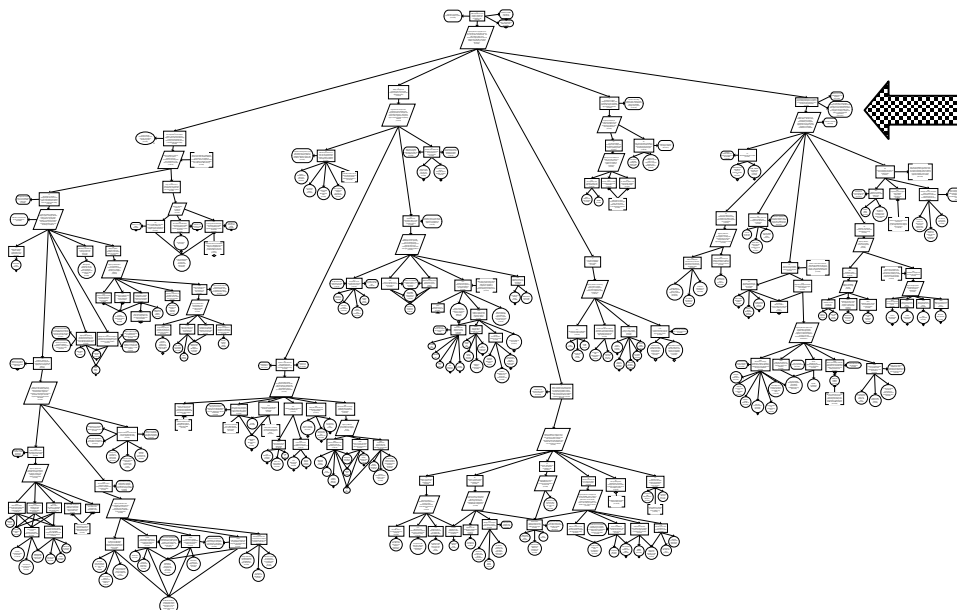
**SOLUTION (GOAL 52): PARTICIPATION IN NETMA MEETINGS IAW AGREED TORS**

**SOLUTION (GOAL 52): APPROPRIATE DISCHARGE OF AGREED ACTIONS AND RESPONSE TO SUPPORT REQUESTS FROM NETMA, GE AND IT**

## 6 Section 6: Safety Management System (Goal 6)



### Location within Safety Case



Tornado Safety Case (v1.0) - Baseline - created February 2004

## **Goal 6: Comprehensive and co ordinated Project Safety Management Systems ensure that all risks remain as low as reasonably practicable**

### **Context (Goal 6): Definition of Project Safety Management Systems**

*The project safety management systems include all safety management processes procedures and practices of the safety stakeholders as defined in Annex A of the TESMP.*

*For the purposes of this safety case the following core processes functions and organisations are considered to be the primary elements of the project safety management system:*

### **Change/Upgrade/Clearance**

*Panavia(Weapon System Designer)*

*Turbo Union(Engine Designer)*

*Panavia/Turbo Union Sub-contractors*

*Mauser (Gun System Designer)*

*NETMO QG (Design Approval Authority)*

*Tornado IPT (UK Design Approval Authority and National Airworthiness Authority)*

*Trinational OTCs (Independent T&E advisers)*

*NETMA SRP (Tri-national service clearance authority)*

*Other UK IPTs (GFE Design Approval and Certification Authorities)*

*RAF Service engineering authorities*

### **Support/Maintenance**

*Tornado IPT (UK Engineering and Support Authority)*

*Panavia/Turbo Union/Mauser and sub contractors (Repair, spares, defect investigation and design changes)*

*Handling Squadron (Aircrew Publication advisers)*

*CTS(TD) ( Maintenance Manual advisers)*

*LSS (SOIU maintenance authority)*

*NETMA (Design change co-ordination and interchange of user information)*

*QinetiQ (Independent advisers on Structural design and management, engine lifing and husbandry and the T&E of UK design changes)*

### **Operations**

*Release to Service Authority (Controllers of the Service operating clearance as set out in the RTS/ADS)*



*Aircraft Operating Authority (Operators and maintainers of the operating resources and infrastructure)*

*DASC (Accident/Incident analysis and advisers on safety of operations)*

*Eng Pol (Oversight and analysis of service engineering standards and trends)*

### **Hazard Management**

*Panavia - BAES (Weapon System Design Hazard co-ordinator and advisor)*

*Turbo Union - Engine design hazard management*

*Tornado IPT (Operational Weapon System Hazard Log manager)*

*Others? e.g. AOA, Base, FLC, DASC*

**Context (Goal 6):** *Co-ordination of the safety management system is effected via the maintenance of SLAs/CSAs/IBAs or other agreements between the parties and by the documentation and promulgation of safety management systems by the participant organisations*

*In addition to ensuring that each element of the safety challenge is being addressed (as indicated in the other legs of this GSN) the Project Safety Management System (PSMS) must provide for the co-ordination of activities between the various parties responsible for managing safety and operations. It must ensure that any arisings are effectively interpreted and communicated to those immediately affected and to the parties responsible for any subsequent management actions and interventions. The system must contain adequate provision for dealing with the all envisaged operational scenarios and contain robust contingency arrangements for dealing with all credible emergencies such that the airworthiness/safety of the weapon system is not compromised.*

*The PSMS will draw upon, but may not be confined to:*

*IPT Tornado Equipment Safety Management Plan,*

*RTSA Safety Management Plan,*

*AOA Safety Management Plan,*

*DASC Safety Management Plan*

*Commodity IPT Safety Management Plans*

*which will in turn be supported by:*

*NETMA Safety Management Arrangements*

*Panavia and PPC Safety Management Arrangements*

*Turbo Union and PC Safety Management Arrangements*

*QinetiQ Safety Management System*

*LSS Safety Arrangements*

*CTS(TD) Safety Management System*

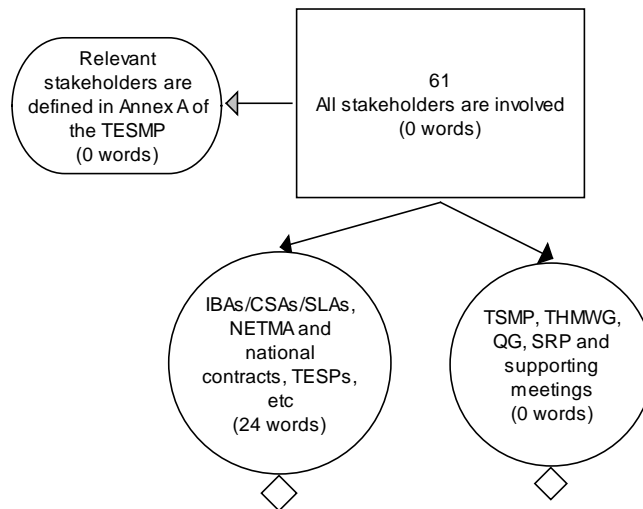
Handling Squadron Safety Management Arrangements

**Strategy (Goal 6):** Argue by involvement of all stakeholders, effective safety management systems (documented, promulgated, maintained and co-ordinated), appropriate management and mitigation of hazards, maintenance of auditable records and provisions for contingencies

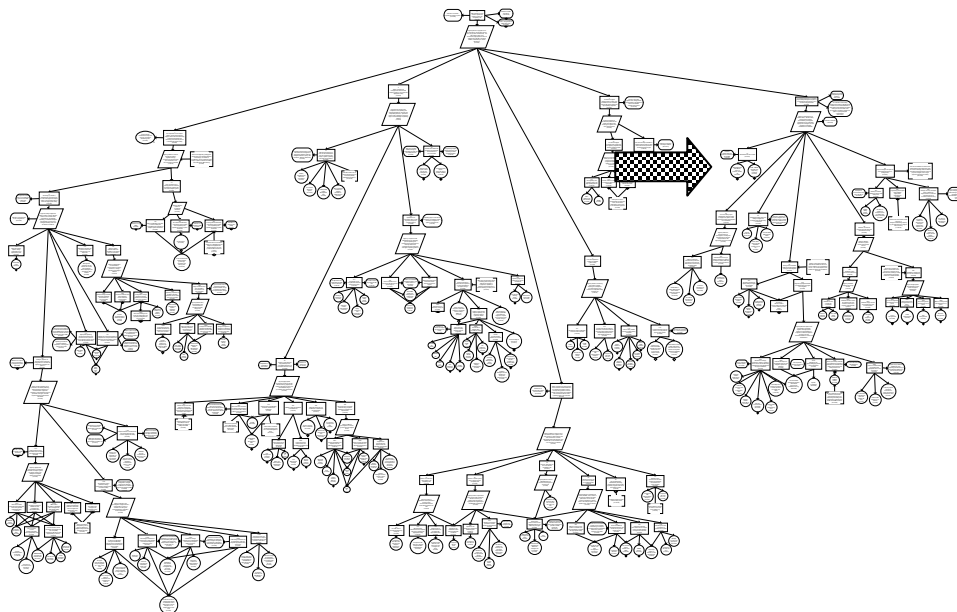
**Context (Strategy(Goal6)):** Definition of Hazard

A Hazard is a condition that has occurred, or could occur in the future, that has the potential in certain circumstances to lead to a significant unplanned event with associated detriment to people, property or process.

### 6.1 Stakeholder involvement (Goal 61)



#### Location within Safety Case



### Goal 61: All stakeholders are involved

**Context (Goal 61):** Relevant stakeholders are defined in Annex A of the TESMP

**SOLUTION (GOAL 61): IBAS/CSAS/SLAS, NETMA AND NATIONAL CONTRACTS, TESPS, ETC**

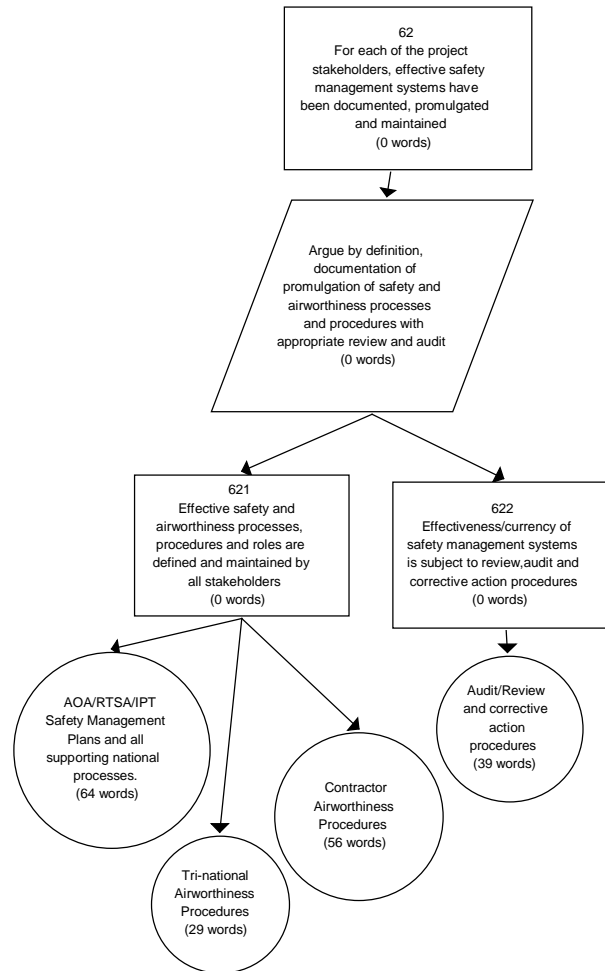
These agreements define the formal working relationships between safety stakeholders and their respective roles, responsibilities, activities and duties. Refer to Annex D to TESMP

**Node Status: Development required to complete Annex D of TESMP and establish a clear record of all external management arrangements**

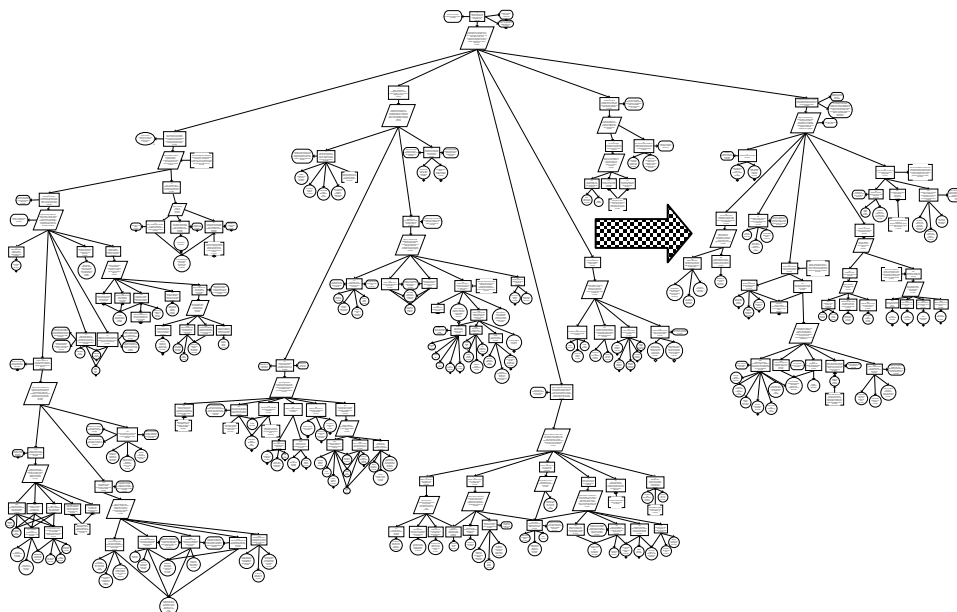
**SOLUTION (GOAL 61): TSMP, THMWG, QG, SRP AND SUPPORTING MEETINGS**

**Node Status: Development required to ensure that TESMP captures and documents all relevant working arrangements**

## 6.2 Documented systems (Goal 62)



### Location within Safety Case



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## **Goal 62: For each of the project stakeholders, effective safety management systems have been documented, promulgated and maintained**

*Strategy (Goal 62): Argue by definition, documentation of promulgation of safety and airworthiness processes and procedures with appropriate review and audit*

### **Goal 621: Effective safety and airworthiness processes, procedures and roles are defined and maintained by all stakeholders**

#### **SOLUTION (GOAL 621): AOA/RTSA/IPT SAFETY MANAGEMENT PLANS AND ALL SUPPORTING NATIONAL PROCESSES.**

Safety Management Plans are as identified within the TESMP.

Supporting national processes include include Joint Service procedures, Joint Air Procedures, DLO Business Procedures, the Acquisition Management System and all relevant Standing Orders and Instructions that implement the requirements.

Roles are defined and delegated through formal delegation letters (e.g as required by BP 1206), supported where necessary by Terms of Reference and Job Descriptions.

#### **SOLUTION (GOAL 621): TRI-NATIONAL AIRWORTHINESS PROCEDURES**

These are defined in Panavia documents QFN01, QFN02, QFN03 and QFN04 as well as NETMA procedures, Terms of Reference and agreements for the QG, SRP and all related fora.

#### **SOLUTION (GOAL 621): CONTRACTOR AIRWORTHINESS PROCEDURES**

These embrace the Panavia airworthiness procedures and related documentation systems together with those of the partner companies (BAE Systems, Alenia, EADS), Mauser, Turbo Union (including RR, MTU and Fiat) and QinetiQ.

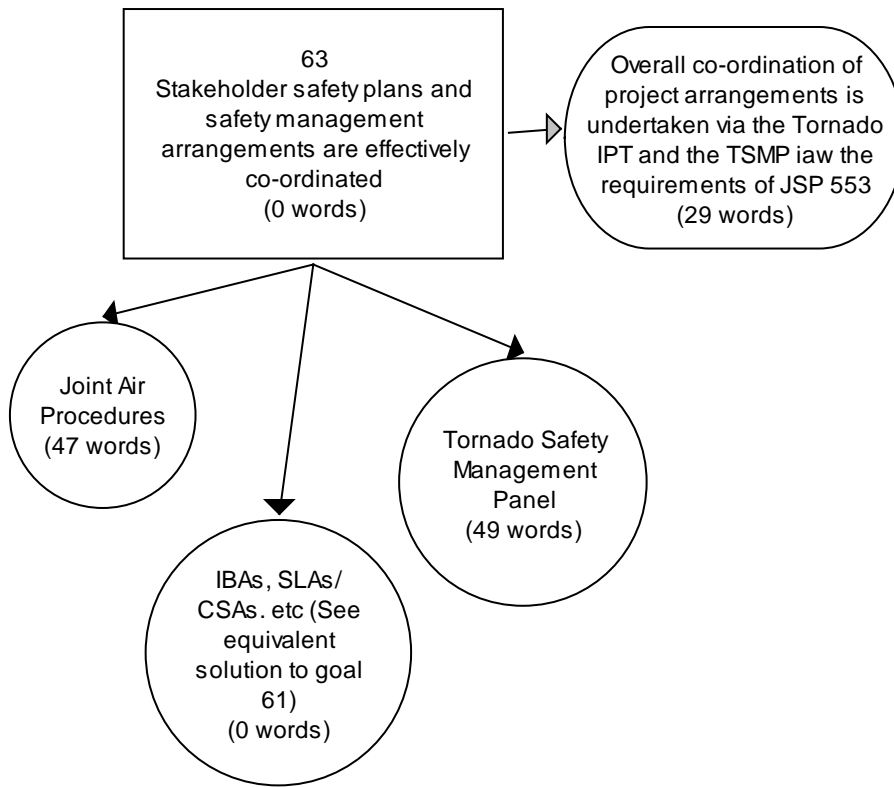
It should be noted that for BAES and QinetiQ the contractor procedures are subject to review and endorsement as part of the national DAOS scheme.

### **Goal 622: Effectiveness/currency of safety management systems is subject to review, audit and corrective action procedures**

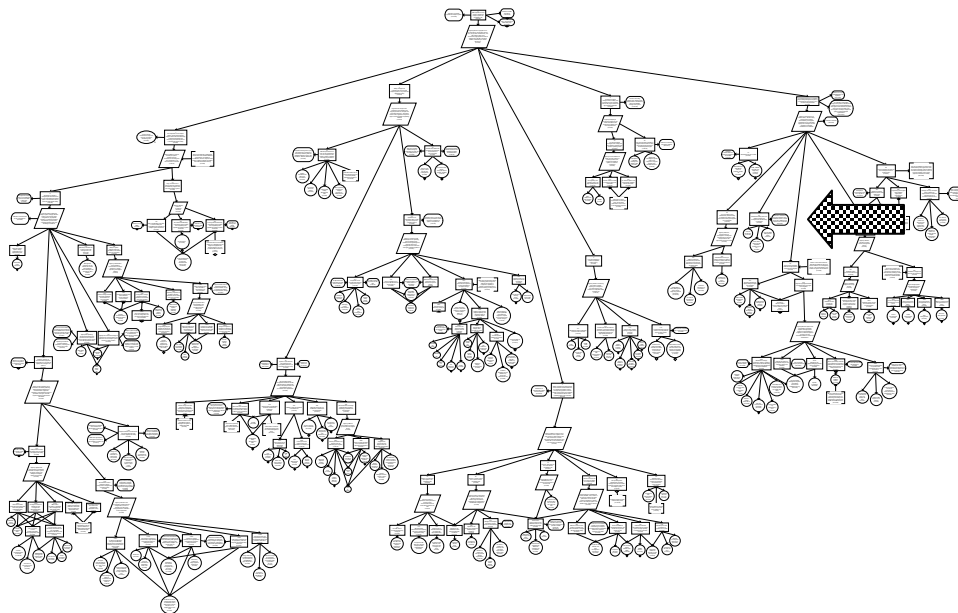
#### **SOLUTION (GOAL 622): AUDIT/REVIEW AND CORRECTIVE ACTION PROCEDURES**

Audit and review arrangements are defined within the safety plans and processes of the project stakeholders and are intended to establish both the compliance of day to day practices with the stated management systems and effectiveness of those systems.

### 6.3 Safety Plans Co-ordinated (Goal 63)



### Location within Safety Case



## **Goal 63: Stakeholder safety plans and safety management arrangements are effectively co-ordinated**

*Context (Goal 63): Overall co-ordination of project arrangements is undertaken via the Tornado IPT and the TSMP iaw the requirements of JSP 553*

*The Platform IPT has a key role in the co-ordination of Tornado activities throughout the platform lifecycle. Key roles include Design Authority, Engineering Advice, Operating Requirements and Configuration.*

### **SOLUTION (GOAL 63): JOINT AIR PROCEDURES**

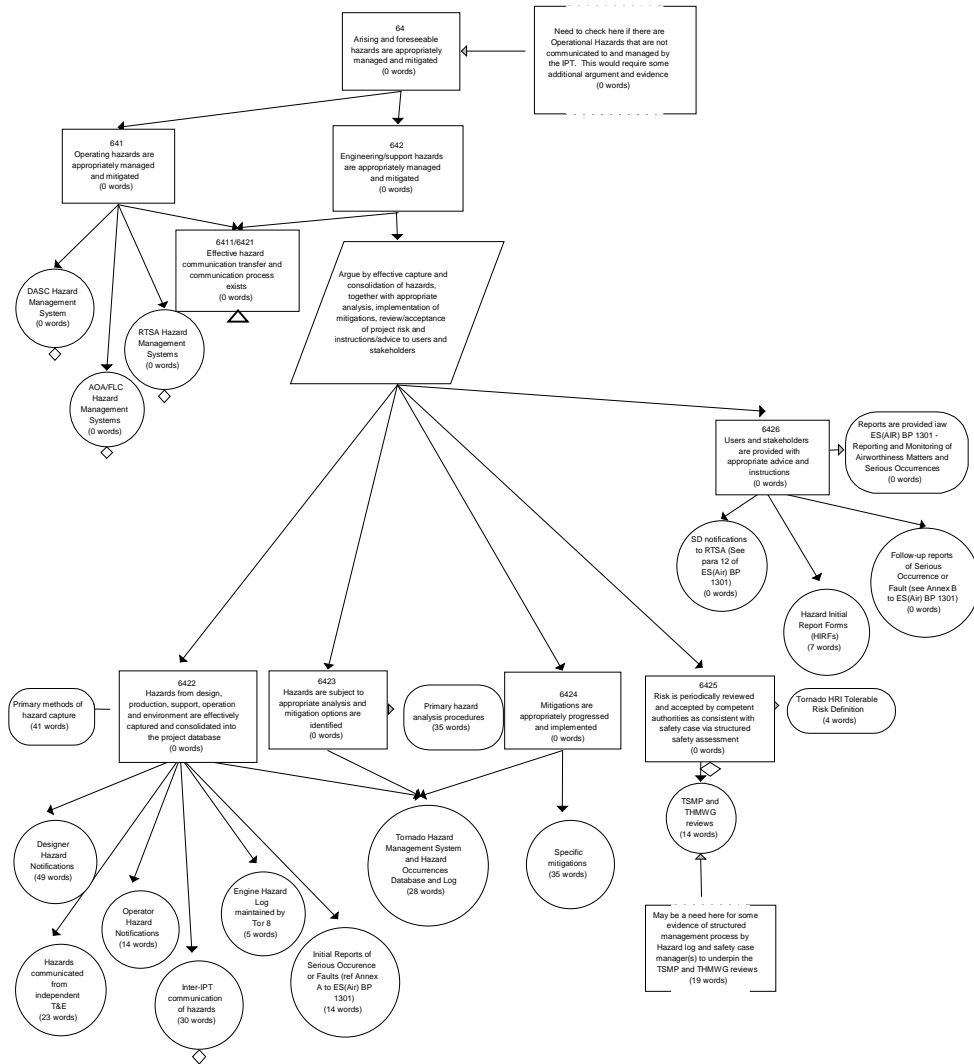
Joint Air Procedures define the required framework and interface requirements between MoD organisations and the Services with regard to specific airworthiness and safety responsibilities. They also provide guidance to safety managers and information on good practice to assist safety stakeholders in achieving sound and consistent working practice..

### **SOLUTION (GOAL 63): IBAS, SLAS/ CSAS. ETC (SEE EQUIVALENT SOLUTION TO GOAL 61)**

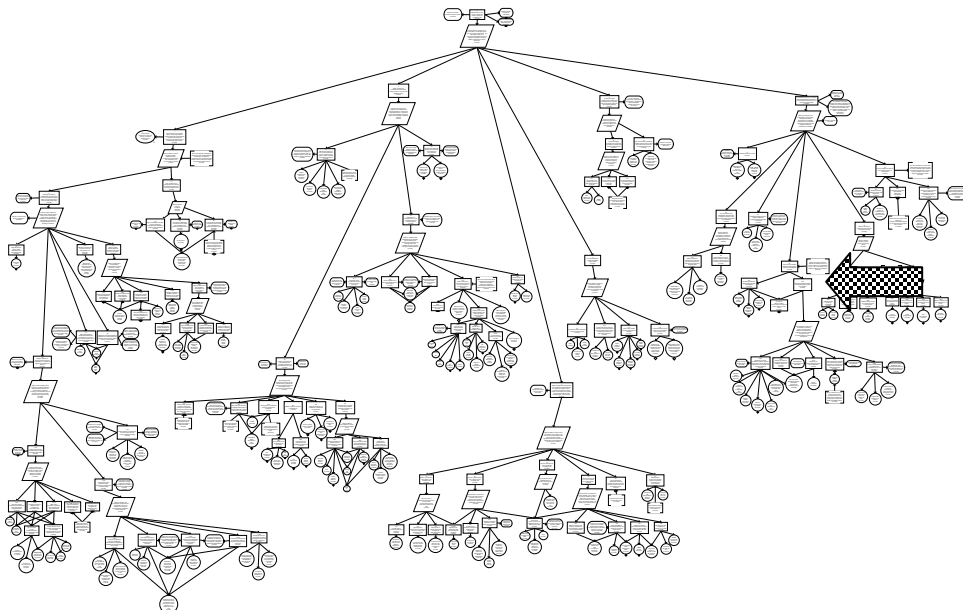
### **SOLUTION (GOAL 63): TORNADO SAFETY MANAGEMENT PANEL**

The TSMP provides the primary forum for all project stakeholders to oversee and review the effectiveness of the projects safety management arrangements and to address any concerns on the contributions of the respective stakeholders and the co-ordination of those contributions. Refer to Appendix to Annex A of TESMP

## 6.4 Hazard Management (Goal 64)



## Location within Safety Case



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## **Goal 64: Arising and foreseeable hazards are appropriately managed and mitigated**

**Note (Goal 64):** Need to check here if there are Operational Hazards that are not communicated to and managed by the IPT. This would require some additional argument and evidence

### **Goal 641: Operating hazards are appropriately managed and mitigated**

#### **SOLUTION (GOAL 641): DASC HAZARD MANAGEMENT SYSTEM**

**Node Status: Development required to establish and document DASC system**

#### **SOLUTION (GOAL 641): AOA/FLC HAZARD MANAGEMENT SYSTEMS**

**Node Status: Development required to establish and document existence of systems**

#### **SOLUTION (GOAL 641): RTSA HAZARD MANAGEMENT SYSTEMS**

**Node Status: Development required to establish and document existence of systems**

### **Goals 6411/6421: Effective hazard communication transfer and communication process exists**

**Node Status: Instantiation required to establish and document existence of processes**

### **Goal 642: Engineering/support hazards are appropriately managed and mitigated**

**Strategy (Goal 642):** Argue by effective capture and consolidation of hazards, together with appropriate analysis, implementation of mitigations, review/acceptance of project risk and instructions/advice to users and stakeholders

### **Goal 6422 Hazards from design, production, support, operation and environment are effectively captured and consolidated into the project database**

**Context (Goal 6422):** Primary methods of hazard capture

*Tornado specific arising hazards will be identified by users and reported using standard RAF procedures to IPT and other key stakeholders.*

*Foreseeable design, operational, and third party hazards will have been assessed as part of the designers safety analyses. Where practicable suitable safeguards will also have been defined for any significant residual risk.*

*Environmental hazards are identified from safety analysis and incident reports related to operations.*

#### **SOLUTION (GOAL 6422): DESIGNER HAZARD NOTIFICATIONS**

Panavia notifications of relevant or potential hazards are provided via:

- Design Specifications (PDR, AVS, System Specifications)

- Environmental Handbook
- Design Data Sets
- Panavia Accident/Incident Database
- ASSAR
- DDPs
- Panavia AWFLs and advice in support of Service Release Recommendations
- Safeguards and advice as contained in aircrew and ground crew publications

### **SOLUTION (GOAL 6422): HAZARDS COMMUNICATED FROM INDEPENDENT T&E**

Joint OTC advice is contained in inputs and advice to NETMA Service Release Panel.

QinetiQ advice is provided via MARRs and supporting reports

### **SOLUTION (GOAL 6422): OPERATOR HAZARD NOTIFICATIONS**

Operator notifications of relevant hazards are provided iaw:

- JSP 551
- JAP(D)100A-01

### **SOLUTION (GOAL 6422): INTER-IPT COMMUNICATION OF HAZARDS**

Hazard Initial Report Form (HIRF) used to advise other IPTs of emergent Tornado problems (see ES(Air) SBP TOR 1201-5

What is used by other IPTs to advise Tornado?

[Node Status: Development required to establish adequacy of communications from other IPTs](#)

### **SOLUTION (GOAL 6422): ENGINE HAZARD LOG MAINTAINED BY TOR 8**

To be integrated into TEHL

### **SOLUTION (GOAL 6422): INITIAL REPORTS OF SERIOUS OCCURENCE OR FAULTS (REF ANNEX A TO ES(AIR) BP 1301)**

Annex A reports are promulgated and maintained via the Aircraft Management Data Base (AMDB)

### **Goal 6423: Hazards are subject to appropriate analysis and mitigation options are identified**

*Context (Goal 6423): Primary hazard analysis procedures*

*These comprise:*

*Preliminary Hazard Analysis Procedure*

*Failure Mode Effect and Criticality Analysis Procedure*

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*Fault Tree Analysis Procedure Zonal Hazard Analysis Procedure*

*Risk Assessment Procedure*

*System Safety Assessment Procedure*

*Software Aspects of System Safety Assessment Procedure*

## **SOLUTION (GOALS 6422, 6423 & 6424): TORNADO HAZARD MANAGEMENT SYSTEM AND HAZARD OCCURRENCES DATABASE AND LOG**

THMS is developed from proposals set out in QinetiQ/AT&E/CR00441

See Annex C of TESMP and Tornado Supplemental Business Procedures 1201-1 to 1201-4

### **Goal 6424 Mitigations are appropriately progressed and implemented**

#### **SOLUTION (GOAL 6424): SPECIFIC MITIGATIONS**

Management options will include:

- Design modifications
- Mods to airfield or operating procedures,
- SI(T) procedures,
- Revisions to RTS,
- Provision of safety equipment,
- awareness instructions and training,
- Hazard Log entries
- Audit/review of hazard management procedures

### **Goal 6425: Risk is periodically reviewed and accepted by competent authorities as consistent with safety case via structured safety assessment**

*Context (Goal 6425): Tornado HRI Tolerable Risk Definition*

*See TESMP Annex C*

#### **SOLUTION (GOAL 6425): TSMP AND THMWG REVIEWS**

Records of reviews are maintained via the minutes and supporting papers for these meetings

**Note (Goal 6425):** May be a need here for some evidence of structured management process by Hazard log and safety case manager(s) to underpin the TSMP and THMWG reviews

The linking structure between the Hazard Logs and the Safety Case is established through Key Hazards and Accident Cases

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**Goal 6426: Users and stakeholders are provided with appropriate advice and instructions**

*Context (Goal 6426): Reports are provided iaw ES(AIR) BP 1301 - Reporting and Monitoring of Airworthiness Matters and Serious Occurrences*

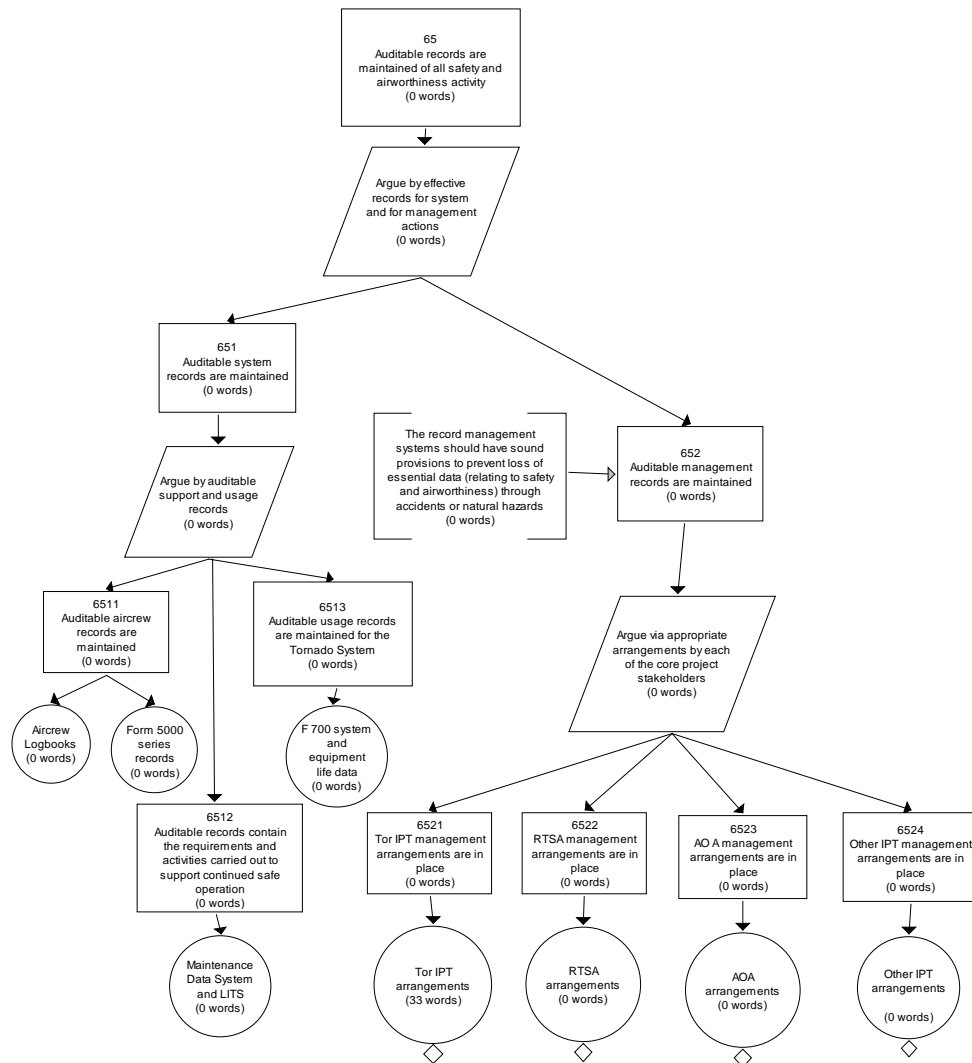
**SOLUTION (GOAL 6426): SD NOTIFICATIONS TO RTSA (SEE PARA 12 OF ES(AIR) BP 1301)**

**SOLUTION (GOAL 6426): HAZARD INITIAL REPORT FORMS (HIRFS)**

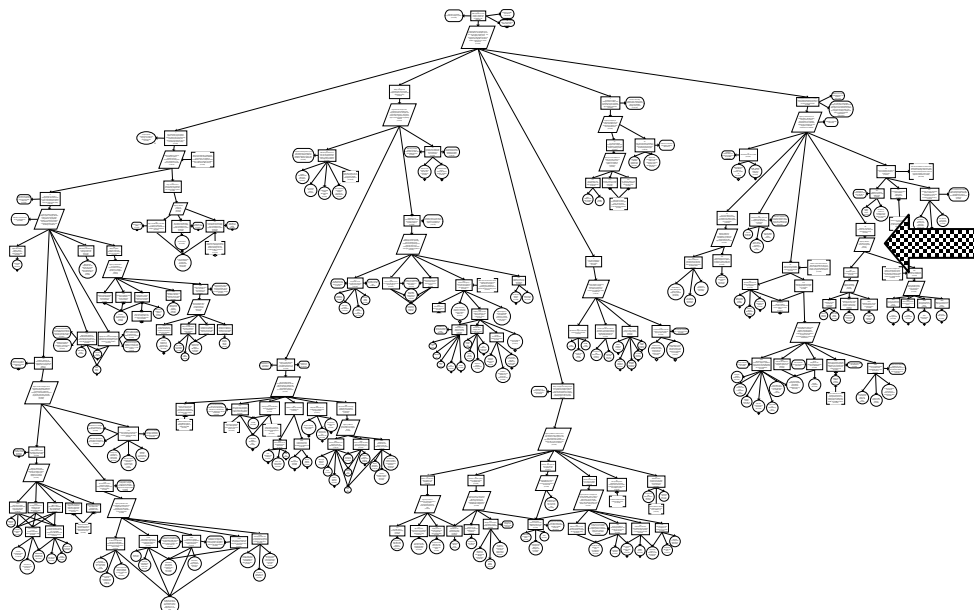
See ES(AIR) SBP TOR 1201-5

**SOLUTION (GOAL 6426): FOLLOW-UP REPORTS OF SERIOUS OCCURRENCE OR FAULT (SEE ANNEX B TO ES(AIR) BP 1301)**

## 6.5 Auditable records (Goal 65)



### Location within Safety Case



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**Goal 65: Auditable records are maintained of all safety and airworthiness activity**

*Strategy (Goal 65) Argue by effective records for system and for management actions*

**Goal 651: Auditable system records are maintained**

*Strategy (Goal 651): Argue by auditable support and usage records*

**Goal 6511: Auditable aircrew records are maintained**

**SOLUTION (GOAL 6511): AIRCREW LOGBOOKS**

**SOLUTION (GOAL 6511): FORM 5000 SERIES RECORDS**

**Goal 6512: Auditable records contain the requirements and activities carried out to support continued safe operation**

**SOLUTION (GOAL 6512): MAINTENANCE DATA SYSTEM AND LITS**

**Goal 6513: Auditable usage records are maintained for the Tornado System**

**SOLUTION (GOAL 6513): F 700 SYSTEM AND EQUIPMENT LIFE DATA**

**Goal 652: Auditable management records are maintained**

**Note (Goal 652):** The record management systems should have sound provisions to prevent loss of essential data (relating to safety and airworthiness) through accidents or natural hazards

*Strategy (Goal 652): Argue via appropriate arrangements by each of the core project stakeholders*

**Goal 6521: Tor IPT management arrangements are in place**

**SOLUTION (GOAL 6521): TOR IPT ARRANGEMENTS**

See TESMP Annex O - once complete the IPT arrangements must embrace those of NETMA, Panavia, Turbo Union and all other organisations who work in support of the air vehicle and weapon system integration.

**Node Status: Development required To complete the capture and documentation of arrangements**

**Goal 6522: RTSA management arrangements are in place**

**SOLUTION (GOAL 6522): RTSA ARRANGEMENTS**

**Node Status: Development required to identify/document RTSA arrangements**

**Goal 6523: AO A management arrangements are in place**

**SOLUTION (GOAL 6523): AOA ARRANGEMENTS**

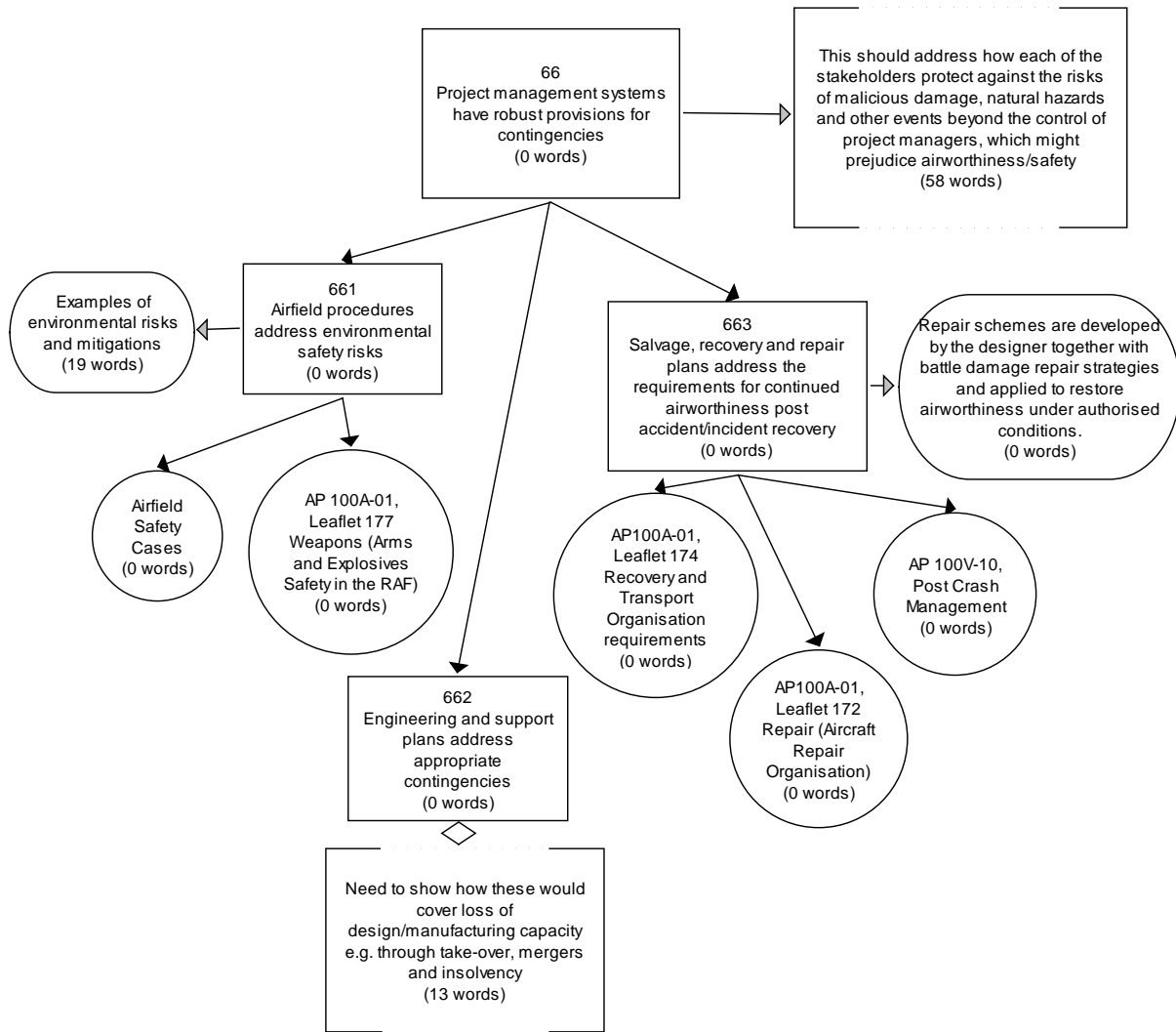
**Node Status: Development required to identify/document AOA arrangements**

**Goal 6524: Other IPT management arrangements are in place**

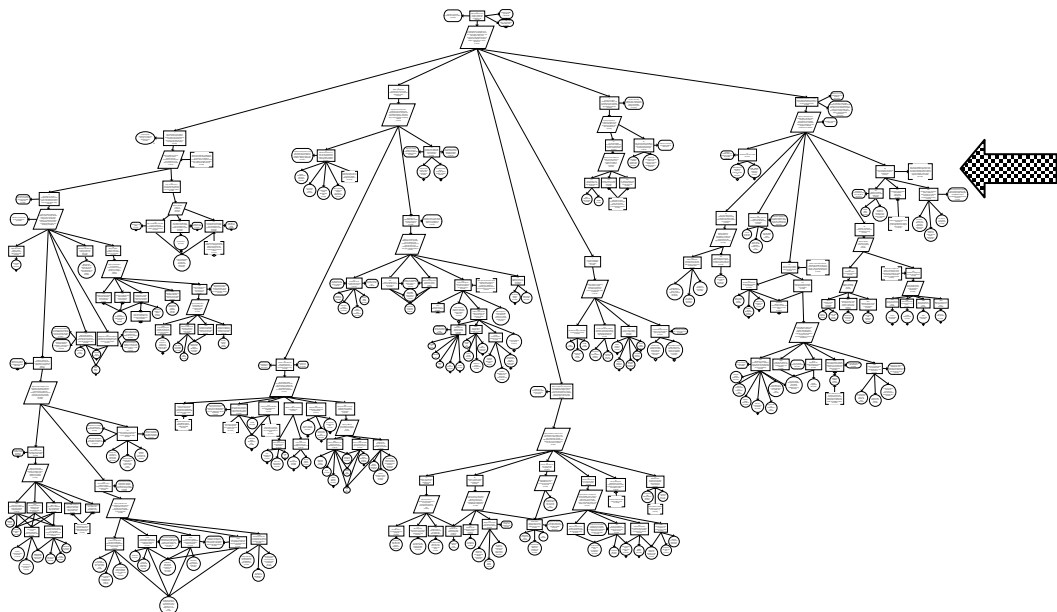
**SOLUTION (GOAL 6524): OTHER IPT ARRANGEMENTS**

**Node Status: Development required to identify/document other IPT arrangements**

## 6.6 Provision for contingency (Goal 66)



## Location within Safety Case



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## Goal 66 Project management systems have robust provisions for contingencies

**Note (Goal 66):** This should address how each of the stakeholders protect against the risks of malicious damage, natural hazards and other events beyond the control of project managers, which might prejudice airworthiness/safety

Risks to be addressed should include:

Loss of essential data and information

Damage or loss to key equipment and infrastructure

Loss of design/manufacturing capacity

Loss of key personnel

Recovery from accidents should be planned and exercised so that there is a sound base of evidence to show that consequences are capable of being mitigated as far as practicable.

It is important to note that this safety case does not currently address the implications of operational threat or hostile action that may require management provisions above and beyond those contained within the management arrangements identified herein.

## Goal 661 Airfield procedures address environmental safety risks

**Context (Goal 661):** *Examples of environmental risks and mitigations*

*Risks arise from factors such as weapons, aircraft movements, radar and fuel handling.*

*Mitigations including medical and fire cover*

### SOLUTION (GOAL 661): AIRFIELD SAFETY CASES

### SOLUTION (GOAL 661): AP 100A-01, LEAFLET 177 WEAPONS (ARMS AND EXPLOSIVES SAFETY IN THE RAF)

## Goal 662: Engineering and support plans address appropriate contingencies

**Node Status: Development required to identify how contingency provisions are managed and maintained.**

**Note (Goal 662):** Need to show how these would cover loss of design/manufacturing capacity e.g. through take-over, mergers and insolvency

Potential options are:

Retention of second sourcing

Robbing of existing assets

Life extensions

**Goal 663: Salvage, recovery and repair plans address the requirements for continued airworthiness post accident/incident recovery**

*Context (Goal 663): Repair schemes are developed by the designer together with battle damage repair strategies and applied to restore airworthiness under authorised conditions.*

**SOLUTION (GOAL 663): AP100A-01, LEAFLET 174 RECOVERY AND TRANSPORT ORGANISATION REQUIREMENTS**

**SOLUTION (GOAL 663): AP100A-01, LEAFLET 172 REPAIR (AIRCRAFT REPAIR ORGANISATION)**

**SOLUTION (GOAL 663): AP 100V-10, POST CRASH MANAGEMENT**