

Qualification and certification challenges of multi-national and multi-variant aircraft

presented to
European Military Airworthiness Conference
Cyprus, 26th to 27th September 2012



Heiko P. ERNST
NAHEMA, Aix-en-Provence
Section Leader TTH
h.ernst@nahema.nato.int

The NH90 programme

Qualification/ Certification

JMAAN – MDOA

Conclusion

The NH90 programme

Qualification/ Certification

JMAAN – MDOA

Conclusion

Overview of NH90 NAHEMO and Community Programme

- Corporate Identity:
 - ❑ NAHEMO is a subsidiary body of NATO
 - ❑ NAHEMA is the International Programme Office of NAHEMO
- Established:
 - ❑ In 1992, in Aix-en-Provence (France) in vicinity of NHIndustries
- Mission:
 - ❑ Management of the NH90-programme on behalf of the NAHEMO Nations, during the
 - design & development,
 - production & post-design and
 - in-service support phases



NH90 programme in brief

- 1 product: **NH90**
- 2 Versions: TTH, NFH
- 14 Variants: TGEA, GITA, TFRA, HITN, NBEN, NNLN, ...
- Customer: **NAHEMA**
- 14 Nations: BEL, DEU, FRA, ITA, NLD, PRT
AUS, ESP, FIN, NOR, NZL, SWE
GRC, OMN (NAHEMO)
(Community incl. observ.)
(export)
- Contractor: **NHIndustries**
- 4 Industries: AW, EC, ECD, FK

- Design & Development (D&D)
 - development of two versions TTH and NFH
 - signed in 1992
- Production Investment/ Production
 - production of the serial h/c in different variants
 - signed in 2000
 - first serial helicopter delivered in 2006 (IOC)

NH90 versions and variants

	T-Version	N-Version	M-Version	G-Version	H-Version
NH90 Versions	TTH with RTM322 Engine	NFH with RTM322 Engine	TTH with NFH MRH T700 Engine	TTH with T700 Engine	NFH with T700 Engine
NAHEMA Variants	T1: GE Army (TGEA) T2+: GE Air Force (TGEE) T6 : FR Army (TFRA) T10: PO Army (TPOA)	N1: FR Navy (NFRN/ NFRS) N2: NL Navy (NNLN)	T5: IT Navy (MITT)	T3: IT Army (GITA)	N3: IT Navy (HITN)

NH90 Variants (NAHEMO):

- ❑ 2 basic versions:
 - TTH and NFH
- ❑ Customization:
 - Engine, Sonar, EWS, Radios, Mission Equipment, ...

In addition:

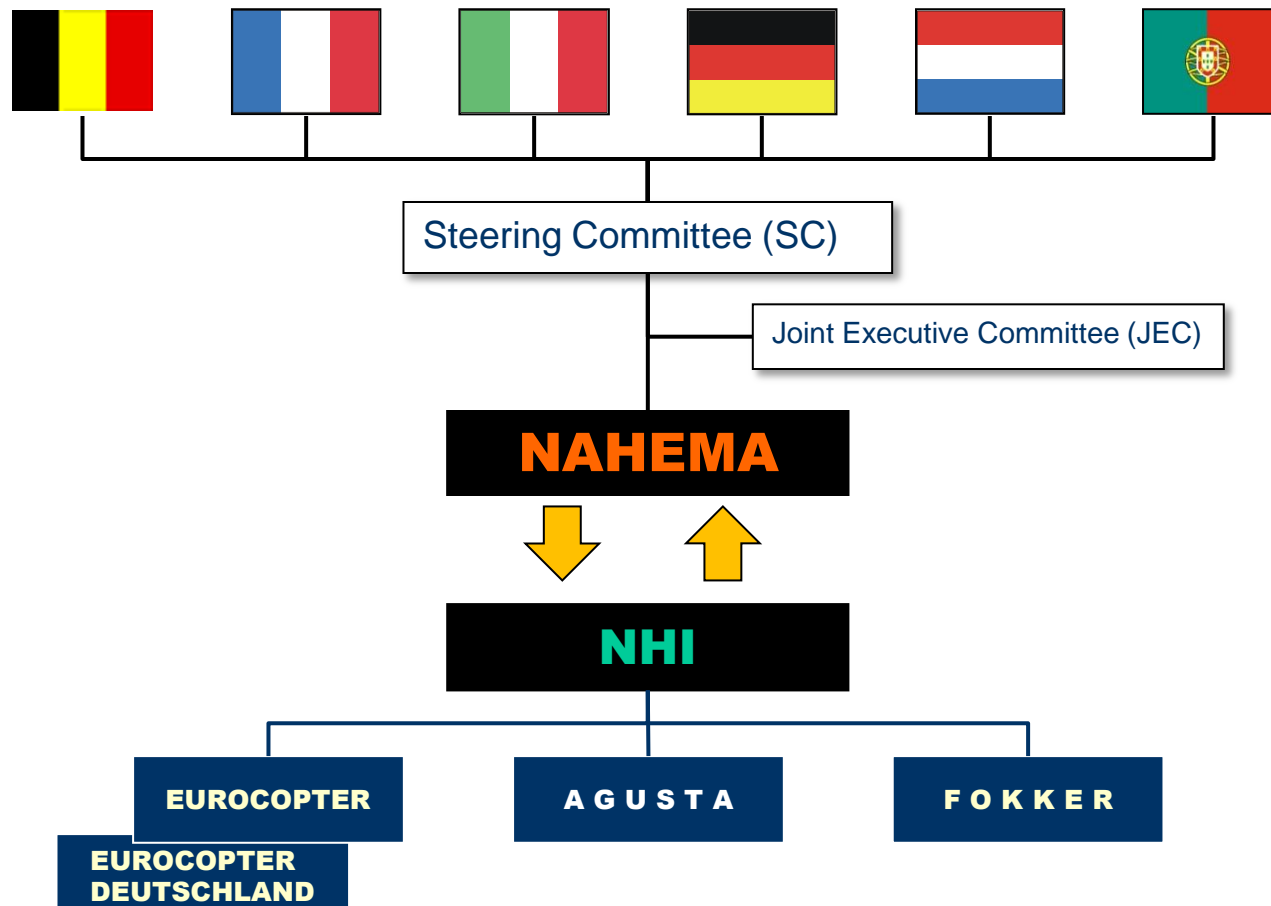
Nordics variants:

- ❑ No/ partial / Full NAHEMA involvement

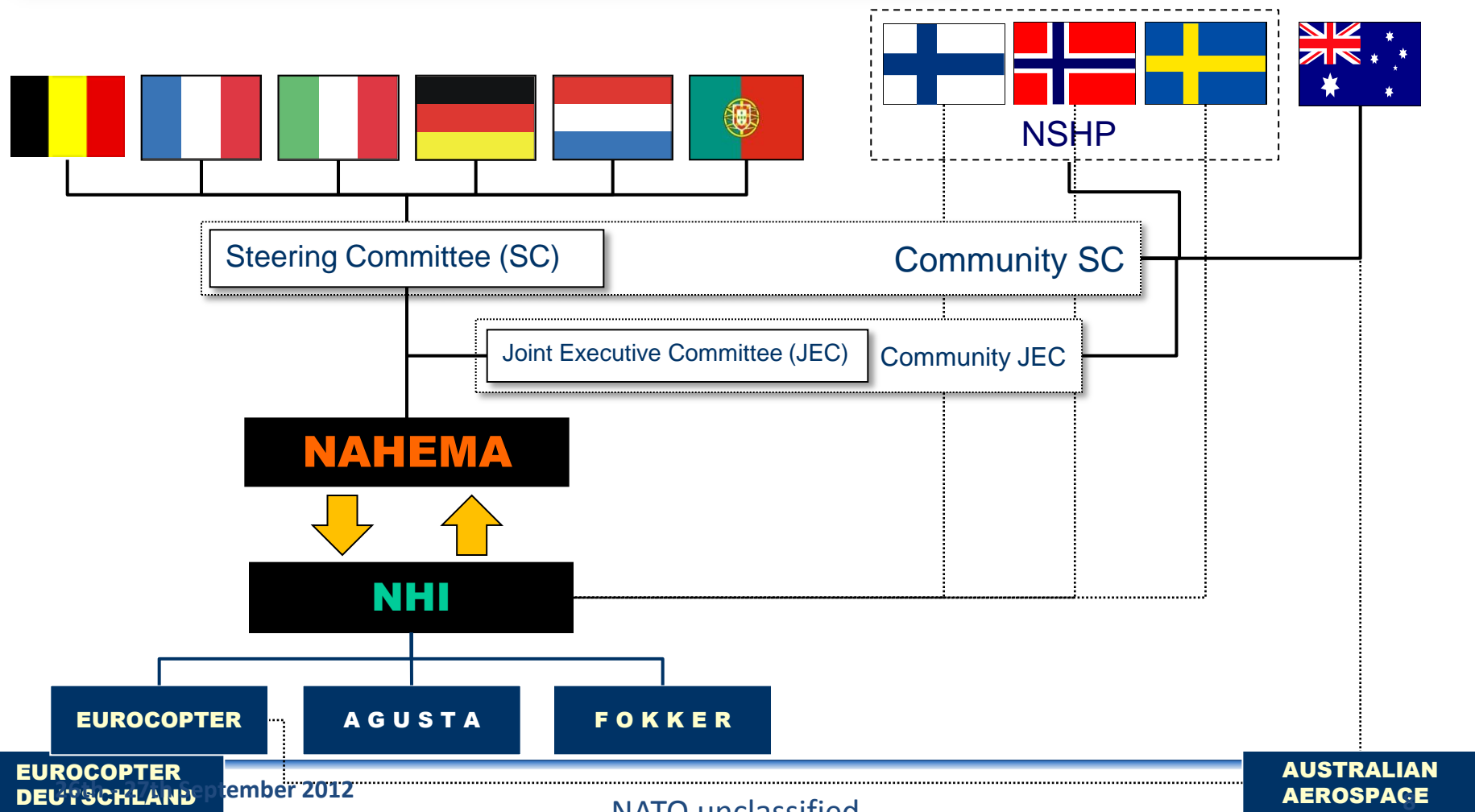
“Export” variants:

- ❑ No NAHEMA involvement

Overview of NH90 NAHEMO and Community Programme



Overview of NH90 NAHEMO and Community Programme



The NH90 programme

Qualification/ Certification

JMAAN – MDOA

Conclusion

Qualification and Certification bodies

Certification relevant activities are performed in

❑ *Qualification Group*

- being a body mentioned in the D&D and PI/P contracts
- main activities related to D&D phase
- acting for
 - NAHEMO and
 - on the basis of Programme Arrangements for some of the Community Nations.

❑ *Joint Military Airworthiness Authorities NH90 (JMAAN)*

- came into being by Programme Arrangement on Continuing Airworthiness
- is a body of the NH90 Community
- activities mainly focusing on the in-service phase
 - e.g. changes to the Type Design

Qualification Group

- Qualification Group (QG) is in charge of the qualification of the NH90 helicopter:
 - Composed of one representative from each D&D Nation + Portugal + NAHEMA
- QG is advised by various working groups:
 - Test Coordination Group, ILS, Tech Pub, Structure Expert Meeting, ...
- QG is in charge to accept/ approve qualification documents according to the work share

NH 90 workshare

EUROCOPTER

AGUSTA

**EUROCOPTER
DEUTSCHLAND**

FOKKER



NH 90 Qualification

Objective:

Demonstration of the compliance of all *airworthiness* requirements and *performance* requirements of the NH90 Weapon System.

Airworthiness requirements

- FAR 29 amdt 31
- Qualification Review Items (QRI)
 - additional requirements to FAR 29,
 - defining more precisely the means of compliance and the equivalent level of safety

Performance requirements

- Weapon System Development Specification
- Customization of each variant

NH 90 Qualification

- Qualification according to the variant Qualification Plan (QP)
 - ❑ QP identifies:
 - ITBQ,
 - Allocation matrix,
 - Means of Compliance,
 - Evidence Document List
 - ❑ QP Variant is used as reference for ITBQ QPlans

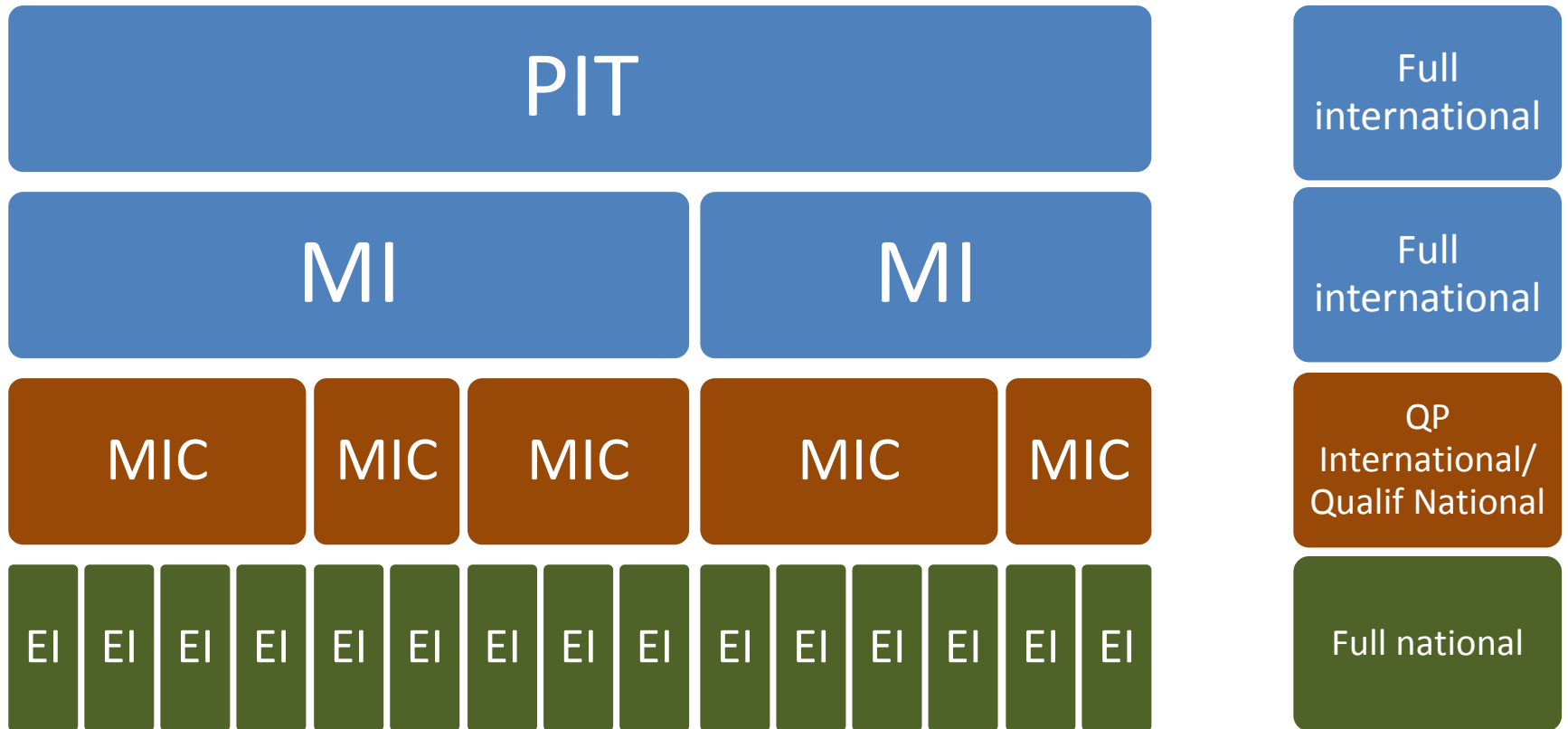
- Qualification Compliance File
 - ❑ summarizes the entire qualification activities
 - ❑ forms part of the basis for NAHEMA's Declaration of Compliance (DoC)
 - ❑ DoC part of the basis for producing MTC by National Authorities

NH 90 Qualification

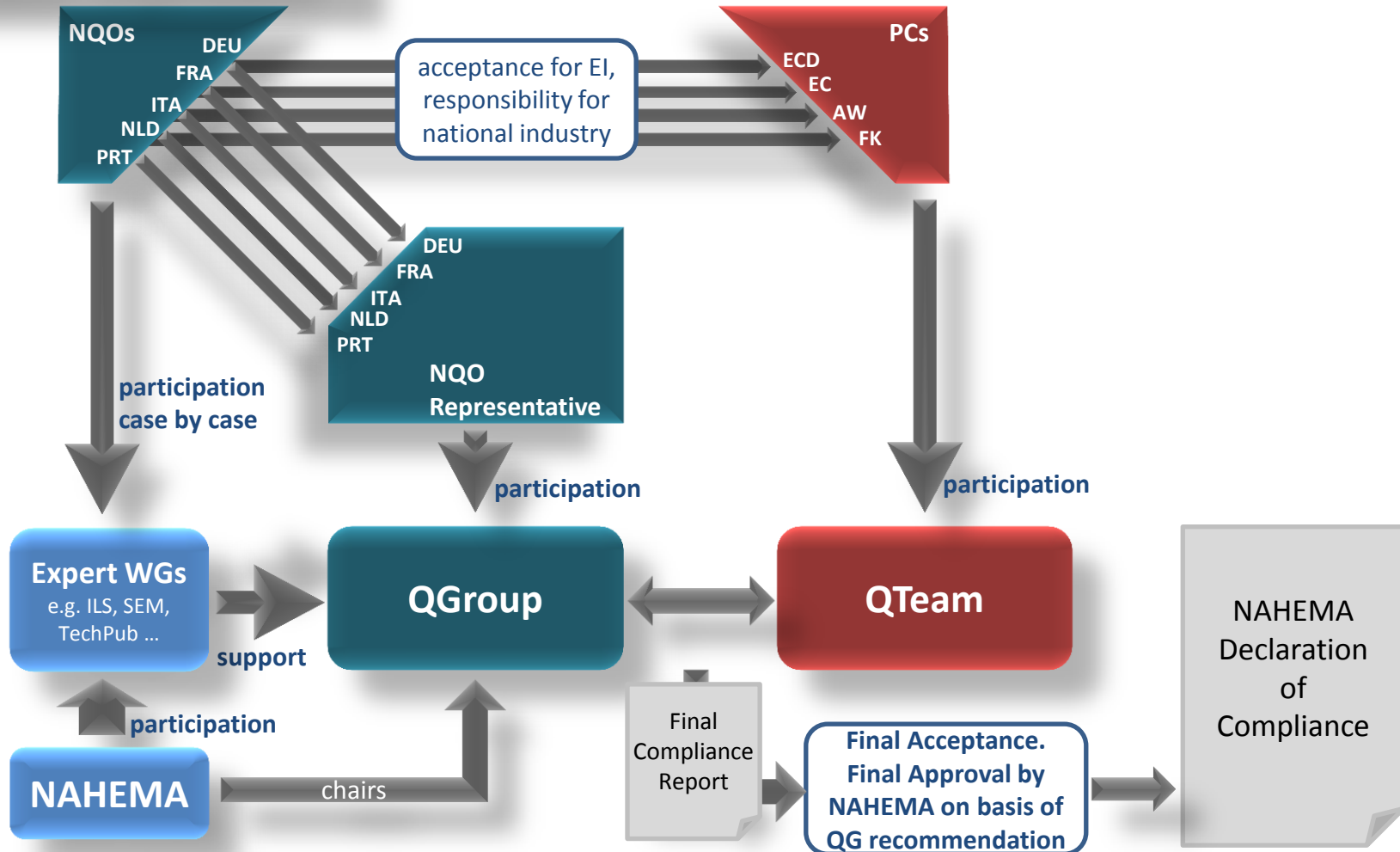
- For the qualification, the helicopter is broken down into
 - ❑ Prime Item Topics (PIT)
General engineering disciplines (potentially) affecting the whole helicopter (e.g. performance, handling qualities, hardening, crashworthiness, safety etc.)
 - ❑ Major Items (MI)
Systems (Structure, Dynamic System, Flight Control System, Core System, Mission Avionic System)
 - ❑ Major Item Constituents (MIC)
(Sub)systems (Fwd/ Center/ Aft Fuselage, Landing Gear, Rotors, Power Plant, Electrical System, Fuel System, Ice Protection System, Environmental Control System, Navigation System, Communication Identification System, Plant Management System, EWS, Tactical Control System etc.)
 - ❑ End Items (EI)
Subsystems/ Equipments (engines, gearboxes etc.)

Qualification of the baseline

Allocation of the qualification activities, is derived from a functional breakdown:



Qualification Organisation



Recognition of qualification documents' acceptance

- The recognition of acceptance as a principle is agreed between the Nations in
 - General MoU
 - D&D MoU

- The recognition of qualification documents' acceptance is a contractual commitment towards the Contractor from
 - D & D contract
 - PI/P contract

- *But certification and preparation of MTC remain national tasks.*

The NH90 programme

Qualification/ Certification

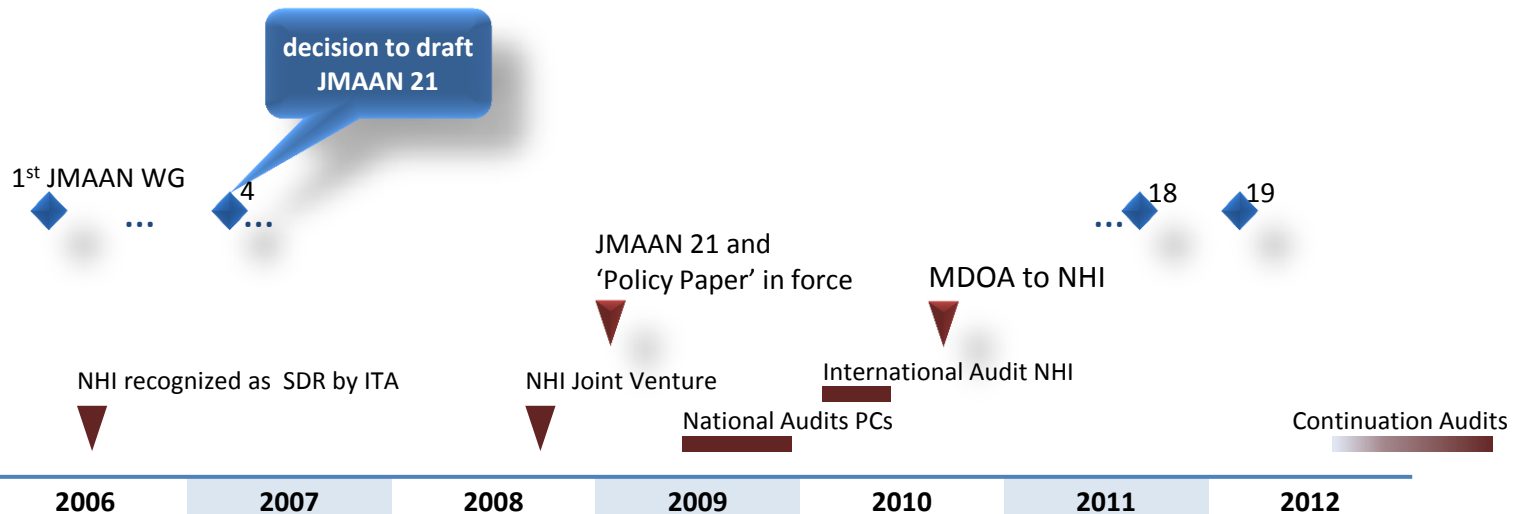
JMAAN – MDOA

Conclusion

Joint Military Airworthiness Authorities NH90 (JMAAN)

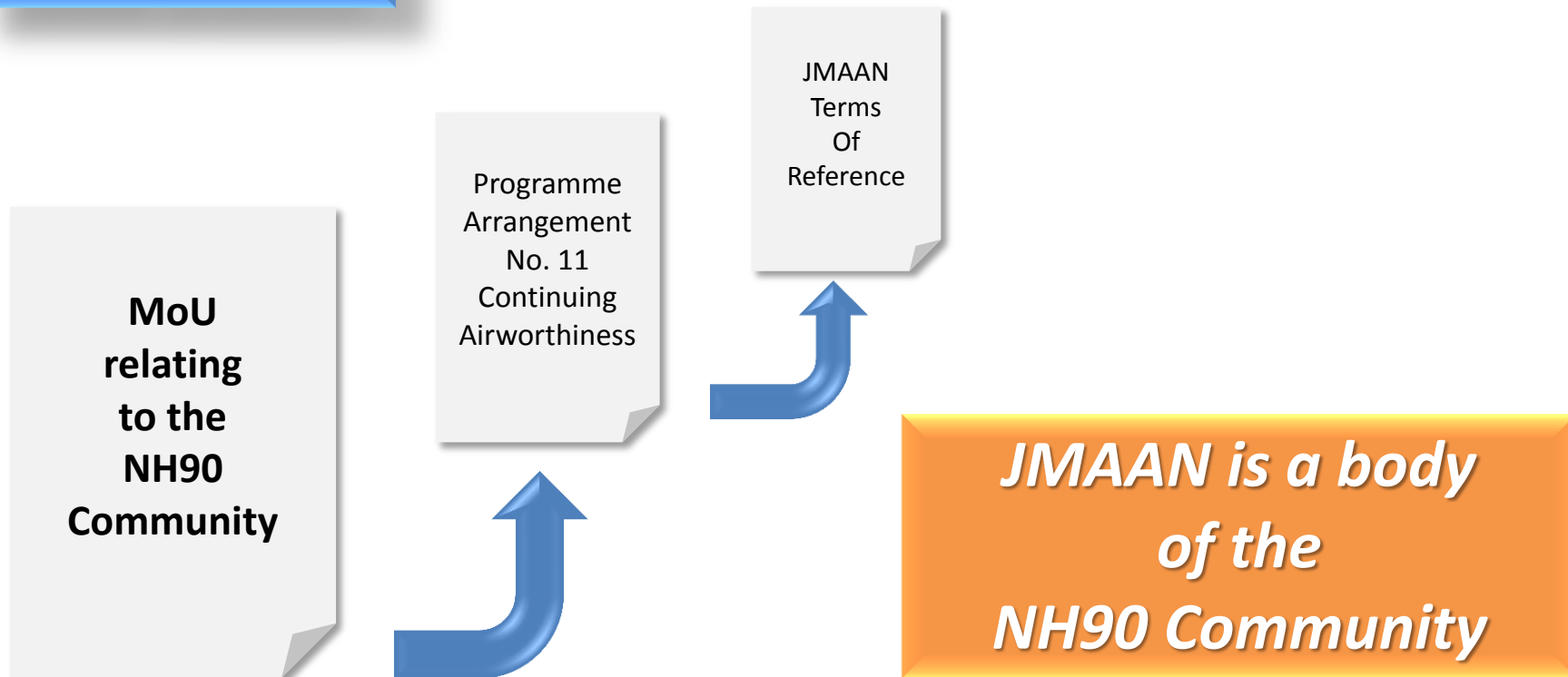
Anticipating the in-service phase, activities were launched in 2004 to identify and define processes and regulations regarding

- Design Organisation Approval
- Continuing Airworthiness
- Changes to the Type Certificate



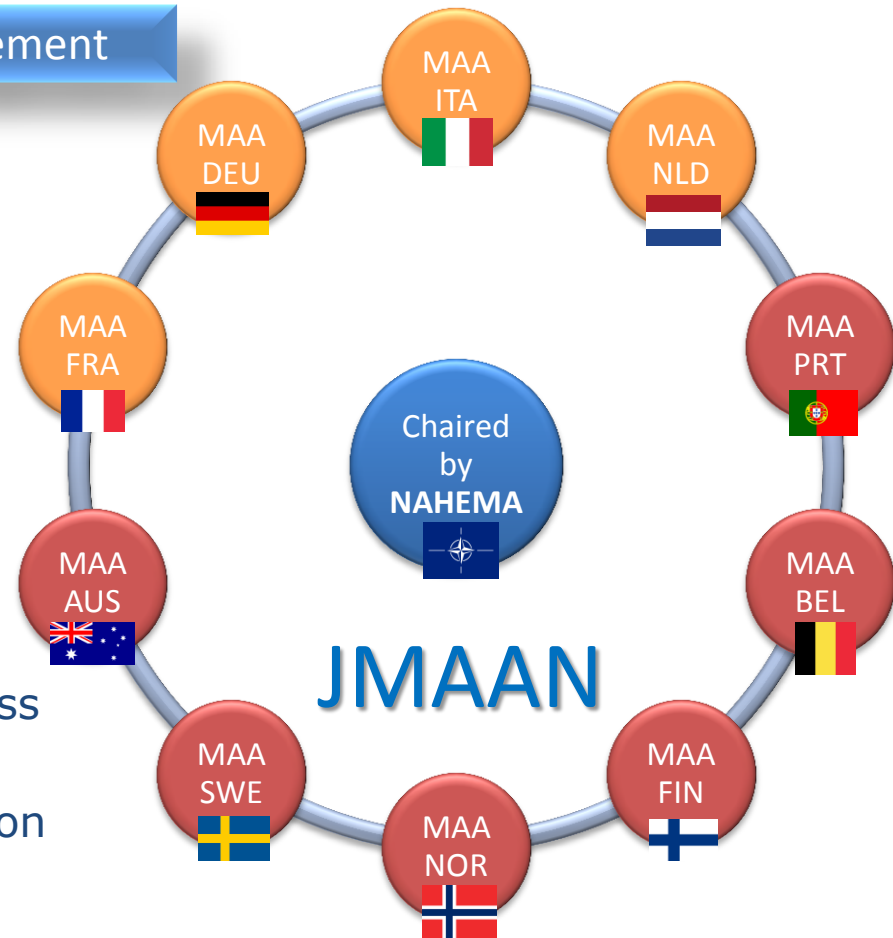
◆ JMAAN WGs

JMAAN constitution



Continuing Airworthiness Programme Arrangement

- Participants are the Community Nations
- JMAAN is defined as international advisory board
 - composed of national military aviation/ airworthiness authority representatives and
 - chaired by NAHEMA
 - towards the national airworthiness authorities
 - for the exchange of information on Airworthiness and Continuing Airworthiness matters
- *no legal power on its own*



Primary Authorities

PA CA: Objectives

The objectives under the PA CA are:

- ❑ to establish and implement instructions to support national military aviation/airworthiness authorities so that the MTC is maintained through the entire operation life of all NH90 Variants.
- ❑ to implement the *exchange of information* on CA in accordance with national rules and regulations;
- ❑ to *establish an international advisory board* (JMAAN) to support the National Military Aviation Authorities responsible for NH90;
- ❑ to harmonize and establish the principles for the *recognition* and the *supervision* of the Military Design Organisation Approval (MDOA);

PA CA: Objectives

For Contributing Participants' nations not holding the MTC, ...

For Contributing Participants' nations holding the MTC, each of those Contributing Participants may decide ...

... to maintain, apply and link the CA activities with configuration management and Supportability Data Exchange (when in place) to ensure that

- any configuration change is analyzed to ensure the CA and to assess the impact on performances;
- a corrective measure analyzed by CA is implemented according to CM rules;
- Any incident is analyzed to prevent the regression in the NH90 Variants MTC.

PA CA: JMAAN Activities

For Contributing Participants' nations not holding the MTC, and for other Contributing Participants' nations, on request,

- to *establish and implement instructions for CA* to ensure that the Airworthiness and the performance standard of the aircraft MTC are maintained [...] according to national military rules and regulations;
- to *initiate immediate analysis of safety related Incidents*, to assess proposals for Preventive or Corrective measures and to provide the national airworthiness authorities of the Contributing Participants with associated recommendations;

PA CA: JMAAN Organization

For all Contributing Participants' nations:

- the JMAAN is an *international advisory board* composed of aviation/airworthiness authority representatives and *chaired by NAHEMA airworthiness management*.
- the JMAAN is an advisory board *for the national airworthiness authorities which remain responsible* of the decision of implementing any Preventive/ protective or Corrective measure on their own national fleet.
- the JMAAN is a *forum to provide assessment on the Incident reports*, [...].
- JMAAN is also a *forum to address questions on CA*, or consider the implementation of modifications (in terms of organisation or procedures) for the Continuing Airworthiness.
- all outcomes for CA provided by JMAAN are *recommendations* requiring national approval for the implementation in the relevant national fleet.

PA CA: JMAAN Organization

For Contributing Participants' nations not holding the MTC, and for other Contributing Participants' nations, on request,

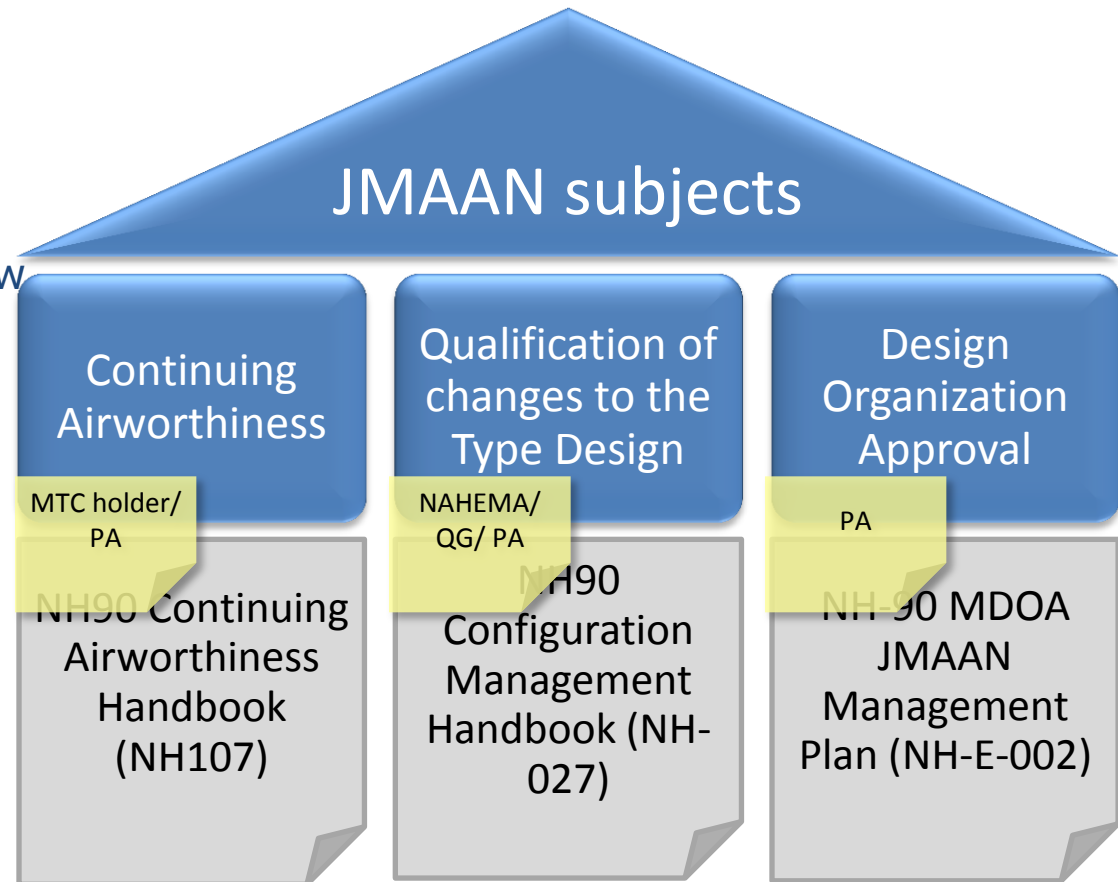
- the JMAAN is responsible for *managing* all the *necessary audits* and investigations related *to deliver/ maintain the MDOA* or the SDR recognition.

JMAAN Terms of Reference

- ❑ The JMAAN responsibility is
 - to provide the *regulatory framework* within which the Industry must work and
 - thereafter to monitor if Industry performance in term of organization, procedure, and more specifically on the helicopter airworthiness is set and maintained.
- ❑ The JMAAN is an *advisory board* for the national airworthiness authorities which remain responsible of the decision of implementing any preventive or corrective measure on their own national fleet.
- ❑ In relation to any kind of configuration modification impacting the MTC, JMAAN will *conduct* all the necessary *technical assessment* aiming to enable the change process decision by providing a recommendation to the MTC Holder with regard to the maintenance of the MTC.

JMAAN subjects

- CA relies on data from Serviceability Data Exchange
 - ❑ Processes involve PA
- Type Design changes follow the CM procedures
- DOA is a PA activity



JMAAN-21 and policy paper

- JMAAN-21 “Certification of NH90 and related parts and appliances and approval of the military design organisation” (Requirements)
 - ❑ JMAAN-21 has been developed on behalf of the JMAAN by the MAA of NLD and SWE.
 - ❑ JMAAN-21 provides among others
 - Subpart A: General Provisions governing rights and obligations for applicant or holder
 - Subpart B: establishes procedure for issuing military type certificates for NH90
 - Subpart D: establishes procedures for changes to the military type certificates for the NH90
 - Subpart J: establishes procedure for the approval of the IIO as Military Design Organisation

Seven principles of JMAAN policy paper

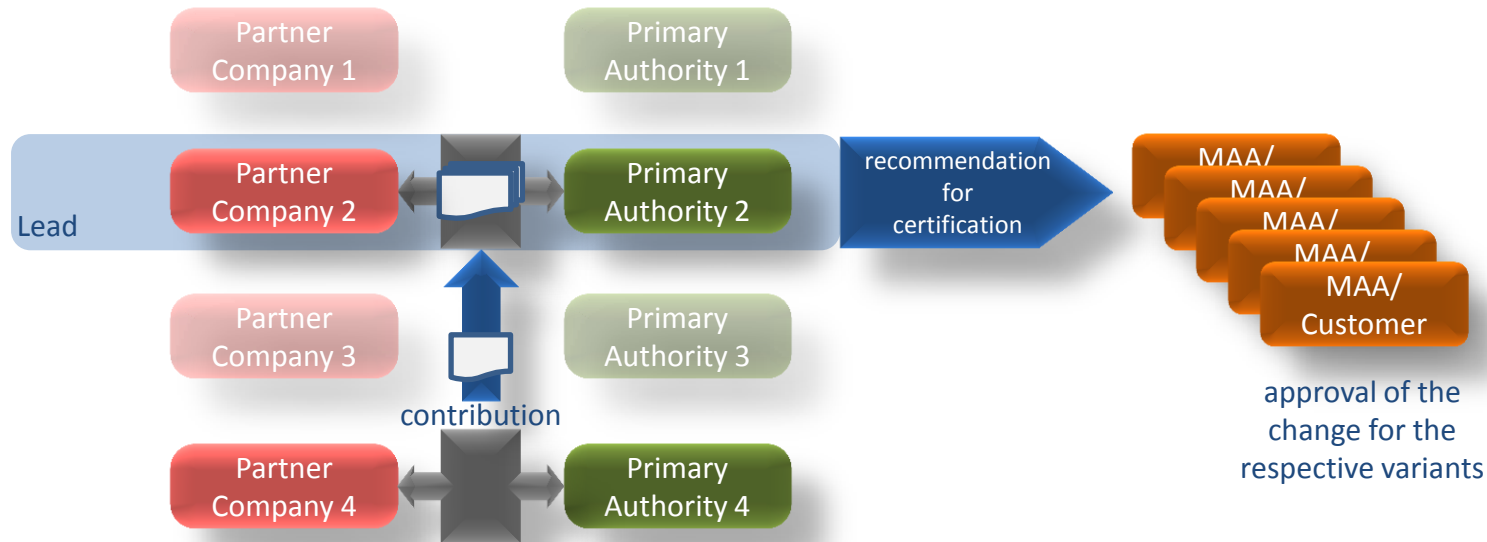
- ❑ **Funnel Principle**
 - Communication between industry, operator and MAA is funnelled thru JMAAN and IIO
- ❑ **Lead Nation Principle**
 - The NH90 programme has Primary Authorities
- ❑ **Recommendation Principle**
 - JMAAN PA's will recommend for certification
- ❑ **Aviation Safety Principle**
 - JMAAN is guided by aviation best regulatory and safety practices
- ❑ **Privilege Principle**
 - NH90 Nations, thru JMAAN, will make special rights available to the IIO
- ❑ **Sovereignty Principle**
 - NH90 nations have the sole responsibility for the decision on implementation of 'approved data' (recommendation for approval)
- ❑ **Continued Airworthiness Principle**
 - NH90 nations and IIO have a shared responsibility for maintaining the continued airworthiness of each NH90 and its type design



MDOA compliance assessment

- Tasks related MDOA compliance assessment
 - ❑ National responsibility tasks
 - compliance of one partner company against applicable requirements
 - to be assessed under responsibility of mirror lead auditor.
 - e.g. ECD audited by DEU lead auditor, EC audited by FRA lead auditor
 - ❑ International responsibility tasks
 - compliance of NHI against full set of requirements baseline
 - to be assessed under responsibility of an international team (4 lead auditors of the PA, 6 observers of other participating nations, lead by JMAAN MDOA certification team coordinator)

Change of Type Design: Lead nation principle



- "Lead PA" assesses substantiation documents of the corresponding "Lead PC" and if applicable "further PC" contribution including the "further PA" approval.
- "Lead PA" completes assessment and issues the recommendation

The NH90 programme

Qualification/ Certification

JMAAN – MDOA

Conclusion

QG qualification process

- Qualification process is well recognized among NAHEMO nations
 - turned out as capable to qualify the various variants
 - final QG approval and NAHEMA DoC allow the National Authorities to perform the Type Certification

- Certification and preparation of the MTC
 - remain national tasks
 - follow national regulations
 - further substantiation may be requested by national authorities in extent to primary authorities' recommendation

JMAAN process

- Processes within JMAAN
 - are build around 'Lead nation' principle
 - are driven by national regulations
 - reflect the least common denominator
 - JMAAN is an Advisory Board
 - for the moment no development towards an international Aviation Authority
 - Privileges may be given to MDO
 - procedure for the recognition of privileges requires well defined conditions
- coordination among the PA requires some effort.
 - continuation audits outstanding
 - NAHEMA has no mandate directing the PA
- in case of more complex changes coordination among PA will be required
 - may end up in a QG like process

Thank you for your attention.

Questions?



Heiko P. ERNST
NAHEMA, Aix-en-Provence
TTH Section Leader
h.ernst@nahema.nato.int