



**NATO UNCLASSIFIED**

06 December 2021

**DOCUMENT**  
**AC/259-D(2021)0068**  
**NIAG-D(2021)0045**  
**Silence Procedure ends:**  
**20 Dec 2021 18:00**

**CONFERENCE OF NATIONAL ARMAMENTS DIRECTORS (CNAD)**  
**NATO INDUSTRIAL ADVISORY GROUP (NIAG)**

**Proposals for Advisory Studies by the NIAG in Budget Year 2022 + ACT funded studies**

**Note by the Secretary**

1. NIAG studies constitute a key mechanism by which industry advice supports the work of the CNAD, CNAD's sub-groups, ACT and wider NATO activities.
2. The preparation of the 2022 NIAG study programme went through a series of established activities<sup>1</sup> (study proposals formulation, agreement and priority assignment within each study sponsor entity, NIAG Roundtable) and has now passed a key milestone that is the agreement of study priorities across the entire portfolio by CNAD Main Group Chairs during the Main Group Forum on 26 October 2021.
3. The resulting NIAG Studies Programme for 2022, at annex, is now submitted for your approval. The proposed studies package includes:
  - Annex 1 – Proposed NIAG Studies 2022 – Overview;
  - Annex 2 – Proposed NIAG Studies 2022 – Step 1 Studies description.
4. In addition to the above, ACT has also submitted a number of study proposals to be sponsored and funded by ACT in 2022. The list of proposed studies is available at Annex 3 together with studies descriptions at Annex 4. Administrative support for the these studies is provided by ACT.
5. Unless the CNAD Secretary hears to the contrary by **17:30 hrs on Monday, 20 December 2021**, it will be assumed that the CNAD in Permanent Session has approved:

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<sup>1</sup> NIAG-D(2011)0022 – NIAG Handbook

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AC/259-D(2021)0068, MULTI REF

- the proposed NIAG studies programme for 2022 as set out in Annexes 1 and 2;
- the proposed studies sponsored and funded by ACT as set out in Annexes 3 and 4.

(Signed) Silva AHER

Annex 1: List of proposed NIAG studies for 2022  
Annex 2: Description of proposed studies for 2022 (step 1)  
Annex 3: List of 2022 studies sponsored and funded by ACT  
Annex 4: Description of ACT-proposed studies for 2022 (step 1)

4 Annexes

Action Officer: JS VAUTIER (+6924)  
Original: English

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**LIST OF PROPOSED NIAG STUDIES FOR THE CALENDAR YEAR 2022**

Nr	Sponsor	Study Title	Open to Partners
1	NAAG/JCGSBAMD	Ground Based Air Defence (GBAD) Survivability and Effectiveness in Joint Operations when faced by a Peer State Threat – Phase 2	Allies only
2	NAAG/JCGVL	Joint-Domain NATO Rotorcraft Interoperability and Survivability in a Peer Nation Threat Environment – Phase 2	Allies only
3	NAAG LCGLE/LCGDSS/JCGVL	Embarked Soldier Power/Data Subsystem	IP
4	NAFAG	The challenges of operating VTOL UAS to support maritime operations	IP
5	NNAG/UWWCG	Recording of multi-static (MS) acoustic parameters on different platforms and replay of such MS scenarios	Allies only
6	NAAG/ICGIF	Development of innovative artillery ammunitions	Allies only
7	C3B	Classified Collaboration in Public Clouds	Allies only

Nr	Sponsor	Study Title	Open to Partners
8	LCMG	Reliability prediction of electronic equipment	Allies only
9	CNAD	Enhancing the security and resilience of supply chains essential to Allied capability development and delivery	Allies only
<b>TOTAL BUDGET(*): <u>2.450 M (to be confirmed)</u></b>			

(\*) Each NIAG study budget is determined considering both length/complexity of the study but also the number of participants to ensure a fairly comparable level of effort per participant across the NIAG studies portfolio. The budget for each study will therefore be confirmed after the exploratory group meeting has taken place.

**Reserve list (in priority order):**

Nr	Sponsor	Study Title	Open to Partners
1	NNAG/AWWCG	Specialised Unmanned Surface Vessel for ASuW/AAW Force Protection	IP
2	NNAG	AI Support to Internal Battle Damage in Warships	IP
3	NNAG/JNLWCG	Impact Assessment of the use of Directed Energy Weapon on the field	IP

**DESCRIPTION OF PROPOSED NIAG STUDIES FOR  
CALENDAR YEAR 2022**

**Nr. 1 NAAG/JCGSBAMD – continuation of NIAG SG.265**

- 1. Title of the study:** Ground Based Air Defence (GBAD) Survivability and Effectiveness in Joint Operations when faced by a Peer State Threat – Phase 2
- 2. Brief description:** The objective of the Study is to assess SBAMD capabilities and operational effectiveness today and in the near to mid-term (5-10 years), identifying any shortcomings and presenting solutions to mitigate these shortcomings.

This 2-year project was approved under silence procedure on 28 April 2021 (ref. AC/259-D(2021)0021 and Action Sheet dated 19 May 2021). The project was launched in May 2021 and will conclude by June 2023.

**Nr. 2 NAAG/JCGVL – continuation of NIAG SG.266**

- 1. Title of the study:** Joint-Domain NATO Rotorcraft Interoperability and Survivability in a Peer Nation Threat Environment – Phase 2
- 2. Brief description:** The study will identify technology driven concepts that will provide the framework for defining and enabling joint rotorcraft, to include Special Operations Forces (SOF) aviation assets and air defence capability, integration and interoperability.

This 2-year project was approved under silence procedure on 28 April 2021 (ref. AC/259-D(2021)0024 and Action Sheet dated 19 May 2021). The project was launched in May 2021 and will conclude by May 2023.

**Nr. 3 NAAG/ LCGLE/LCGDSS/JCGVL**

- 1. Title of the Proposed Study:** Embarked Soldier Power/Data Subsystem.
- 2. Brief Description of Proposed Study:** Dismounted Infantry Soldier from NATO and Partner nations are transported during operations in different nations ground combat vehicles and rotary and/or fixed wing aircraft. Today's infantry soldier is equipped with a number of electronic devices, such as computer displays, and communications equipment required in the performance of their mission. During transit power is required to be provided by the transporting platform to the individual soldier to operate

and charge the electronic devices. While in transit the individual soldiers and their leader need updated situational awareness (audio and visual) to ensure maximum effectiveness on dismounting from the platform. To provide these three functions, power, charging of batteries and data the embarked soldier requires a robust universal quick disconnect connector that enables these functions and that is integral to the ground and/or aerial platform.

The study will develop an integrated ground and aerial platform architecture that enables the powering of the embarked soldier's equipment, charging the soldiers batteries and providing timely and sharable operational situational awareness. The ability to filter and tailor the information shared with the embarked soldiers internal to the platform and from external sources must be considered in designing the data/platform architecture.

**3. Background:**

- a. The NAAG has identified the embarked soldier power and data capability as a critical implementing technology for the advanced battlefield when facing an advance state or peer nation threat. The rapid implementation of advanced electronic technology to aid the infantry soldier has come at a price, the weight and quantities of batteries that must be carried by the individual.
- b. Early efforts to resolve this issue have been focused on advanced battery design and the need for a common light weight power connector that could be used to power the soldier's equipment, as well as recharge the various batteries when in transit. A common power connector would enhance NATO soldier integration and interoperability. Today these efforts are still underway.
- c. The speed in which events take place across the area of conflict has a direct impact on the embarked infantry soldier while in transit. Timely situational awareness from controlling formation down to the individual platform and to the embarked soldier is important. This has created the requirement for multiple data formats to be available to the embarked soldier in near real time.
- d. To accomplish the full task will require the identification of a common, robust, quick disconnect light weight connector able to provide power, battery charging and data to the embarked soldier in an EMI, Cyber and EW environment, while not interfering with the operation of the host platform<sup>2</sup>.
- e. The power and data architecture for platform integration to support the embarked soldier power and data requirements resides with the platform design authority.

**4. Objectives of the Study:**

- a. To develop a generic ground combat vehicle and aerial fixed and rotary wing platform power and data architecture in support of the embarked soldier that meets current safety and airworthiness certification criteria.

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<sup>2</sup> STANAG 4754, "NATO Generic Vehicle Architecture for Land Systems".

- b. Identify the design of a single common, light weight, robust, quick disconnect connector capable of meeting the power, battery charging and data requirements
- c. The power and data architecture and proposed common connector must meet or exceed current NATO EMI, Cyber and EW requirement for ground and aerial platforms.
- d. Identify the interface of the architecture in the generic ground combat and aerial fixed and rotary wing platforms, together with weight and volume added by incorporation of this capability.
- e. Provide a detailed development estimate for any required items that are at not at TRL-7 or above.
- f. Develop a detailed power and data development and platform test schedule for the architecture and connector proposed.

**5. NATO Priority:** High. Alliance dismounted infantry soldiers are embarked in different NATO and Partner nations ground and aviation platforms. The operational tempo requires timely situational updates while the soldiers are in transit. The number of electronically powered devices carried by the soldier continues to expand. For maximum effectiveness, the devices should be fully charged when the soldier disembarks from the platform. A number of nations are in the process of developing and producing advanced ground and aerial platforms. Early identification and incorporation of the embarked soldier power and data subsystem will mitigate platform development and modification costs while increasing combat effectiveness and interoperability.

**6. Intended Follow on to the Study:**

- a. The study results will be utilized by nations that are in the process of developing new ground combat and aerial platforms, as well as those nations that are planning to retrofit their legacy platforms.
- b. Technology advances, especially those associated with NATO's Emerging Disruptive Technologies (EDT) program are expected to impact this activity and may require modifications of the platforms in future years.

**7. Other NATO Bodies Involved in the Related Area of Work:**

- a. The NATO Army Armaments Group (NAAG) has been addressing this topic for a number of years in coordination with the Land Capability Group Dismounted Soldier Systems (LCG DSS), Land Capability Group Land Engagement (LCG LE) and Joint Capability Group on Vertical Lift (JCG VL).
- b. The air and maritime platform developers will benefit from the study and the NAFAG and NNAG communities may become involved.
- c. The study will provide important current and out-year data to support the ACO Force Generation and NATO Defense Planning Processes.

**8. Current Industrial Involvement with the Sponsor Group:**

- a. The NAAG and its subordinate groups have developed a very close working relationship with the industry of NATO and Partner nations through the conduct of multiple NIAG studies dating back over a decade.
  - b. Industry has consistently been a strong supporter of enhanced land capability related activities.
9. **Proposed Start Date:** ASAP but not later than February 2022. Due to the importance of this effort, an early start in 2021 is desired.
10. **Desire Completion Date:** February 2023.
11. **Study Classification:** Up to and including NATO Restricted
12. **Open to Partners:** Yes
13. **Sponsoring Group Point and IS Point of Contact:**
- a. Sponsor: Dr. Barton Halpern, Chairman, NAAG
  - b. IS: Mr. Osman Tasman
  - c. Co-Sponsors:
    - i. Major Magnus Hallberg, Chairman, LCGDSS
    - ii. Mr. Dirk Lissmann, Chairman, LCGLE
    - iii. Mr. Lars Ericsson, Chairman, JCG VL

<b>Nr. 4 NAFAG</b>
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1. **Title of the Proposed Study:** The challenges of operating VTOL UAS to support maritime operations.
2. **Brief Description of Proposed Study:**
  - a. VTOL UAS are planned to fulfil several different roles in the future maritime operating environment. The characteristics and benefits of these types of systems are becoming increasingly well-understood through a range of developmental activities including synthetic environment modelling, physical test and evaluation, and operational experience.
  - b. Early activities have identified a number of challenge areas related to the use of VTOL UAS systems in maritime applications. These appear to stem from a general lack of technical maturity and understanding relating to maritime-specific requirements.
  - c. The proposed study will identify the principal challenges to the development and implementation of maritime VTOL UAS. The activity will seek to understand the genre-specific aspects which must be addressed in order to permit the widespread and robust adoption of maritime VTOL UAS-enabled capabilities.
3. **Background:**

- a. NATO nations are engaged in a range of activities to explore the utility of VTOL UAS in the maritime operating environment. This is likely to be an enduring topic in the coming years as the nations' armed forces look to expand the use of uncrewed vehicles.
- b. Activities so far have helped to mature the platform and system technologies underpinning UAS operations. This has in turn enabled government and industry teams to explore a wide range of UAS applications and their attendant benefits.
- c. The unique (and often stressing) maritime environment poses several risks to the operation of current VTOL UAS technologies and operating concepts. In particular, the harsh operating conditions at sea have the potential to significantly degrade system performance or otherwise hamper effectiveness. The overall system architecture must also be tailored to the maritime application, with consideration given to how the disparate system components are integrated to deliver tangible military capability.
- d. The understanding of the art of the possible, the levels of performance required, appropriate standards and what constitutes best practice in this space is considered to be immature. Whilst individual 'pathfinder' programmes have begun to address these gaps on a case-by-case basis, there would be considerable benefit to a concerted enterprise-level approach.

4. **Objectives of the Study:**

- a. Inform NATO of the breadth of potential VTOL UAS applications in the maritime environment. This should include where VTOL UAS have been exploited in support of current capabilities and where they could be exploited more widely in the future;
- b. Infer the main challenge themes derived from these applications through a combination of practical experience, analysis and engineering judgment.
- c. Considerations should include ranging, stowing and securing; launch and recovery; aviation facilities, support and maintenance; command and control; application of standards and protocols; test and evaluation to determine operating limits (including the use of modelling and simulation); qualification and certification.
- d. Highlight the current gaps in knowledge, capability and technology necessary to address these challenges;
- e. Identify those priority challenge themes that will drive technology development to overcome barriers to VTOL UAS exploitation;
- f. Outline the key near-term activities required to overcome these challenges, along with the longer-term roadmap to established maritime VTOL UAS operations.
- g. Develop a set of common lessons to inform NATO activities moving forward.
- h. Emphasis should be placed on NATO Class 2 and Class 3 UAS but Class 1 UAS may also be considered where appropriate.

5. **NATO Priority:** High.

- a. As capabilities that current rely on crewed platforms are reaching their out of service dates, the timely development and fielding of robust and effective

uncrewed air vehicle capabilities is critical to realizing the nations' future warfighting visions. The mass employment and proliferation of these types of system by both Peer Nations and irregular threat actors has intensified the need for a truly integrated operational capability within NATO. Uncrewed vehicles have the potential to revolutionise the way that current maritime tasks delivered, with tangible benefits in affordability, risk and resource management and mission effectiveness all within reach. It is therefore vital that Defence finds ways of overcoming the inherent challenges to exploit these systems to the fullest.

6. **Intended Follow on to the Study:**

- a. This study is a means of capturing and assessing the growing body of knowledge relating to practical experience of introducing VTOL UAS into service with NATO Navies. The understanding gained from the organizations involved in designing, developing, integrating and operating these systems will provide valuable information to identify how to improve the exploitation of VTOL UAS more rapidly and more efficiently.
- b. Sharing this information across NATO will benefit the alliance by enabling lessons learned to be captured, shared and reviewed thereby identifying best practice or common areas of concern.
- c. This information will help to inform future procurement requirements and direct research to address the priority challenges in national programmes and informing the NATO STO community of collaboration opportunities.
- d. Practical experience of implementing relevant NATO standards or protocols will inform stakeholders of best practice in exploiting the standards, identify whether there any issues with their implementation, or where there may be gaps in those standards that might affect interoperability.

7. **Other NATO Bodies Involved in the Related Area of Work:**

- a. There are a broad range of NATO bodies involved in the development, evaluation and exploitation of maritime VTOL UAS. This includes Joint Capability Group for ISR, Allied Command Operations, Allied Command Transformation, the Joint Air Power Competence Centre (JAPCC), NATO Alliance Ground Surveillance and the NATO Science and Technology Organization.
- b. In addition, the Maritime Unmanned Systems Initiative coordinated through the MUS Innovation & Coordination Cell (MUSIC<sup>2</sup>) aims to strengthen the ability of navies to operate in a multinational context above, on, and under the water, in an increasingly complex maritime domain.

8. **Current Industrial Involvement with the Sponsor Group:**

- a. The JCG VL has a strong relationship with rotorcraft manufacturers and principal systems providers of NATO Partner nations. This relationship has been developed over the past 10 years through a series of NIAG study groups and associated activities.
- b. The JCG UAS also has a strong history of working with Industry on UAS. The Flight in Non-segregated Airspace (FINAS) sub-group has developed several UAS-related standards working with Industry partners. Notable among these in

the context of this study proposal are: STANAG 4702 Rotary Wing Unmanned Aircraft Systems Airworthiness Requirements and STANAG 4586–Standard Interfaces of UCS for NATO UAV Interoperability.

- c. Industry has in the past strongly supported related activities sponsored by JCG-UAS and JCG-VL undertaken by NIAG and STO.

- 9. **Proposed Start Date:** February/March 2022
- 10. **Desired Completion Date:** No later than June 2023
- 11. **Study Classification:** NATO UNCLASSIFIED
- 12. **Open to Partners:** yes
- 13. **Sponsoring Group Point and IS Point of Contact:**
  - a. Pat Collins, Vice Chairman of JCG VL
  - b. Patrick Buckley, Chairman of JCG UAS
  - c. Don Turnbull, NATO DI, Secretary to JCGVL
  - d. Ross McKenzie, NATO DI, Secretary to JCG UAS
  - e. Sean Trevethan, NATO DI, Director MUSIC<sup>2</sup>

**Nr. 5 NNAG/UWWCG**

**1. Title of Proposed Study**

Recording of multi-static (MS) acoustic parameters on different platforms and replay of such MS scenarios

**2. Brief Description of Proposed Study**

The proposed study will increase the interoperability capabilities between various air, surface and subsurface platforms for the use and exploitation of multi-static acoustics

**3. Background**

Due to increased submarine threat and reduced submarine signatures, multi-static acoustic operations gain importance. Therefore, the recording, replay and analysis based on data from various platforms (air, surface, subsurface) require suitable standards. STANAG 4283 provides the downstream data format for the information required for further use.

NIAG Study Group (SG) 223 - Validation of the proposed NATO standard on Multi-Static and Low Frequency Active Sonar Common Standards – provided a comprehensive definition of data messages to be exchanged in order to coordinate MS operations.

**4. What is the Objective of the study in terms of what is to be carried out, why and with what purpose?**

The objectives of the study are to assess the necessary parameter sets required for recording in order to replay and analyses of operational scenarios with multi-static acoustic processing. It builds on the results of SG 223 and takes it to the next operational phase: the recording, replay and analysis activities on multiple ASW platforms.

The scope of study is to:

- Deliver a Final Report, releasable to NATO that covers all of the above.
- Provide a way forward to increase the interoperability between multiple ASW platforms utilizing multi-static acoustics.

The study will address:

- Determine which type of data is absolutely necessary or otherwise usable for the analysis, the replay and the associated tactical development ASW and ACINT.
- Identification of the minimum requirements of the functions (such as static, dynamic, topography) for current and future underwater situation imaging systems.

The required output of the study will be:

- A classified Final Report, releasable to NATO that addresses the full scope of the study.
- Update to STANAG 4283 Edition 7 and ANEP 93

## **5. NATO Priority**

The following is a preliminary list of the operational scenarios that would be supported by this study, multi-statics is a major priority for NATO in support of Anti-Submarine Operations. Additional scenarios may be added as the study progresses:

- Several MPAs conducting Multi-Statics (MS)
- Several HCs / UAVs conducting MS
- Several MPAs and several surface ships conducting MS
- Several HCs / UAVs and several surface ships conducting MS
- MPA(s) and subsurface units conducting MS

## **6. Intended Follow-on to the study**

- Update to STANAG 4283 Edition 7/ANEP 93
- Update to MMSC specification, SD-1.43

## **7. Are any other Bodies involved in the related area of work**

- UWWCG
- Maritime Air Syndicate
- ASW Syndicate
- MARCOM

## **8. Is there any current industrial involvement in the area of work**

- Maritime Air Syndicate Industrial Support Team (IST)
- Companies involved in SG 223 study
  
- The following companies are active members of the Underwater Warfare Capability Group – Maritime Air Syndicate Industrial Support Team and may have expertise and interest in participating in this study:
  - Atlas Elektronik: Florian Schulz ([florian.schulz@atlas-elektronik.com](mailto:florian.schulz@atlas-elektronik.com))
  - ESG: Dr Ingo Eickmann ([ingo.eickmann@esg.de](mailto:ingo.eickmann@esg.de))
  - Leonardo: Francesco Traversa ([francesco.traversa@leonardocompany.com](mailto:francesco.traversa@leonardocompany.com))
  - Sparton: Chuck Sitarski ([charles.sitarski@sparton.com](mailto:charles.sitarski@sparton.com))
  - Thales France : Pierre Blanc-Benon ([pierre.blanc-benon@fr.thalesgroup.com](mailto:pierre.blanc-benon@fr.thalesgroup.com))
  - Thales UK: Graham Ward ([graham.ward@uk.thalesgroup.com](mailto:graham.ward@uk.thalesgroup.com))
  - Ultra UK

In addition to the above, the following companies are known to the sponsor group through previous work and may have expertise and interest in participating in this study:

- Galileo Avionica
- General Dynamics Mission Systems – Canada
- Intracom
- Lockheed Martin
- L-3 Communications Systems East
- SAES
- SAIC – Southern Maryland, US Group
- BAE – US and UK

**9. Proposed Start Date:** Early2021

**Proposed Completion Date:** August 2022

**10. Study Classification level:** NATO SECRET (to be re-assessed after kick-off meeting)

**11. Study Open to Partners:** No

**12. Sponsoring Group Point of Contact and IS Point of Contact:**

Sponsoring Group Points of Contact

- Maritime Air Syndicate IST Chairman, US  
[Barbara.clothier@navy.mil](mailto:Barbara.clothier@navy.mil)
- Maritime Air Syndicate IST Vice Chairman, US  
[Donald.gladu@navy.mil](mailto:Donald.gladu@navy.mil)
- Maritime Air Syndicate Chairman  
[BjoernMalmus@bundeswehr.org](mailto:BjoernMalmus@bundeswehr.org)
- Maritime Air Syndicate Secretary  
[davidliesenfeld@bundeswehr.org](mailto:davidliesenfeld@bundeswehr.org)

NATO Staff Points of Contact:

- UWWCG/NNAG Secretary  
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<b>Nr. 6 NAAG/ICGIF</b>
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1. **Title of Proposed Study:** Development of innovative artillery ammunitions
2. **Brief Description of Proposed Study:**

The study will investigate the possible development of a 155 mm artillery grenade or a rocket with innovative effect and capability. In particular the study will focus on:

- ammunition capable of delivering non-lethal EMP effects releasing an electromagnetic impulse capable of neutralizing such electronic devices located in the surrounding area aimed at interfering/disabling electronic devices (e.g. transmission systems, computers, navigators, etc..) of the opponents;
- loitering munition (capable of seeking, identifying, monitoring and engaging objectives) envisaging the integration of lethal/non-lethal payload with existing UAV, in order to contain R&D costs. Evaluate the possible development of a UAV endowed with an ammunition/payload (HAROP type), an ammunition with reduced volume and weight. That will allow the system to orbit around a certain area ensuring adequate surveillance.
- *smart* munition integrated with an artificial intelligence (AI) module capable of analyzing the battlefield; identifying a target in a pre-charged target set and providing appropriate effect, specific for the identified target. For e.g. discriminate a heavy armored enemy vehicle from an infantry dismounted squad and deliver in the first case a HEAT effect and in a second case an High Energy fragmentation effect or non-lethal effect (for e.g. EMP).

### 3. Background:

Joint Fires Land Common Capability statement<sup>3</sup> 2.04 indicates the capability to deliver no lethal munition/guided munition and minimize collateral damages. Currently NATO has a limited portfolio of non-lethal ammunitions. The EMP ammunition will increase the capability to suppress/neutralize the opponent activities disrupting the C2 combat function, IAW maneuverist approach to operations.

If this EMP ammunition/payload or an existing explosive payload is combined with a loitering munition/ UAV this kind of ammunition will further increase the capability to suppress/neutralize the opponent activities, and give the capability to conduct initial BDE and minimize collateral damage being guided by the operator.

If the loitering munition/UAV is integrated with an AI module capable of target identification and strike target delivering the appropriate effect based on the type of target this will further increase the capability to suppress/neutralize the opponent activities, to reduce the number of volleys delivered, minimizing the time of vulnerability to enemy counter fire and maximizing the effectiveness of the ammunition, minimizing collateral damage.

### 4. Objectives of the Study and what is expected to be delivered in the Final Study Report:

The possible development of:

- a 155 mm artillery grenade/rocket capable of disrupting electronic devices (e.g. transmission systems, computers, navigators, etc..) of the opponents in a limited target area.
- a 155 mm artillery grenade/rocket capable of loitering on a specific target area, ensuring adequate surveillance. Once identified a target (fixed or mobile), the ammunition should ensure the following actions:
  - o Impact the target and blast / release non lethal effect;
  - o Deliver the ammunition on the intended target and perform a 1st level BDA to evaluate the achieved effects;
  - o Cancel the kinetic mission and continue the surveillance activity;
  - o Re-address to a new target
- a 155 mm artillery grenade/rocket integrated with an AI module capable of identification of the target and best effect delivery.

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<sup>3</sup> SH/SDP/SDF/CFR/DPF/19-003782 5000/FPR - 0070/TT-1758/Ser:NU0517 Bi-SC CAPABILITY CODES AND CAPABILITY STATEMENTS, dated 22 January 2020

The expected output will be a report on the feasibility of an ammunition with all or at least one of the aforementioned set of capabilities, possibly accompanied with project/s or demonstration on how it will work at least in a theoretical model that can prove that the ammunition can be actually realized.

**5. NATO Priority (e.g. applicable LTCR):**

Assured precision Strike 7.c; Longer Term Aspects AC225, 2019.

**6. Intended Follow-on to the Study:**

The study will help to identify the multinational cooperation opportunities, and associated harmonized requirements, concepts and potential standards.

**7. Are any other NATO Bodies involved in the related area of work:** Not Known

**8. Is there any current Industrial involvement in the area of work:** No

**9. Proposed start date:** 2022

**10. Desired completion date:** 2023

**11. Study Classification level:** NATO Unclassified

**12. Study Open to Partners:** No

**13. Sponsoring Group Point of Contact and IS Point of Contact:**

Mr Osman TASMAN, Land Armaments Coordinator Defense Investment Division, IS Staff Advisor and secretary of ICGIF

<b>Nr. 7 C3B</b>
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**1. Title of Proposed Study:** Classified Collaboration in Public Clouds

**2. Brief Description of Proposed Study:**

The study's aim is to progress the modernization of NATO ways of Working and increased adoption of cloud-based solutions for collaboration services.

Because of the NATO security context, two perspectives are proposed:

- Investigate solutions for classified (up to NATO Restricted - NR) collaboration leveraging public cloud offering;
- Explore optimization of the certification effort for cloud-based solutions (up to NATO Unclassified - NU).

### 3. Background:

Current security models are based on the use of encryption within the communications part of NATO CIS. Some of the consequences of this approach are:

- The security boundary is defined by the communications encryption device;
- There are separate IT domains for NS and NU, and cross-domain collaboration is a security issue;
- It is difficult to move classified data to a Public Cloud service in a secure manner.

In the future, with Data Centric Security (DCS) using application encryption technology, the data itself will be secured – both at rest and in motion. Once all data is secured with DCS, the classified information is accessible to authorized users when they need it, but is inaccessible to unauthorized users even if they access the data.

But the transition to DCS will take some time, and, in the meantime, NATO is willing to explore alternative ways for lower classification level (NR) collaboration to happen in Public Clouds. Because wider spread adoption of cloud-solutions will also increase the accreditation effort, concurrent effort to automate as much as possible accreditation for NU solutions would allow resources to focus on the more challenging cases and provide significant support to NATO digital transformation.

Additional context can be found in the C3B-sponsored Collaboration Study - AC/322-N(2021)0055 and in the draft preliminary analysis on public cloud environments handling NATO Restricted information - NOS/24(2018)001.

### 4. Objectives of the Study:

1. For Classified Collaboration:
  - a. Explore the security challenges for security levels higher than NU (recognizing that a committee approved technical directive for NR information shall be generated before any implementation may occur); This would include:
    - i. Encryption related security measures (i.e. Hardware Security Modules appliance, Virtual Private Network appliance, Key Management and Public Key Infrastructure);
    - ii. Personnel Security Clearance for system administrators;
    - iii. Independent security audits.
  - b. Propose architecture designs, ready to be configured on cloud solutions, for testing industry proposals to address the security challenges identified at 1.a.
2. For increased adoption of Public Cloud services at NATO:

- a. Automate the NATO security accreditation process as much as possible for the cloud-based services, with a view to shorten time-to-NATO use (limited to NU);
- b. Propose architecture designs, ready to be configured on cloud solutions, for testing the solution for 2.b. above.

**5. Please indicate whether you would like to be presented with alternative solution options, taking into consideration that exploring various options may reduce the depth of the study scope:**

Yes, the objective of the study is to explore available solutions that would fulfil the collaboration and security requirements.

**6. NATO Priority:** in support of NATO's Coherent Implementation Strategy on Emerging and Disruptive Technologies

**7. Intended Follow on to the Study:** Pilot project on Classified Collaboration

**8. Other NATO Bodies Involved in the Related Area of Work:** NATO Office of Security, NCI Agency (NATO Digital Workplace)

**9. Current Industrial Involvement with the Sponsor Group:**

Likely participants in the Study Group area already involved in the Cloud Technical Directive Writing Team

**10. Proposed Start Date:** January 2022

**11. Desired Completion Date:** December 2022

**12. Study Classification:** NATO Unclassified

**13. Study Open to Partner industries:** No

**14. Final report releasable to:** NATO

**15. Sponsoring Group Point and IS Point of Contact:** NHQC3S / Mr Sylvain Sermesant

<b>Nr. 8 LCMG</b>
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**1. Title of Proposed Study:** Reliability prediction of electronic equipment

**2. Brief Description of Proposed Study:**

To discuss and propose a common standard or a set of standards or a set of criteria to be used in order to achieve the best solution/s to calculate the electronic equipment reliability data for engineering, safety and IPS purposes (Integrated Product Support).

**3. Background:**

The MTBF (Mean Time Between Failures) is a key parameter for several purposes. For instance, in particular during tender/bidding phases it is used as a contractual requirement in engineering design activities, for safety applications, diagnostics and IPS. Currently, several methodologies are available to perform the reliability prediction of electronic equipment (MIL-HDBK217F, 217Plus, Fides Guide 2009A, IEC61709 etc.) involving also different calculation approaches. The difficulty caused by the presence of several standards, which can be used for reliability prediction, produces incoherent results and/or discrepancies, which can impact both manufacturers and customers.

**4. Objectives of the Study**

On the basis of the calculation methods currently used, the study will:

- Perform an analysis of current standards, including data conversion methods, and comparison with from-the-field data;
- Verify whether current standards are applicable to new technologies and emerging ones;
- Provide detailed and complete information about their users: institutional bodies, industries in NATO countries, NATO programs;
- Verify the current level of adoption of the standard;
- Verify the user-friendliness of the standard;
- Verify whether any costs are applicable to use the standard;
- Verify the current standards applicability to typical defense use environments, also focusing on hazard and safety analyses;
- Verify whether current standards provide guidance on the manufacturing and testing processes of components;
- Verify the presence of checklists involving the use of factors selected on a discretionary or subjective basis.

**5. Please indicate whether you would like to be presented with alternative solution options, taking into consideration that exploring various options may reduce the depth of the study scope:**

As already described in point 2, one or more options could be considered due to the complexity of the subject matter.

**6. NATO Priority:** High

**7. Intended Follow on to the Study:** Possible STANAG or STANREC

8. **Other NATO Bodies involved in the related area of work:** NIAG
9. **Current industrial involvement with the Sponsor Group:**  
IEC- International Electrotechnical Commission, Technical Committee 56 (TC56)
10. **Proposed Start Date:** As soon as possible (beginning of 2022)
11. **Desired Completion Date:** By the end of 2022
12. **Study Classification:** NATO Unclassified
13. **Study open to Partner Industries:** No (liaison to be requested to IEC TC56)
14. **Final report releasable to:**  
NATO countries and partners that NATO identifies as being of interest
15. **Sponsoring Group Point and IS Point of Contact:**  
Italy offers the possibility to host and chair this study
  - Michele Porcu, Chief 3° Office  
Italian MoD, Secretariat General of Defence and National Armaments Directorate  
5<sup>th</sup> Department – Technological Innovation  
E-mail: [r5u3s0@sgd.difesa.it](mailto:r5u3s0@sgd.difesa.it)
  - Jean-Sebastien Vautier, LCMG Coordinating Staff Officer  
NATO International Staff / Defence Investment Division  
E-mail: [vautier.jean-sebastien@hq.nato.int](mailto:vautier.jean-sebastien@hq.nato.int)

<b>Nr. 8 CNAD</b>
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1. **Title of Proposed Study:**  
Enhancing the security and resilience of supply chains essential to Allied capability development and delivery.
2. **Brief Description of Proposed Study:**  
Through a series of studies, the NIAG is invited to provide insight on key challenges and opportunities facing industry, Allies and NATO in securing a resilient supply of strategic materials and microelectronics. Industry views will inform the CNAD, and potentially other NATO communities, in taking forward work on this subject.

### 3. Background:

The maintenance of secure and resilient supply chains contributes to Allies' commitment, under Article 3 of the Washington Treaty, to develop individual and collective capacity to resist any form of attack. Article 3 provides the foundation for two major and interconnected NATO political priority areas of interest to industry: resilience and capability development. At their 2021 Summit in Brussels, Heads of State and Government agreed to step up efforts to secure and diversify supply chains.

From a resilience perspective, well-known threats to NATO, Allied and industry supply chains and sources of vulnerability include tampering and sabotage, cyberattacks, theft, surveillance and terrorism. They also include reliance on a limited number of suppliers and sources of some strategic materials, components and assemblies. Foreign control, influence, and interference in key elements of supply chains adds to the potential for single points of failure in successful defence acquisition. The NIAG has already recommended that NATO should consider issuing guidance to Allies to block or set limits to the predatory buying of strategic assets by foreign investors on the grounds of public security or public policy<sup>4</sup>.

Security of supply also relates closely to Allied capability development and delivery from a defence planning perspective. It encompasses the timely provision of products Allies require, often from industry based outside their borders, to meet Defence Minister-level commitments to introduce NATO Capability Targets into Allies' own defence planning and capability development.

In April 2021, National Armaments Directors (NADs) endorsed an approach to enhance the security of supply chains critical for capability development, to include both the resilience and capability development dimensions, and tasked the CNAD in Permanent Session to implement it. Relevant findings from recent NIAG studies on the implications of Emerging and Disruptive Technologies (EDT)<sup>5</sup> and the impact of COVID-19<sup>6</sup> strongly influenced the CNAD approach. Therefore, further elaboration by industry will be essential to inform the CNAD's work going forward. Related work underway in other committees, including the Civil Emergency Planning Committee, the Security Committee and the Consultation, Command and Control Board, would likewise benefit from the NIAG's insights.

### 4. Objectives:

- Given the large scope for which an industry perspective would be valuable, a series of studies is envisioned, starting with a first phase including the following objectives, to be accompanied with recommendations to NATO, Allies and industry:

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<sup>4</sup> AC/259-D(2021)0014, NIAG Spontaneous High-Level Advice (HLA) Study on Industry Perspective on the impact of COVID-19.

<sup>5</sup> AC/259-D(2021)0001, NIAG study on Emerging and Disruptive Technologies, in the context of Emerging Powers - Final report.

<sup>6</sup> AC/259-D(2021)0014, NIAG Spontaneous High-Level Advice (HLA) Study on Industry Perspective on the impact of COVID-19.

- Describe the most important strategic materials and microelectronics, together with the security, economic, regulatory, technology, environmental, workforce and other considerations most relevant from a defence industry perspective;
- Outline realistic contours and roles of NATO, Allied governments and industry in developing and implementing their potential strategic approaches to supply chain risk management, applicable, but not necessarily limited to, strategic materials and microelectronics, taking into consideration relevant national policies and developments in other international organisations, including, in particular, the European Union, as appropriate.
- Depending on the outcome of the first phase and the evolving political environment surrounding supply chain issues, further studies could be conducted to address the following objectives:
  - Identify the steps needed, and who should take them, to understand and strengthen existing supply chains and, as appropriate, create new ones “from the mine to the battlefield”, in order to safeguard short-term availability of strategic materials and components, and, in the longer term, maintain the necessary level of independence from risks of supply interruption;
  - Incorporating potential contributions from the Science and Technology Organisation, include in the above assessment specific ways to reduce Allies’ foreign dependency on the mining and processing of strategic materials, including rare earth elements, through the following:
    - considerations to reactivate mining and processing in Allied countries,
    - the potential offered by recycling these materials, and
    - leveraging the current state-of-the-art in development of alternatives;
  - Provide an industry perspective on the obstacles facing timely cross-border delivery of components, assemblies and complete equipment between Allies, and steps required to surmount them; and
  - Lay out a direction of travel for NATO to extend its supply chain security and resilience focus beyond the issues addressed above, including further work that could be undertaken by the NIAG.

**5. Please indicate whether you would like to be presented with alternative solution options, taking into consideration that exploring various options may reduce the depth of the study scope: Yes**

**6. NATO Priority: High**

**7. Intended Follow on to the Study:** Incorporation into the CNAD’s Strategic Materials and Microelectronics Supply Chain Security and Resilience Action Plan and its

implementation; potential use by other committees conducting work related to supply chain security and resilience (see below).

**8. Other NATO Bodies Involved in the Related Area of Work:** Science and Technology Organization, Allied Command Transformation, IS/Defence Policy and Planning Division in support of the Civil Emergency Planning Committee and Defence Policy and Planning Committee (Reinforced), IS/Joint Intelligence and Security Division in support of the Security Committee, NATO HQ Consultation, Command and Control (C3) staff in support of the C3 Board, IS/Emerging Security Challenges in support of the Cyber Defence Committee.

**9. Current Industrial Involvement with the Sponsor Group:** None, with the exception of NIAG.

**10. Proposed Start Date:** March 2022 (Phase 1).

**11. Desired Completion Date:** March 2023 (Phase 1), to allow results to inform decisions at the Spring 2023 CNAD Plenary.

**12. Study Classification:** NATO Unclassified (Annexes can be higher classification as necessary).

**13. Study Open to Partner industries:** No

**14. Final report releasable to:** NATO

**15. Sponsoring Group Point and IS Point of Contact:**

CNAD (POC TBD)

Ms Arina Danila (Head P3S) - Mr Jason Pogacnik (P3S Officer)

<b>Reserve 1</b>	<b>NNAG/AWWCG</b>
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**1. Title of Proposed Study:** Specialised Unmanned Surface Vessel for ASuW/AAW Force Protection.

**2. Brief Description of Proposed Study:**

Study the feasibility of developing a surface UxV as a point defence toolbox with sensors, Hard Kill and Soft kill capability in coordination with other specialized HVU UxV's for surface applications to protect the HVU's during its operations in Littoral waters against relevant targets like low RCS fast flyers.

**3. Background:** The potential of Unmanned Surface Vessels (USVs), large and small, in all maritime operations has not yet been considered to its fullest extent within Allied forces. The potential to develop USVs as part of a point defence system is significant, coupled with the advances in autonomy, especially regarding COLREG/collision avoidance, mean that

ultimately successful development of systems such as PD USVs could yield manpower and thus capability cost savings into the future.

#### 4. Objectives of the Study:

The study may address:

- Issues with leaving a heavily armed autonomous unmanned surface vehicle on its own. What new standards would be required?
  - Safety standards
  - Man in the loop
  - Cyber security
  - Communication - interoperability
- It cannot be a frigate, but how small could you build it and still have sensor and firepower enough to make it a real self defence tool
  - Realistic engagement range. Since this tool is protecting unmanned systems one could put all efforts at killing the targets at close range. With close in range weapons the “safety area” could be limited
  - Type of weapons – existing or new development
  - Hard kill or Soft kill or both – link to “reusable off board decoy” SD initiative
  - Portability – as part of “mother ship” You deploy this tool when the threat demands
  - Seaworthiness
- One could probably envision several scenarios if this tool finally becomes real, but the initial need stems from the challenge of protecting other specialized USV toolboxes i.e. that are keeping important shipping lanes in the littorals free from mines.

- Targets:
  - Flying bombs
  - Long range surface missiles
  - Smaller ground launched missiles
  - Aircraft
  - Helicopter

**5. Please indicate whether you would like to be presented with alternative solution options, taking into consideration that exploring various options may reduce the depth of the study scope:** Yes, open to alternative suggestions.

**6. NATO Priority:** Would form part of Maritime Engagement, a key shortfall in the MC SRA.

**7. Intended Follow on to the Study:** Potential to develop a STANAG for the C2 of small USVs.

**8. Other NATO Bodies Involved in the Related Area of Work:** STANAG 4817, C2 of Multi-domain UxVs. ESC Autonomy Strategy. CNAD EDT work stream. NCIA AI Development. ACT NWCC. C3S – C2 of Autonomous Systems. NATO MUSI (REPMUS 21, DYMS 22).

**9. Current Industrial Involvement with the Sponsor Group:** None as of yet.

**10. Proposed Start Date:** March 2022

**11. Desired Completion Date:** June 23

**12. Study Classification:** NATO Unclassified

**13. Study Open to Partner industries:** Yes

**14. Final report releasable to:** NATO and Partners

**15. Sponsoring Group Point and IS Point of Contact:**

NNAG Level 2 Capability Group – Above Water Warfare.  
IS POC Mr Sean Trevethan. [Trevethan.Sean@hq.nato.int](mailto:Trevethan.Sean@hq.nato.int)

Reserve 2	NNAG
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**1. Title of Proposed Study:** AI Support to Internal Battle Damage in Warships

**2. Brief Description of Proposed Study:**

This study will investigate the feasibility of using AI/ML to support ships teams when a warship sustains battle damage. It will specifically look at the following:

Exploitation of ships internal platform management systems to automatically reconfigure auxiliary power and systems to maintain operation of key capabilities such as propulsion systems, weapon systems and sensors in maintain a warships ability to fight the external battle.

Exploit a ships internal fixed fire fighting and damage control systems to automatically deal with damage, containing fires and floods as appropriate.

Provide decision support to Ship's teams when determining internal battle damage priorities and damage repair.

Provide decision support to operators as to optimum capability based on damage sustained. i.e. max speed available, weapons available etc.

**3. Background:**

This NIAG study will be focused on providing decision support and automatic system configuration when a warship is sustaining battle damage. The practice of training with battle damage is common place for most warships generating for an operational deployment. The challenge to ship's teams fighting the internal battle is immense and one that puts a significant load on ship's teams. Exploiting the advances in AI/ML in this area could significantly aid ship's teams and free up and focus personnel on the damage that really matters, enabling allied forces to fight and win. It would have to draw on data from the ships combat system and a ships platform management system to provide holistic recommendations.

**4. Objectives of the Study and what is expected to be delivered in the Final Study Report:**

1. Understand in what scenarios AI/ML would be useful in the internal battle.
2. Determine which warship systems would need to be accessed to glean the most benefit.
3. Identify which systems could be automatically reconfigured and which would still require human intervention with decision support.

4. Identify the security classification challenges of access Combat System data and Platform Management Data.
5. **NATO Priority:** Combat Survivability
6. **Intended Follow-on to the Study:** Development of a concept paper for Nations to consider development with their own systems.
7. **Are any other NATO Bodies involved in the related area of work?** Not directly, but ESC AI Strategy and NCIA AI development are related.
8. **Is there any current Industrial involvement with the Sponsor Group?** Not yet.
9. **Proposed start date:** May 2022.
10. **Desired completion date:** 24 months after commencement of the study
11. **Study Classification level:** NATO Unclassified.
12. **Study Open to Partners?** Yes
13. **Sponsoring Group Point of Contact and IS/DI Point of Contact:**

ST-SCS: Chair Mr. Mattias Osback  
IS/DI - Mr Sean Trevethan - [Trevethan.Sean@hq.nato.int](mailto:Trevethan.Sean@hq.nato.int)

<b>Reserve 3</b>	<b>NAAG/JNLWCG</b>
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1. **Title of Proposed Study:**  
Impact Assessment of the use of Directed Energy Weapon on the field. (Based on the Spontaneous Study Proposal per DI(STR)(2021)0001(CDS))
2. **Brief Description of Proposed Study:**  
The proposal aims at studying the usability of DEWs for protection of ground based installations and mitigating the problems arising from such employment.
3. **Background:**  
Directed Energy Weapons employment is currently under study to meet a broad range of applications: area protection, VSHORAD, Less-Than-Lethal uses. The flexibility they give in situations like countering asymmetric threats is extraordinary as they allow the modulation of the effect; their employment is also extremely interesting since they ease a faster kill chain with respect to kinetic weapons. Another point of interest is the effectiveness against lower cost threats. These benefits can be regarded as complementary to more traditional effectors and allow for an escalation depending on the evolution of the scenario. DEWs have now reached a high level of maturity and have been studied in several contexts. Nevertheless,

there are several key points that deserve attention: ranging from kill assessment to collateral effects or logistics of those weapon systems, there several topics still needing attention.

**4. Objectives of the Study:**

The overall purpose is to provide answers to the field employment. As such, the following main objectives are investigated: problems arising from field employment and ergonomics of use. One problem arising in field employment is how to manage weapon assignment, not only during the first engagement but also for escalating the reaction. The kill or damage assessment is crucial for ensuring the effectiveness of the overall reaction, with the right weight depending on the threat. The evaluation of the threat and the assignment of the right effector as well as the escalation are crucial for ensuring an effective mission. A suitable damage assessment allows escalating when needed.

Another set of problems arises from environmental conditions. E.g. for LDEW the employment on the field poses big problems for the impact of dirt and dust on the optics as those elements can cause the immediate self-destruction of the optics. Also RFDEW systems are affected as the environmental conditions would affect propagation.

Collateral damages are a topic to be further analysed: light wavelengths, reflections, lobe of irradiation, impact on civilian structures are all elements to be carefully analysed for both LDEW and RFDEW. In addition, studying the effect of high power radiation on living beings is vital for ensuring adequate impact on the enemy and reducing the effects on neutrals or friends.

Lastly, the health management of the system is crucial for ensuring a very low life cycle cost for the DEW systems.

Liaising with the NATO community is an important result of the mentioned activities.

**5. NATO Priority: High**

**6. Intended Follow on to the Study:**

Incorporate any recommendations into the Programmes of Work and propose a follow NIAG study on how to train for these recommendations.

**7. Other NATO Bodies Involved in the Related Area of Work:**

This area is a topic being addressed in multiple Science & Technology Organisation (STO) activities.

**8. Current Industrial Involvement in the Area of Work:**

SAS140 purpose is to provide analytical and operational inputs for a future DEW concept.

**9. Proposed Start Date: Early 2022**

**10. Desired Completion Date: Early 2023**

11. **Study Classification:** NATO Unclassified
12. **Study Open to Partners:** Yes
13. **Sponsoring Group and IS Point of Contact:** NAAG-JNLWCG POC Vice-Chair  
Ms. Susan Le Vine, IS POC: Esther Savvidis Toledo ([savvidis-toledo.e@hq.nato.int](mailto:savvidis-toledo.e@hq.nato.int))

**LIST OF PROPOSED NIAG STUDIES SPONSORED AND FUNDED BY ACT**

Nr	Sponsor	Study Title	Open to Partners	Budget (EUR)
1	ACT	High Altitude Pseudo Satellites (HAPS) for NATO Beyond Line of Sight (BLoS) Communications	IP	150,000 (tbc)
2	ACT	Hybrid Military and Commercial Satellite Communication (SATCOM) Operations	IP	150,000 (tbc)
3	ACT	Very Low Frequency (VLF) Communication Services NATO Standardization Agreement (STANAG) 4724 and 5030 Interoperability	IP	150,000 (tbc)
4	ACT	Cognitive Augmentation for Military Applications	Allies only	150,000 (tbc)
5	ACT	High Frequency Internet Protocol Based Communication Services NATO Standardization Agreement (STANAG) 5066 and 5070	IP	150,000 (tbc)

**DESCRIPTION OF PROPOSED NIAG STUDIES SPONSORED AND FUNDED BY ACT**

**Nr. 1 High Altitude Pseudo Satellites (HAPS) for NATO Beyond Line of Sight (BLoS) Communications**

**1. Title of Proposed Study:** High Altitude Pseudo Satellites (HAPS) for NATO Beyond Line of Sight (BLoS) Communications.

**2. Brief Description of Proposed Study:** Request industry perspectives on the potential opportunities presented by fixed wing and airship HAPS technologies for hosting NATO BLoS Communications both now and in <10 year timeframe. The assessment will inform NATO's efforts to conduct innovation, operational experimentation and potentially introduce HAPS technologies into the NATO communications-information infrastructure, including the development of CONEMP statements. The study should elaborate approaches where NATO, can influence HAPS research and development (R&D) within industry and partners to increase the likelihood of Commercial-off-the-Shelf (COTS) and Military-off-the-Shelf (MOTS) HAPS solutions being capable of being utilized for military opportunities in order to avoid lengthily and costly bespoke internal R&D. Finally the report should discuss opportunities where HAPS could support and/or align to NATO adoption of IoT and 5G networking.

**3. Background:** Satellite Communications (SATCOM) has been a key force enabler for decades enabling Beyond Line of Sight (BLoS) military communications in support of military outputs (e.g. Command and Control (C2), Intelligence Surveillance and Reconnaissance (ISR)) within and between military domains. As the need for low latency and high throughput information flows within information exchange requirements (IER) increases, the need to leverage high capacity BLoS solutions typically associated with Civilian Low Earth Orbit (LEO) constellations is being realised within the NATO SATCOM and NATO members' sovereign military programmes. NATO members have been investing in HAPS R&D for purpose of ISR yet thus far HAPS are not being leveraged to enable BLoS Communications in support of other military requirements. For example, HAPS systems can potentially be used to provide both fixed broadband connectivity for end users and transmission links between the mobile and core networks for backhauling traffic. Both types of HAPS applications would enable wireless broadband deployment in remote areas, including in mountainous, coastal and desert areas. In some situations, HAPS may be rapidly deployed for disaster recovery communications, particularly because the use of inter-HAPS links allows the provision of services with minimal ground network infrastructure.

**4. Objectives of the Study:**

- a. Identify gaps in NATO SATCOM capacity, coverage and spectrum diversity.

- b. Provide an estimation of the types of BLoS services enabled by HAPS that will be deployed by Industry in the next 10 years with the potential for military use within operations.
- c. Provide a detailed set of opportunities or use cases for Joint Functions elaborated within Allied Joint Publication (AJP)-3 Doctrine for the Conduct of Joint Operations focussing primarily with regards to information exchange via the Internet of Things (IoT)
- d. To provide a clear assessment of the operational challenges, with the ability of industry to address those challenges in the next 10 years. Emphasis should be made on the ability to overcome airspace, security, frequency sharing, complexity of operations, and cost of operations. The assessment should show potential gaps that require further science and technology development. The Allied Global Surveillance Programme Global Hawk capability might be referenced as a close comparable.
- e. Propose commercial contracting frameworks which could be used by NATO to procure/lease HAPS capabilities/services. Within this objective, provide an assessment of the positives and negatives of the fielding and management of NATO owned HAPS capability with or without contractor support.
- f. Provide an assessment of how NATO can influence HAPS R&D within industry and partners to include NATO led innovation and operational experimentation efforts to increase the likelihood of COTS and MOTS HAPS solutions being capable of being utilized for military opportunities to avoid lengthy and costly bespoke internal R&D.

**5. NATO Priority:** High

**6. Intended Follow on to the Study:** The output from this NIAG study would be to incorporate results into an innovation and operational experimentation strategy to inform a CONEMP and capability development plan for the introduction of HAPS into NATO common funded capability.

**7. Other NATO Bodies Involved in the Related Area of Work:** Questions related to this subject may be presented to the NATO HQ SACT CAP DEV CIS SATCOM Programme Director who may pose information requests to SMEs within the NCI Agency. There is no specific 2022 POW so any NCI Agency involvement is without commitment. The Allied Ground Surveillance Program has parallels with regards to unmanned nature of the system and BLoS provision and may be a suitable reference regarding acquisition and capability sustainment.

**8. Current Industrial Involvement with the Sponsor Group:** None thus far.

**9. Proposed Start Date:** Q1 2022 - Kick-off meeting Q1 2022 subject to funding.

10. **Desired Completion Date:** Dec 2022
11. **Study Classification:** NATO Unclassified
12. **Study Open to Partner industries:** Yes
13. **Final report releasable to:** NATO IP
14. **Sponsoring Group Point and IS Point of Contact:**

ACT: **Squadron Leader Thomas Gallagher** – NATO HQ SACT CAP Dev CIS SATOM Programme Director; [thomas.gallagher@act.nato.int](mailto:thomas.gallagher@act.nato.int), +1.757.747.3577.

<b>Nr. 2 Hybrid Military and Commercial Satellite Communication (SATCOM) Operations</b>
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1. **Title of Proposed Study:** Hybrid Military and Commercial Satellite Communication (SATCOM) Operations

2. **Brief Description of Proposed Study:** Request industry perspectives on the potential opportunities presented to enable Hybrid Military and Commercial SATCOM operations with existing and future technologies and associated CONEMPs to enable NATO Beyond Line-of-Sight (BLoS) Communications both now and within the next 10-year timeframe. The assessment will inform NATO's efforts to introduce Hybrid Military and Commercial SATCOM concepts and technologies into the NATO communications-information infrastructure, including Concept of Operations/Concept of Employment (CONOPS/CONEMP) and the development of a strategy for implementation. The study should also consider challenges associated with Hybrid Military and Commercial SATCOM employment to force realism of detailed opportunities. These challenges may point to gaps that need to be addressed through science and technology efforts. The opportunities would include the technical solutions to enable hybrid deployment of currently employed and programmed Military and Commercial SATCOM capabilities in support of a single Deployed Point of Presence (DPoP) and consider future Terminal Segment technologies that will be able to simultaneously access multiple Military and Commercial SATCOM constellations via a single Satellite Ground Terminal (SGT). The report should address multi-spectral and multi-latency consideration. The study should elaborate on approaches where NATO can influence SATCOM Research and Development (R&D) within industry to increase the likelihood of Commercial off-the-Shelf (COTS) solutions being capable of being utilized for military opportunities in order to avoid lengthy and costly bespoke internal R&D. Finally, the report should discuss opportunities where HAPS could support and/or align to NATO adoption of IoT and 5G networking.

3. **Background:** SATCOM has been a key force enabler for decades enabling BLoS military communications in support of military outputs (e.g. Command and Control (C2),

Intelligence Surveillance and Reconnaissance (ISR)) within and between military domains. NATO has employed both Military and Commercial SATCOM solutions independently to enable a variety of mission dependant information exchange requirements. As the need for low latency and high capacity information flows within Information Exchange Requirements (IER) increases, the need to leverage high capacity SATCOM solutions typically associated with Civilian Low Earth Orbit (LEO) constellations is being realised within the NATO SATCOM and NATO members' sovereign military programmes. It is considered that mission requirements may result in the need to leverage both high capacity, low latency Commercial SATCOM solutions alongside highly resilient Military SATCOM solutions to enable high capacity and assured BLoS Communications in support of other military requirements.

At a high-level, NATO's operational requirement for a hybrid SATCOM service/capability includes:

- a. Require access to a hybrid commercial and military SATCOM networks to increase available capacity while using dynamic routing services.
- b. Require the ability for roaming between military and commercial satellites (On-the-Move (OTM) for mobile teams, i.e., Operational Liaison Reconnaissance Team (OLRT) or mobile deployed HQs that move frequently (On-the-Pause (OTP)).
- c. If a military SATCOM link is being jammed, then ability to dynamically switch to a commercial link and vice-versa.
- d. Increased coverage area by having access to both services.
- e. Once an operation is established in theatre with its deployed HQs/Units, military SATCOM can eventually be replaced with commercial infrastructure and services where feasible e.g. as was done in ISAF/Afghanistan.

#### **4. Objectives of the Study:**

- a. To provide detail of the types of technologies available at a technical readiness level of 6<sup>7</sup> or higher to enable integration of Military and Commercial SATCOM solutions to enable a single Deployed Point-of-Presence (DPoP).
- b. To provide a foresight analysis of the types of SATCOM technology that will be deployed by Industry in the next 10 years that could enable simultaneous access to Military and Commercial SATCOM constellations across multiple bands via a single SGT with the potential for military use within operations. Identify the challenges in achieving such a capability. Emphasis should be made on the ability to overcome security, complexity of operations, and cost of operations. The assessment should show potential gaps that require further science and technology development.

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<sup>7</sup> <https://esto.nasa.gov/tr/>

c. Provide a detailed set of opportunities or use cases for Joint Functions elaborated within Allied Joint Publication (AJP)-3, Doctrine for the Conduct of Joint Operations focussing primarily with regards to SATCOM solutions to BLoS IERs.

d. Assessment of the various service commercial vehicles available with pro/con and O&M impacts.

e. Assessment of how NATO, can influence SATCOM R&D within industry and partners to increase the likelihood of COTS Hybrid Multi-band SGTs solutions being capable of being utilized for military opportunities to avoid lengthily and costly bespoke internal Research and Development (R&D)

5. **NATO Priority:** TBC

6. **Intended Follow on to the Study:** The output from this NIAG study would be to incorporate results into a strategy, capability development, implementation plan and CONOP/CONEMP for the introduction of Hybrid Military Commercial SGT solutions into NATO common funded capability.

7. **Other NATO Bodies Involved in the Related Area of Work:** Questions related to this study may be presented to the NATO HQ SACT CAP DEV CIS SATCOM Programme Director who may pose information requests to Subject Matter Experts (SMEs) within the NCI Agency. There is no specific 2022 Programme of Work (POW), so any NCI Agency involvement is without commitment. C2 COE may be approached for support/collabotation.

8. **Current Industrial Involvement with the Sponsor Group:** None thus far.

9. **Proposed Start Date:** Q1 2022 - Kick-off meeting Q1 2022 subject to funding.

10. **Desired Completion Date:** Dec 2022

11. **Study Classification:** NATO Unclassified

12. **Study Open to Partner industries:** Yes

13. **Final report releasable to:** NATO IP

14. **Sponsoring Group Point and IS Point of Contact:**

ACT: Squadron Leader Thomas Gallagher – NATO HQ SACT CAP Dev CIS SATOM Programme Director; [thomas.gallagher@act.nato.int](mailto:thomas.gallagher@act.nato.int), +1.757.747.3577.

**Nr. 3 Very Low Frequency (VLF) Communication Services NATO Standardization Agreement (STANAG) 4724 and 5030 Interoperability**

**1. Title of Proposed Study:** Very Low Frequency (VLF) Communication Services NATO Standardization Agreement (STANAG) 4724 and 5030 Interoperability

**2. Brief Description of Proposed Study:** The NATO VLF Broadcast system, a strategic component of Allied Maritime CIS to support Command and Control (C2) functions for naval operations, includes transmitters in national radio stations located in up to five (5) NATO member nations. This communications system supports NATO C2 capability for allied submarine operations and submarine operational safety when deployed or tasked under the NATO flag. Request industry perspectives on the technological and architectural requirements to achieve full interoperability between STANAG 4724 and STANAGs 5030 VLF Broadcast systems. The study should elaborate on a subsequent NATO Research and Development (R&D) process regarding STANAGs 4724/5030, depending on the possibilities and scope for future improvements.

**3. Background:** In 2017, the Strategic Commands submitted Capability Package (CP) 9A0101 WIRELESS ADDENDUM 1, related to the Very Low Frequency (VLF) Broadcast system to the NATO Headquarters for Council approval. The purpose of this addendum is to update and upgrade this communications system, specifies STANAG 4724 and STANAG 5030 as relevant NATO standards for the transmission of VLF data, which is consistent with the intent of the C3 Board substructure development in this area, even though they are currently not fully interoperable. Additionally, the improvements to transmission capability mainly in terms of speed and geographical coverage, it is essential to ensure backwards compatibility with STANAG 5030. Submarine communications are a strategic aspect of the Maritime CIS for C2 purposes for the member nations and for NATO itself. This study request is also based on the recommendation made by the Working Group of National Technical Experts (WGNTEx) in 2019 that ACT should diversify its resources of technical and industrial advice and not focus exclusively on a single regular provider.

**4. Objectives of the Study:**

- a. Provide ongoing efforts in industry and NATO member nations related to this matter.
- b. To provide technical requirements, cost, and operational impact of implementing STANAG 4724 within the NATO VLF Broadcast system.
- c. Evaluate the current STANAG 4724/5030 available modes and their compatibilities/incompatibilities to focus on identifying interoperability issues.
- d. Provide advantages and disadvantages of implementing both STANAGs 4724/5030.

e. Provide recommendations on the possible future capability to improve both STANAGs, considering technological development and industrial interests.

f. Provide any other technological or industrial aspect that could help meet the above-expressed aim.

g. To provide the industry's current and foreseeable future interest to develop new technologies for IP-based VLF communications services delivery.

5. **NATO Priority:** High

6. **Intended Follow on to the Study:** The output from this NIAG study would be in line with a NATO R&D process, which ACT should develop through the yearly POW, necessary to support technical improvements to the NATO VLF Broadcast system.

7. **Other NATO Bodies Involved in the Related Area of Work:** None thus far.

8. **Current Industrial Involvement with the Sponsor Group:** None thus far.

9. **Proposed Start Date:** Q1 2021 Kick-off meeting potential March 2022 subject to funding.

10. **Desired Completion Date:** June 2022

11. **Study Classification:** NATO unclassified (parts could be restricted due to STANAG 5030 classification).

12. **Study Open to Partner industries:** Yes

13. **Final report releasable to:** NATO IP

14. **Sponsoring Group Point and IS Point of Contact:** ACT: LCDR Garrett Adams NATO SACT CAP Dev CIS Wireless Programme Director; [garrett.adams@act.nato.int](mailto:garrett.adams@act.nato.int), +1.757.747.4329.

#### Nr. 4 Cognitive Augmentation for Military Applications

1. **Title of Proposed Study:** Cognitive Augmentation for Military Applications

2. **Brief Description of Proposed Study:** Request industry perspectives on the potential opportunities presented by the Cognitive Dimension for NATO Operations. The study will inform NATO's efforts to effectively acquire and preserve cognitive superiority over any adversary, in any part of the spectrum of conflict.

**3. Background:** In December 2020, the NATO Warfighting Capstone Concept (NWCC) was completed, later approved by the MC in early 2021 and finally by Heads of State and Government. The NWCC brings a strong focus on the Cognitive dimension, and introduces the term Cognitive Warfare among several other terms related to the Cognitive, including Cognitive Superiority, Cognitive Effects, Cognitive Resilience etc. The initial view of Cognitive Warfare is an holistic approach to the military aspects of the Cognitive dimension. I.e. all areas where cognitive processes (human or artificial) are employed or intentionally influenced to achieve or protect military objectives. As part of HQ SACTs ongoing work to increase the Alliance's shared understanding of the Cognitive Dimension, a NIAG study is requested to conduct multi-disciplinary research on the specific area of exploring possible uses of emerging science and technology to augment the cognitive capabilities of decision-makers. The intent is to improve understanding of how to enhance cognitive abilities in order to improve and protect the knowledge and decision-making of the future multi-domain war fighter.

The exponential growth in data and information available to military decision-makers is overwhelming. Multi-domain operations and synchronisation of activities between nations and across Instruments of Power introduce very high levels of complexity that needs to be managed in order to achieve Situational Understanding as a sound basis for making decisions. The Human Mind needs help to cope with the increasing speed and complexity of the operating environment.

At the same time, potential adversaries (state and non-state actors) are developing capabilities to deceive, disrupt and degrade those decision-making processes of Allies (directly or indirectly). They employ a wide spectrum of tools and techniques to achieve a cognitive advantage by affecting individuals, identified groups or the mass consciousness of whole societies. We must be able to detect such threats and counter their effects targeting the cognitive dimension.

**4. Objectives of the Study:**

Provide suggestions on how to augment NATO decision-maker's cognitive capabilities and ensure NATO's Cognitive Superiority.

(Advances in cognitive technologies (AI, ML, Big Data Analytics...) are helping organisations move beyond traditional risk management methods by using intelligent machines to detect, predict, and prevent risks and making decision. While cognitive technologies can replace some human tasks and decision-making, sustainable competitive advantage is likely to be achieved by augmenting and amplifying human cognitive capabilities through the combination of cognitive technologies and human cognitive performance enhancement technologies).

**5. NATO Priority:** High

**6. Intended Follow on to the Study:** The output from this NIAG study would be to incorporate results into future work on the Cognitive dimension.

It is intended to have follow-on studies for 2023, with the following objective:

Provide inputs on how to overcome human mind limitations and bias in order to protect and improve our decision-making.

(The interdisciplinary scientific study of psychology, computational science, linguistics, philosophy and neuroscience to understand the human mind has been defined as cognitive sciences. The growing collaboration between humans and machines requires to design a cognitive security model that integrates technological solutions with the cognitive processes of humans in order to prevent the decision-making from being hacked).

The objective above will be refined as the 2022 study advances.

**Other NATO Bodies Involved in the Related Area of Work:**

7. **Current Industrial Involvement with the Sponsor Group:** N/A.
8. **Proposed Start Date:** January 2022
9. **Desired Completion Date:** December 2022
10. **Study Classification:** NATO Unclassified
11. **Study Open to Partner industries:** No
12. **Final report releasable to:** NATO
13. **Sponsoring Group Point and IS Point of Contact:** ACT:
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<b>Nr. 5 High Frequency Internet Protocol Based Communication Services NATO Standardization Agreement (STANAG) 5066 and 5070</b>
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1. **Title of Proposed Study:** High Frequency Internet Protocol Based Communication Services NATO Standardization Agreement (STANAG) 5066 and 5070
2. **Brief Description of Proposed Study:** High Frequency (HF) communications Internet Protocol (IP) based service provision is minimal due to reduced bandwidth. Therefore, a vast majority of these IP-based communications service are only able to be provided via cable or satellite link that offer greater bandwidth/throughput. A technical solution is needed in the Alliance Maritime environment to facilitate the efficient provisions

of these IP-based communications services over HF links, both as an alternative to cable or satellite services and to alleviate the increase in bandwidth saturation.

**3. Background:** Satellite communications have begun to raise serious doubts about their reliability in case of conflict due to the fact they can now be engaged and destroyed in orbit. Their links can also be jammed and disrupted to the point of being unusable. The last aspect could mean a crucial strategic variation in the Maritime communications domain. Although still in its infancy, the new Wide-Band HF (WBHF) technology opens up an attractive future option for the provision of IP-based communications services. However, it needs further development. NATO Standardization Agreement (STANAG) 5066 Edition 3 is critical to NATO Maritime Broadcast and Ship-Shore Services (BRASS) Enhancement-1 Target Architecture (BRE1TA) and represents an essential component at the Strategic, Operational, and Tactical levels of the Alliance Maritime CIS for Command and Control (C2). In particular, it represents the interoperability of IP over HF. Future NATO STANAG 5066 Edition 4, currently under development, raises several interoperability concerns due to proposals for its updating and upgrading cover many aspects, including the enhancement to support WBHF. There are two proposed STANAGs for WBHF, contiguous and non-contiguous, which are not interoperable. STANAG 5070, currently under study, incorporates a significant number of features defined in STANAG 5066. It adapts them to non-contiguous WBHF, raising concerns on the future co-existence of two standards that can support some overlapping issues. This study request is also based on the recommendation made by the Working Group of National Technical Experts (WGNTe) in 2019 that ACT should diversify its resources of technical and industrial advice and not focus exclusively on a single regular provider.

**4. Objectives of the Study:**

- a. Provide ongoing efforts in industry and member nations related to this matter.
- b. To provide recommendations on the improvements in maritime HF communications that are provided through the NATO Beyond Line of Sight Access Points (BLOS AP) (BRASS) project.
- c. Evaluate the current STANAG 5066 Ed 3 and the different proposals for its updating and upgrading.
- d. Evaluate the current STANAG 5066/5070 available modes and their compatibilities/incompatibilities to focus on identifying interoperability issues.
- e. Evaluate the contiguous and non-contiguous WBHF current technology and its possible developments and improvements in the medium term (5-15 years).
- f. Provide recommendations on the possible future capability to improve both STANAGs, considering technological development and industrial interests.

g. Evaluate the present and future availability of the frequency bandwidth for WBHF at the governmental level in the International Telecommunication Union (ITU) and NATO member nations.

h. Provide an analysis of IP-based HF communications services under complete independence from the SATCOM domain.

i. Provide any other technological or industrial aspect that could help meet the above-expressed aim.

5. **NATO Priority:** High

6. **Intended Follow on to the Study:** The output from this NIAG study would be in line with a NATO R&D process, which ACT should develop through the yearly POW, necessary to support technical improvements to the NATO HF Broadcast system.

7. **Other NATO Bodies Involved in the Related Area of Work:** None thus far.

8. **Current Industrial Involvement with the Sponsor Group:** None thus far.

9. **Proposed Start Date:** Q1 2021 Kick-off meeting potential March 2022 subject to funding.

10. **Desired Completion Date:** June 2022

11. **Study Classification:** NATO unclassified (parts could be restricted due to unknown security classification of STANAG 5070)

12. **Study Open to Partner industries:** Yes

13. **Final report releasable to:** NATO IP

14. **Sponsoring Group Point and IS Point of Contact:** ACT: LCDR Garrett Adams  
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