NATO STANDARD

AJP-2.8

ALLIED JOINT DOCTRINE FOR MEASUREMENT AND SIGNATURE INTELLIGENCE

Edition A Version 1

SEPTEMBER 2018

NORTH ATLANTIC TREATY ORGANISATION

ALLIED JOINT PUBLICATION

Published by the
NATO STANDARDISATION OFFICE (NSO)

Intentionally blank

NORTH ATLANTIC TREATY ORGANISATION (NATO)

NATO STANDARDISATION AGENCY (NSA)

NATO LETTER OF PROMULGATION

5 September 2018

1. The enclosed Allied Joint Publication AJP-2.8, Edition A, Version 1, ALLIED JOINT DOCTRINE FOR MEASUREMENT AND SIGNATURE INTELLIGENCE, which has been approved by the nations in the Military Committee Joint Standardisation Board, is promulgated herewith. The agreement of nations to use this publication is recorded in STANAG 6521.

2. AJP-2.8, Edition A, Version 1, is effective upon receipt.

4. This publication shall be handled in accordance with C-M(2002)60.

Zoltán GULYÁS
Brigadier General, HUNAF
Director, NATO Standardization Office

Intentionally blank

RESERVED FOR NATIONAL LETTER OF PROMULGATION

Intentionally blank

RECORD OF RESERVATIONS

CHAPTER	RECORD OF RESERVATION BY NATIONS

Note: The reservations listed on this page include only those that were recorded at time of promulgation and may not be complete. Refer to the NATO Standardization Document Database for the complete list of existing reservations.

Intentionally blank

RECORD OF SPECIFIC RESERVATIONS

[nation]	[detail of reservation]
USA	A number of terms introduced in this AJP do not conform to approved NATO terminology. Ref NATO Terminology guidance found in C-M(2007)0023. The US recognizes only NATO approved terms. This reservation will be removed when the correct NATO terms are cited and proper procedures followed for introducing new terms.

Note: The reservations listed on this page include only those that were recorded at time of promulgation and may not be complete. Refer to the NATO Standardization Document Database for the complete list of existing reservations.

Intentionally blank

Table of Contents

Lexicon

Figures and Tables

Related Documents

1.	MCM-0077-2000	Military Committee Guidance on the Relationship between NATO Policy and Military Doctrine
2.	MC 0114	Procedures for Production of NATO Agreed Intelligence
3.	MC 0128	Policy Guidance for NATO Intelligence
4.	MC 0133	NATO' Operations Planning
5.	MC 0161	NATO Strategic Intelligence Estimate.
6.	MC 0166	NATO Intelligence Warning System
7.	MC 0327/2	NATO Military Policy for non-Article 5 Crisis Response Operations
8.	MC 0582/1	NATO Joint Intelligence, Surveillance and Reconnaissance (JISR) Concept
9.	MC 0600	NATO Policy on Knowledge Development
10.	MCxxxx [TBD]	NATO Policy on Measurement and Signature Intelligence (MASINT)
11.	Bi-MNC	Reporting Directive 80-3 Volume II – Intelligence Reports
12.	AJP-01	Allied Joint Doctrine
13.	AJP-2	Allied Joint Doctrine for Intelligence, Counter-Intelligence and Security
14.	AJP-2.1	Allied Joint Doctrine for Intelligence Procedures
15.	AJP-2.7	Allied Joint Doctrine for Joint Intelligence, Surveillance and Reconnaissance
16.	AJP-3	Allied Joint Doctrine for the Conduct of Operations
17.	AJP-3.9	Allied Joint Doctrine for Joint Targeting
18.	AJP-5	Allied Joint Doctrine for Operational-level Planning
19.	AAP-06	NATO Glossary of Terms and Definitions
20.	AAP-03	Directive for the Production, Maintenance and Management of NATO Standardization Documents
21.	AAP-47	Allied Joint Doctrine Development
22.	AAP-32	Publishing Standards for NATO Standardization Documents
23.	STANAG 2522	Specialist CBRN Defence Capabilities (ATP-3.8.1, Vol II)
24.	STANAG 4715	Biometrics Data, Interchange, Watchlisting and Reporting (AEDP-15)
25.	STANAG 4716	NATO MASINT Reporting and Associated Metadata (study draft) (AEDP-16)

Intentionally blank

Preface

1. The successful planning, execution and support of military operations requires a clearly understood and implemented doctrine. Doctrine provides the key principles and fundamentals needed to guide the employment of military forces ~~a~~and is especially important when operations are conducted by multinational forces in a coalition environment. The primary aim of *Allied Joint Doctrine for Measurement and Signature Intelligence* is to provide guidance for the planning, execution and support of joint operations in support of the Alliance in any operating theatre where measurement and signature intelligence (MASINT) capabilities are deployed. Although AJP-2.8 is intended primarily for use by North Atlantic Treaty Organisation (NATO) forces, the doctrine is instructive to, and provides a useful framework for, operations conducted by a coalition of NATO, partners, non-NATO nations, and other organisations.

2. MASINT is generally collected by advanced intelligence sensors that can characterize information still not processed by the other intelligence collection disciplines, such as signals intelligence (SIGINT) or imagery intelligence (IMINT). Whilst some nations choose to include some capabilities in the MASINT discipline, others exclude some of them in favour of different management of the activity outside the MASINT community. The scope of this document is to address MASINT activities, how to collect MASINT information, and how to process MASINT in addition of other collection activities or under other collection activities drivers. MASINT supports traditional intelligence collection disciplines. MASINT activities do not require specific organizations other than, as necessary, dedicated sensors and a MASINT desk at the operational level under CJ2 staff.

3. MASINT as a joint intelligence, surveillance, and reconnaissance (JISR) result is a single source intelligence comparable to the traditional intelligence collection discipline results (e.g. IMINT).

4. This document is to describe the NATO JISR processes to task, collect, process, exploit, and disseminate the MASINT information, and to direct, collect, process, and disseminate MASINT during NATO and NATO-managed operations. Similar types of sensors are used for both MASINT and other intelligence collection disciplines. This doctrine, therefore, should be used in conjunction with other NATO doctrines including, but not limited to, IMINT and SIGINT. In addition, sensors used for MASINT are also used for operations. Finally, while this document is intended to define MASINT as an intelligence discipline~~,~~ the biometrics sub-discipline under MASINT requires such breadth of organisation participation (e.g. military operations, military legal, civil legal, etc.) that the doctrine for biometrics is contained in a separate NATO publication.

5. This first edition reflects ongoing changes to MASINT activities within the Alliance. AJP-2.8 is intended for use primarily by commanders and staffs at the operational level, but can be used at any level as a reference. It describes the principles that

underpin the planning and conduct of Alliance MASINT activities providing commanders with a strategic context for such activities. This will assist commanders and their staffs in identifying the challenges at the operational level and provide strategies to conduct successful campaigns.

6. The purpose of this document is to detail NATO's principles, fundamentals, and policies, with an operational level focus, to foster common understanding and co-operative MASINT planning among NATO military authorities (NMA), nations and NATO agencies. This NATO MASINT doctrine provides the framework for the conduct of multinational operations and serves to assist NATO commanders in the achievement of their missions by providing them and subordinate organisations and formations with relevant and timely MASINT support.

7. To be useful to the commanders in support of deployed forces, AJP-2.8 has to be a living document and will be amended accordingly as this intelligence collection discipline within the NATO environment matures. The reader will find AJP-2.8 deliberately generic and abstract, focusing on the underlying philosophy and fundamentals of MASINT activities in support of joint operations at the tactical, operational, and strategic level. The tactics, techniques and procedures associated with MASINT are described in subordinate allied intelligence publications.

Chapter 1 – Introduction

Background

1.1 For NATO, measurement and signature intelligence (MASINT) is derived from the scientific and technical analysis of data obtained from sensing instruments for the purpose of identifying any distinctive features associated with the source, emitter or sender, to facilitate the latter's measurement and identification. MASINT is divided into eight sub-disciplines in NATO: biometrics, radio, geophysical, electro-optical, nuclear, materials, multi/hyper-spectral, and radar.

1.2 MASINT consists of all technologies used to remotely sense[1] the detailed characteristics of a system or scenario. In particular, these types of sensors are used to measure specific characteristics of the reflected, radiated, or emitted phenomena from a system and then used to infer system characteristics. These sensors are distinct from traditional imaging sensors in that they are designed to detect characteristics of the system or scenario of interest – not just its presence and/or operating status. They are differentiated from signals intelligence (SIGINT) sensors in the character of the radio frequency (RF) emission. Other sensor types are more distinct in their operation from other forms of intelligence collection. In all cases, the intent of the MASINT sensor is to determine the characteristics or signatures of the system under observation.

1.3 MASINT is derived from the scientific and technical analysis of data obtained from sensing instruments for the purpose of identifying any distinctive features associated with the source, emitter or sender, to facilitate the latter's measurement and identification. It is obtained by quantitative and qualitative analysis of data (e.g. metric, spatial, wavelength, time dependence, modulation, plasma and hydro magnetic) derived from specific technical sensors for the purpose of identifying specific features associated with the source, emitter or sender and to facilitate subsequent identification and/or measurement of the sender. MASINT is derived from the collection and comparison of a wide range of emissions with a database of known scientific and technical data in order to identify the equipment or source of the emissions. Whilst some nations choose to include some capabilities in the MASINT discipline, others exclude some of them in favour of different management of the activity outside the MASINT community.

1.4 MASINT can provide specific weapon system identifications, chemical compositions and material content and information on a potential adversary's ability to employ a specific weapon system.

[1] Remote sensing must not be confused with remote viewing. The latter is the practice of seeking impressions about a distant or unseen target using subjective means, in particular, extrasensory perception. MASINT uses objective means (e.g. sensing instruments) only.

1.5 At the operational level, MASINT will help in the timely delivery of intelligence support to improve situational awareness and further enhance the joint intelligence preparation of the operational environment (JIPOE). MASINT provides actionable intelligence to the intelligence support of operational targeting processes. At the tactical level, units with a MASINT detection capability will be battle enablers, allowing the unit to manoeuvre out of contact, launching operations at the optimal point and time. With sensor suites in place as provided by the nations and either under national or Alliance control, the commanders are provided with early indicators and warnings (I&W), and advanced tactical picture recognition. Commanders and staffs will see the results of this MASINT system in a fully processed format on the systems displays and can be made available, as well as relevant products of national and theatre MASINT systems, to the units at the lowest echelon as possible.

Chapter 2 – MASINT Sub-Disciplines

2.1 MASINT sensors were designed and used to detect specific phenomenology. Seismic and particulate sampling sensors were used to detect and characterize nuclear detonations for most of the Cold War. Similarly, advanced signal intelligence sensors were developed that could characterize radio frequency emissions, providing insight into the operating performance of the emitter.

2.2 As the number of MASINT sensors increased over time and with improved technologies to detect systems' operational characteristics, the intelligence community elected to establish MASINT as an intelligence collection discipline.

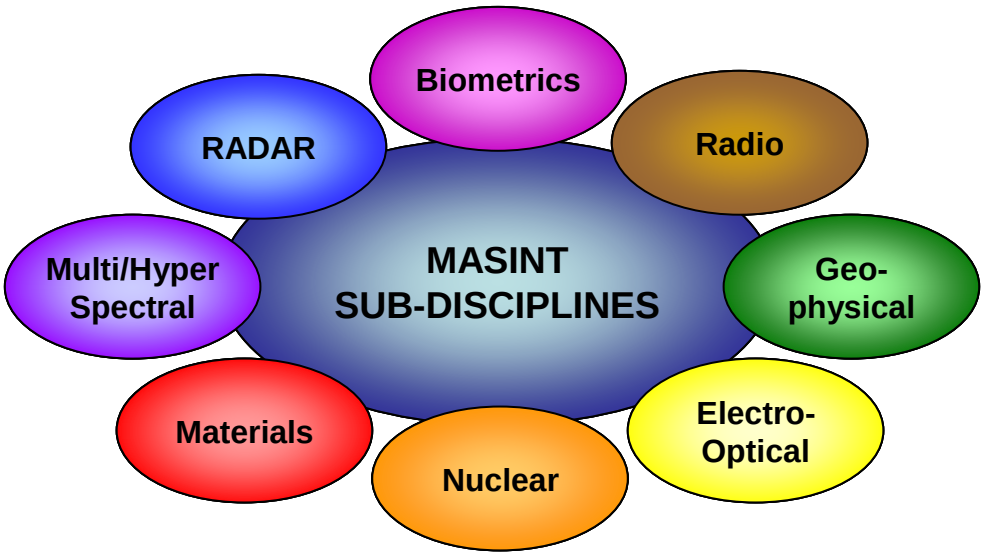

Figure 1; MASINT Sub-Disciplines

2.3 MASINT comprises eight sub-disciplines as illustrated in Figure 1. There are MASINT sensors for each of these sub-disciplines. While NATO defines the sub-disciplines using these eight definitions, many nations use different subsets of these sub-disciplines. Whilst some nations choose to include some capabilities in the MASINT discipline, others exclude some of them in favour of different management of the activity outside the MASINT community. This "super-set" of sub-disciplines incorporates all of the activities of all nations defined as MASINT, allowing each nation to define their own subset definition of MASINT from within this group.

2.4 Examples of the types of capabilities inside each sub-discipline are listed in Table 1.

Table 1: Examples of MASINT Sub-Disciplines

Biometrics	*Radio*	*Geophysical*	*Electro-optical*	*Nuclear*	*Materials*	*Multi/Hyper Spectral*	*Radar*
Identification of Facial features, scars, tattoos Voice Iris Fingerprint DNA	Radio Waves Electro-magnetic Pulse (EMP) Detection Unintentional RF (URF)	Seismic/ Acoustic/ Vibrometric Sensing Very Low Freq (VLF) Extremely Low Freq (ELF)	Non-Imaging Infrared (IR) Visible Light Non-Imaging Ultra-Violet (UV) LASER	X-Rays Gamma Ray Detection Neutron Detection Cosmic Ray Detection	Chemical/ Biological Sensing - Liquid - Solid - Aerosol - Gas	High Spectral Resolution Across Multiple Narrow Bands - IR - Visible - UV	Microwave Over-the-Horizon Radar (OTHR) Synthetic Aperture Radar (SAR) Polarimetric

2.5 **Biometrics.** Biometrics is the automated recognition of individuals based on their behavioural and biological characteristics. Biometrics addresses the detection and analysis of the signatures associated with a human being. These signatures are used to positively identify an individual from a population. Biometrics is used for identification or verification in support of a variety of operations or activities. An example of using biometrics for verification is the use of fingerprint or iris biometrics to verify an individual's access to a military installation. An example of using biometrics for identification is searching a latent fingerprint against a biometric database to identify an individual associated with an item or event. While fingerprints are the most common human trait used for signature analysis, many other attributes of the human body are unique by individual. NATO Standardisation Agreement (STANAG) 4715 defines the biometrics data types and how to exchange the signature information for biometric data base enrolment, search, and watch list reporting. Within this standard are definitions for appearance characteristics (e.g. face image, scars, tattoos), voice patterns, iris scans, fingerprints, and deoxyribonucleic acid (DNA). Other attributes, such as retinal scans, may be added to the standard at a later time.

2.6 **Radio.** Unlike the analysis of intentional radar and radio communications signals of the SIGINT community, RF technical analysis involves measuring electromagnetic radiation across frequencies spanning from nearly zero, up to but not including infrared. RF MASINT targets are usually unintentional by-products of an event (e.g. nuclear explosion electromagnetic pulse (EMP)) or unintentional radiation from sources such as engines, power sources, weapon systems, and electronics. Intentional use of RF pulses as a weapon (but not a signal) or nuclear EMP simulation also falls under RF MASINT. In some nations, legal restrictions may be applied to the collection of some unintentional RF signals, and commanders should request an assessment from legal experts to ensure compliance with all associated laws.

2.7 **Geophysical**. This class of sensors focuses on various physical field changes including acoustic, seismic, magnetic, gravity, and electric field collections. Acoustic involves the collection of passive or active emitted or reflected vibrations in the atmosphere (air-acoustic, infrasonic) or in the water (hydroacoustic). Seismic is the passive collection of vibrations in the earth. Magnetic and gravity include detection of perturbations to the earth's magnetic/gravity fields. Geophysics also involves electric and magnetic field measurements.

2.8 **Electro-Optical.** Electro-optical MASINT sensors provide detailed information on the time-changing radiant intensities, dynamic motion, spectral characteristics, and the material composition of a target. Data may be collected by a variety of optically sensitive devices, such as radiometers, spectrometers, non-imaging systems, lasers, and fibre optics.

2.9 **Nuclear.** These sensors focus on detection, identification, and characterisation of nuclear sources and events. Space-based nuclear radiation MASINT sensors monitor X-rays, gamma rays, and neutrons. Ground-based nuclear radiation sensors allow monitoring of the movement of nuclear materials by tracking the radiation emitted by the nuclear material.

2.10 **Materials.** Material sampling systems involve analysis of chemical, biological, radiological, explosive, and other materials. Materials data may be acquired by air, ship-borne, or ground-based sensors, as well as by human-enabled physical collection.

2.11 **Multispectral/Hyperspectral.** Multispectral and hyperspectral imaging sensors are typically imaging sensors that split the detected spectrum into many small bands. The usual distinction between multispectral and hyperspectral is that the multispectral sensors have between 4 and 99 bands, while hyperspectral sensors have between 100 and 999 bands. (Another term, ultraspectral, has been coined to define sensors with 1000 bands or more, but no practical sensor has yet been developed with that capability. Note also that normal three-band images are considered "colour" sensors since the bands are normally chosen to provide an image with colour representation similar to natural colour or pseudocoloured camouflage detection films.) Through the utilization of spectral information analysts are able to conduct more detailed analysis of the objects. MASINT applies special techniques to the analysis to make detailed measurements of the objects in the image, not simply detect or provide top level identification as in the imagery intelligence community. In some cases, the material composition of the object can be identified. The detection of camouflage, concealment, or deception techniques is enhanced. Spectral information is also used for crop analysis, both in terms of crop yield prediction and in detection of illicit crop cultivation. This type of foliage analysis can also be used for trafficability analyses by determining the type and

extent of ground cover and the effects the foliage would have on wheeled or tracked vehicles.

2.12 **Radar.** The radar sub-discipline involves active or passive collection of electromagnetic energy reflected from a target by line-of-sight, bistatic, or over-the-horizon radar systems. In MASINT, radar data collection provides information on radar cross sections, tracking, precise measurements of components, size, shape, motion, radar reflectance, and absorption characteristics for targets or objects.

Chapter 3 – MASINT Organisations and Responsibilities

3.1 There are several organisations within NATO that are required to manage MASINT activities in support to operations. The challenge for MASINT is that all sensors, assets, and capabilities in this intelligence collection discipline are under national control. NATO's role is in establishing the tasking requests, sharing and protection guidelines to facilitate the transfer of MASINT information in a timely fashion using appropriate data dissemination technologies.

3.2 **NATO Military Authorities (NMAs).** The NMAs are the lead agents for establishing and using the doctrine in NATO operations. Allied Command Transformation (ACT) is the lead for managing the doctrine and ensuring that the training and human resourcing elements of the MASINT process are properly executed. The Allied Command Operations (ACO) is the lead for implementing the doctrine in all NATO and NATO-led coalition operations.

3.3 **Biometrics Community.** The agreement of nations will provide guidance to commanders and their staffs for the use of biometrics and forensics in NATO operations which are to be recorded in STANAG 6515, Allied Intelligence Publication (AIntP) -15. Biometrics poses a special set of circumstances requiring dedicated standards, policy, and doctrine. This is due to the scope of applicability for biometrics beyond MASINT, including human intelligence (HUMINT), law enforcement, force protection, legal, and other applications.

3.4 **Working Groups.** Several organisations play key roles to ensure that MASINT doctrine and procedures are standardized and implemented within NATO. The MASINT Working Group (MWG) is responsible for developing the essential standards for use with MASINT information. In addition, the MWG is also responsible for providing the subject matter experts for development of the policy, doctrine, and tactics, techniques and procedures (TTPs) for MASINT in NATO. The MWG should also work through the respective national representatives to ensure that national doctrine is compatible with this publication.

a. There are other working groups in the Conference of National Armaments Directors (CNAD) structure that have a shared interest in the activities of the MASINT community. As noted previously, the IMINT and SIGINT communities both share the basic sensor types used by the MASINT community. As such, the doctrine for use of common sensor technologies must be coordinated. The NATO Advisory Committee on Signals Intelligence (NACSI) is the appropriate body for coordination on SIGINT doctrine. The chairperson of the Joint Intelligence Standardization Panel (JISP) under the Joint Intelligence Working Group (JINTWG) has responsibility to provide this coordination. Specifically, MASINT has features

in common with technical exploitation for information from materiel and captured persons.

b. The proper use of MASINT also requires that the technical standards be coordinated as well. The imagery working group (IMWG) and signals intelligence electronic warfare working group (SEWWG) have the respective responsibilities for the development of technical standards. Similarly, many of the techniques associated with biometrics are of concern to the HUMINT community. The CNAD's human intelligence technology working group (HTWG) is the organisation tasked to develop the technical standards for the HUMINT community in conjunction with the NATO human intelligence working group (NHWG) which is tasked to manage the operational aspects of HUMINT planning. Because of the close linkage of some aspects of MASINT with the HUMINT community, particularly in the use of biometrics, close coordination is required between the MASINT and HUMINT communities.

c. Finally, the Joint Capability Group for ISR (JCGISR) and its technical subgroup, the All Source Intelligence Integration Sub Group (ASIISG) are tasked to oversee the development of all intelligence collection disciplines. This tasking is executed in conjunction with the Joint Intelligence, Surveillance, and Reconnaissance Capability Area Manager (JISR CAM), who is mandated to coordinate all aspects of JISR capability development and implementation for NATO.

3.5 **Communities of Interest**. Many nations have established communities of interest supporting MASINT activities in their respective nations. These communities of interest provide the basis for providing the subject matter expertise needed in NATO for coalition or Alliance operations.

Chapter 4 – MASINT Collections

Section 1 – MASINT in the NATO environment

4.1 MASINT systems can provide the effector with unique information on objects or targets that are not otherwise available from other intelligence collection sources. All objects inherently possess or produce observable, detectable, and measurable characteristics such as material composition, heat, sound, vibration, radiation, and radar reflective strength. These characteristics can be exploited to identify information about the target. Ground acoustic systems can locate adversary fire; unattended acoustic, magnetic, and seismic ground sensors can identify adversary vehicle movements. RF ground sensors can detect vehicle types; biological and chemical sensors can detect the presence of biological and chemical substances which could be misused as biological and chemical weapons; and radar can provide information concerning missile launches and their trajectories. In post-conflict situations, MASINT can reduce the risks and effects of the remnants of war by providing signature information relating to the residues of war.

4.2 This document addresses MASINT activities – how to collect MASINT information and how to process MASINT intelligence in addition to other collection activities and drivers. MASINT follows traditional intelligence collection processes. MASINT activities requires dedicated sensors and a MASINT desk consisting of a MASINT officer and MASINT analysts at the operational level under the combined joint intelligence staff (CJ2).

4.3 MASINT has been used in support of NATO operations in recent years but generally in an uncoordinated manner. It has not always been available across the entire operating environment. The provision of a coordinated approach to the delivery of MASINT can only be achieved and sustained through the development and use of robust MASINT policy, doctrine, and TTPs. This, in turn, will ensure the use of MASINT results in support of NATO operations.

4.4 MASINT results provide information and data to a variety of customers to support a broad spectrum of operations providing commanders with the knowledge and situational awareness to make informed judgments and decisions. MASINT also supports and stimulates technological development of NATO processes and systems.

4.5 MASINT is generally formed by advanced intelligence sensors to provide the measurement and signature characteristics of a target of interest. The precise threat characteristics and performance information that is derived from MASINT sensors and systems provides the capability to enhance the global intelligence picture given to policy makers, warfighters, and all source intelligence

analysts. MASINT can enhance the knowledge of the planning, development, and application of adversary's weapon systems. This can improve NATO's countermeasures, tactics, targeting, and assist in battle damage assessments. Policy makers depend upon precise information to assess the impacts of the proliferation of weapon of mass destruction (WMD) technologies providing them with a high degree of confidence when monitoring treaties and arms control agreements, protecting the territory addressed in Article 6 (1) of the North Atlantic Treaty, and thwarting acts of terrorism. Other applications of MASINT-related technologies and techniques can, for example, include the timely monitoring of forest fires and volcanic eruptions, tracking volcanic ash clouds, detecting pollution sources, monitoring disaster relief progress and providing data on natural and human made phenomena to contribute to humanitarian assistance and support environmental studies.

Section 2 – MASINT Use in Theatres

4.6 The counter-terrorism community finds utility in what MASINT programs can provide to their specific missions. For example, materials identification programs can detect suspect materials, including biological and chemical substances, and most explosives. Nuclear radiation detection capabilities are used to identify nuclear WMD and transport. In any specific chemical, biological, radiological, and nuclear (CBRN) related MASINT case, specialist CBRN defence capabilities[2] must be involved. MASINT can support counter-terrorism efforts with valuable information necessary for pre-empting, disrupting, and defeating terrorist attacks against NATO nations. This includes monitoring capabilities of terrorists and their efforts to obtain weapons, dangerous materials, technologies, and expertise. MASINT can also support civil and military officials as they respond to terrorist activities by providing information concerning sources of contamination, scale of disaster, and hazards associated with mitigation and clean-up efforts.

a. **Operational.** To meet the operational level priorities and requirements, the tasking of MASINT capabilities and sensors still requires integrating various inputs. The MASINT desk analyst in the CJ2 is tasked to provide inputs to the operations planning process and assist in managing the operating environment. Specific request for information can be provided or more general tasking can be assigned on a continuing basis. These requests for information (RFIs) are handled in the same manner as with other intelligence collection disciplines.

b. **Strategic.** At the strategic level, MASINT provides capability to enhance the global intelligence picture given to decision makers to plan the operational objectives and strategy. In some cases different sensors are required than

[2] See STANAG 2522 Specialist CBRN Defence Capabilities (ATP 3.8.1, Vol II, Ed A)

those used at the tactical level, but the requirement for integration still exists. In fact, many of the questions posed by policy makers will require the integration of multiple results to properly answer. For strategic analysis, the MASINT integration can be performed with a CJ2 MASINT desk dedicated to support the strategic planners. This can be accomplished by dedicating a NATO billet in the planning staff for a MASINT subject matter expert, or by temporary assignment of a national subject matter expert for the purpose of providing specific support to strategic planning.

c. **Tactical.** The key for use of MASINT at the tactical level is to ensure that the information collected is passed back to the MASINT desk in the J2. The information should be passed as quickly as possible to ensure it can be disseminated appropriately. For many sensors, this can be an automated process. The MASINT desk is directed by the MASINT desk officer and supported by analysts supplied by the nations to coordinate and analyse MASINT information. The MASINT desk analyst correlates the information with other intelligence and produce both specific event reports and intelligence summaries in accordance with STANAG 4716. The analysts at the MASINT desk should also have the capability to submit urgent notices to the commander through inputs to the common operational picture (COP), other command display, or command chat function, etc. If the sensor is not configured to provide real time alerts to the tactical forces, the MASINT analyst should have the capability to provide the alerts directly.

d. **Tasking.** Because of the broad use of MASINT sensors, operational command over the collections is held at various levels. While the sensors are all owned by the nations, tasking would flow from the Alliance command to the nations for execution. For intelligence collections, the theatre command level (Joint Staff – Intelligence (J2)) would manage the tasking requests. When the sensors are being used primarily for force protection, the tasking can be allocated to lower levels of command. The application of MASINT results at the tactical level is very important. In many cases, MASINT sensors are also used to provide results that are relevant to other levels than the tactical one. For example, a chemical or biological sensor may be used for detection of contaminants and immediate warning of local forces. However, the area of distribution and contaminants involved are of intelligence value and can be used for operations planning and execution, as well as identifying the possible individuals involved in their release. While the initial warnings are important, and often considered more an operations (Joint Staff – Operations (J3)) issue, the specific analysis of the materials dispersed is an important element of intelligence that supports operations planning and execution.

4.7 Similarly, sensors mounted on an unmanned system[3] may be emplaced to provide tactical warning of approaching hostiles, such as for base/force protection. However, in these instances the images and other detected information are of great value to the intelligence community. In other cases, these sensors may be emplaced primarily for intelligence purposes. For example, an unattended ground sensor (UGS) may be emplaced along a line of communication such as a trail to monitor the traffic on the trail. In those cases, the sensors are directly tasked to provide information of intelligence value.

4.8 Another example of multi-use sensors is the field collection of biometrics. Field collection devices may be used for base access and force protection supporting daily operations. They can also be used to support field human intelligence teams (FHTs) as they validate sources. They can be used by maritime forces during boardings of vessels to identify crew members. The equipment can also be used to support refugee centres or border crossings to identify insurgents. While some of the applications are more operational, in all cases, the information has intelligence value.

4.9 While some of the sensors and systems may be functionally assigned to lower echelons (such as the land component commander (LCC) or maritime component commander (MCC)), it is important to establish a MASINT desk as part of the joint force commander's combined joint intelligence staff (CJ2) of the intelligence branch in a combined joint headquarters, since the sources of information that could be from a wide variety of sensors, assigned to various commands and echelons of command. Elements in the air component, land component, maritime component, and special operations forces plus those assigned to the joint command level and nations can all be integrated by the MASINT desk resulting in a single, integrated input for the commander.

Section 3 – Tasking Methods

4.10 Tasking for the MASINT sensors is accomplished at the joint task force (JTF) level, but can be allocated to lower levels when appropriate. While some sensor systems may be retained within national command channels, requiring coordination between the CJ2 and national authorities to ensure that Alliance requirements are met, most MASINT sensor systems are expected to be assigned to Alliance command. Within the CJ2, the collection manager is responsible for overseeing all MASINT sensor tasking. In some cases, the collection manager may delegate tasking authority to component command collection managers when the sensor is dedicated to support a component command requirement. In general, most tasking is incorporated into the JTF intelligence collection plan (ICP).

[3] Air, land, or maritime

4.11 The tasking of MASINT sensors is as varied as the sensors themselves. In some cases, the sensors can be tasked as an available resource, just as an airborne imagery sensor. Tasking should be generated through the normal request for information (RFI) and intelligence requirement management and collection management (IRM&CM) process. The sensors that would be included are those that can be readily deployed to cover areas of interest. Examples would be an airborne infrared search and track (IRST) system or in some cases, the deployment of unattended ground sensors.

4.12 Other sensors require a longer time to deploy or are more fixed in nature. These sensors would be included in the overall collection plan at the theatre level. Tasking for the sensors would specify the intended coverage area and target set for each sensor. The sensors would then continue to operate against that tasking until retasked.

4.13 It is important for tasking authorities to understand that in some cases, the tasking, routed through normal tasking channels, reflects a capability rather than a specific type of sensor. For example, an unattended ground sensor (UGS) team will be tasked to cover a specific region of interest. The tasking does not specify a specific UGS system, but rather the capability represented by the team and the available equipment. This also holds for teams deploying to collect chemical-biological or biometric/forensic information in the field. The capability is tasked and the field team determines the specific equipment needed to best meet the collection requirement.

4.14 In some cases, it may be appropriate for the tasking authorities to issue standing orders for continuing collection. The commander and collection managers decide when standing orders for tasking are appropriate.

4.15 As MASINT sensors are so varied, it is very important that the collection managers have current, accurate information in the collection manager's handbook as produced for each operation which defines available sensors, their technical capabilities, and the proper information needed to task them. Without this tasking insight, the sensors will be inappropriately tasked, misused, or not used at all.

Section 4 – Collection Methods

4.16 Following the tasking received through normal tasking channels, the collection methods are similarly varied based on the type of sensor. Ground based sensors are emplaced by either persons or airborne delivery. They collect information based on the detected phenomenology and the signature parameters selected for the specific situation or commander's requirements. The sensors relay the detections and associated information by radio, satellite link or hard wire, depending on the situation.

4.17 Other sensors, such as acoustic sensors, can cover the same area continuously and provide alerts when they detect signals that match specified signatures. The theatre tasking defines the area to be observed and the sensors are emplaced in order to observe that area. The sensors detect the phenomenology tasked and report the information through radio or hard wired connections. In some cases the information may be returned through network web-based protocols.

4.18 Airborne sensors, such as infrared search and track (IRST) or radars, observe specific regions and report when items are detected, as tasked in the daily tasking order. Each sensor has a specific collection methodology and the proper collection tasking will identify the parameters of the collection in accordance with the collection manager's handbook. Information from the sensors is returned to the MASINT desk analyst.

Section 5 – Processing Methods

4.19 The information and data collected by a given sensor is processed in accordance with its system design. Many sensor systems are designed with specific signatures with an automated processing function, while others require a higher degree of information and data collection processing to make the detected phenomenology meaningful. In each case, the sensor data is converted to a meaningful form for analysis by a single source analyst at the MASINT desk, which can then be incorporated with the results of other MASINT sensors or results derived from other intelligence collection disciplines.

Section 6 - MASINT Exploitation

4.20 Once the data is processed, it is presented to a MASINT exploiter to make decisions on the significance of the detections and disseminate alerts and produce MASINT results based on the observed phenomenology. The exploiter must make judgements on the significance of the information in relationship to the commander’s requirements. Different inputs can require different exploitation. For example, a detection of an inbound missile requires immediate reporting through the most expeditious channels to the commander. On the other hand, a detection of a low level seismic signal may not require any response or reporting at all. The MASINT exploiter will make the judgements based on experience and the specific tasking given to that sensor.

4.21 The reporting of MASINT-derived results will conform to STANAG 4716 reporting requirements for: routine reporting of MASINT information from specific sensors; intelligence summaries for reporting analyses of information gathered over a period of time or from multiple sensors; and immediate inputs in machine to machine form for urgent information.

Section 7 – Dissemination Protocols

4.22 The dissemination of MASINT results will be by the same methods as other intelligence collection disciplines. Urgent alerts are provided with immediate updates to the commander. MASINT results are also sent to the requesters identified in the tasking as well as deposited into data bases used by all source analysts for all-source intelligence dissemination. Images are uploaded to an appropriate coalition shared data (CSD) server for access by all intelligence analysts.

4.23 Connectivity for the MASINT Desk is through the network connections. Generally, the MASINT Desk will be connected on the operational SECRET network. Since many of the sensors collect the data at the unclassified level, it is important to have a network bridge between the unclassified and SECRET networks with sufficient bandwidth to allow the information to pass without delays. The MASINT Desk can then post information to the various data bases and the common operational picture directly through the network.

4.24 Protocols to be used include STANAG 4715 and 4716 reports, keyhole markup language (KML) feeds, and STANAG 4545 format. The reporting formats (4715 and 4716) provide for the information to be transferred in both message text and extensible markup language (XML) versions. The KML feeds are used to provide the MASINT information to the COP. STANAG 4545 is used for images posted to the CSDs. Information disseminated via the network will include the standard Internet protocols for Ethernet communication.

Intentionally blank

Chapter 5 – MASINT Standards

5.1 The purpose of developing standards is to provide interoperability between the systems of different nations or services to support the operations defined by this doctrine. Interoperability is the ability to act together coherently, effectively, and efficiently to achieve NATO objectives.

From standardisation, NATO derives interoperability. From interoperability, NATO realizes operational effectiveness.

5.2 Standards provide common formats for MASINT use in NATO. Many nations have standards already in place, but these are often narrowly focused and only address one or a few sensors. The MASINT standards are under development to address the much broader range of sensors. Two specific MASINT standards have been developed. The first, STANAG 4715, covers the exchange of biometric-related information. The second, STANAG 4716, covers all of the other sub-disciplines of MASINT.

5.3 STANAG 4715 covers the information required for the exchange of Biometric information. It includes sections for the enrolment of individuals, the comparison of field collected biometrics against existing data bases, and the generation of biometric-enabled watch lists. The standard was developed in conjunction with international standards for biometric exchange to enable NATO cooperation with international and national law enforcement and military biometric operations. The standard includes the agreement for use, and Allied Engineering Documentation Publication (AEDP) -15 includes the technical details of the standard, including Annexes for the separately-published Integrated Data Dictionary (Annex A) and the standard configuration management plan (Annex B).

5.4 STANAG 4716 addresses the other forms of MASINT information. The standard includes a core set of metadata that will be reported on all MASINT sources, followed by annexes to address the specific types of information to be reported for each type of sensor. While the initial drafts of the standard address only a subset of the sensor types, continual updates and careful configuration management will provide an ever-expanded set of standards to support the variety of MASINT sensors as they are developed.

5.5 A key element of the standards process is the definition of the metadata that will be processed with the source data. In some cases, the metadata may be all that will be provided in the MASINT results. For example, an acoustic detection of an explosion does not have to include the actual acoustic signal to report the explosion. In STANAG 4716, the selection of the metadata elements for the common reporting

core data will allow for rapid categorization of all MASINT reports. The additional information in the Annexes of the reports provides the details of the phenomena.

Chapter 6 – Legal and Policy Considerations

6.1 There are substantial considerations in the use of MASINT information. These include legal, privacy, and security concerns that relate back to both national and international laws. Sources of MASINT information are typically very sensitive with the reporting limited to key elements of information and data to ensure the widest possible dissemination. It will be important to ensure that the commander has all the information necessary to make operational decisions, while not jeopardizing the potential sources or methods. The originator of the MASINT results will need to know the guidelines for release of the information.

6.2 In most cases, the limitations are legal restrictions on the collection and exchange of MASINT information. MASINT data has to be collected in accordance with national and international law, and often the sharing of this data may be severely restricted. Commanders and analysts will require coordination with legal experts on potential restrictions to release. Many nations restrict the collection of certain information by military personnel, and others constrain the distribution of it. Within the biometrics sub-discipline, dedicated policy and doctrine for NATO operations provides the details regarding these legal constraints.

Section 1 – MASINT Data Sharing and Releasability

6.3 The sharing of MASINT results for intelligence purposes is based on the principle of a "need to know" balanced with a "responsibility to share." This demands active skilled management supported by technical capabilities. Past NATO operations have repeatedly demonstrated the need to share intelligence information between coalition partners. Failure to share has resulted in the loss of human life and military resources. As a result, nations have agreed to emphasize the responsibility to share intelligence. In the case of sensitive MASINT collection systems, reporting includes "tear line reporting" with all the materials above the line being of greater sensitivity and only releasable to a limited national audience.[4] The material below the tear-line is disseminated to a coalition. Different classifications are applied to the two parts of the report. When placed on coalition networks, the materials above the line are removed. This allows an urgent report to be disseminated to all coalition members, providing the critical information without divulging sensitive collection parameters. The specific mapping of data elements of the reporting will be defined

[4] Data sharing arrangements must be developed in relation to strategic and operational requirements. Certain standing data sharing arrangements will be required to serve the long-term strategic and peacetime needs of NATO. Other contingent data sharing arrangements will be required contingent on operational and mission needs. NATO must encourage the nations to develop and establish data sharing arrangements in accordance with their own national legal requirements and must develop capabilities and processes that support these needs. As national policies develop and legal understanding is broadened, it is NATO's initiative to assist the nations to come to a common understanding of data sharing in support of operations and to develop a NATO standard for data sharing. This will move the Alliance from the complexity of multiple bi-lateral arrangements toward a single multi-lateral arrangement, which will be more stable and manageable.

by each nation for each sensor system provided to Alliance operations. For completing STANAG 4716 reports, it is expected that each nation will map the actual data elements of the sensor to the data elements in the report to allow for rapid generation and dissemination of the reports.

Section 2 – Classification

6.4 Classification determinations of MASINT results, like all national JISR results, are the responsibility of the producing nation. Once the respective nation provides a MASINT result with an identified classification, no other nation or NATO command can change the classification. Requests for lower classification levels are to be forwarded back to the source nation for a determination. Nations are encouraged to mark the classification at the lowest possible level consistent with proper protection of the source information. Using "tear-line" multiple classification level reporting can assist the source nations to release critical elements of the report, while protecting the elements considered sensitive.

Section 3 – Joint Agreements

6.5 In cases where two or more nations use or share MASINT information, it may be appropriate for nations to establish joint agreements for specific operations that reflect the common legal understanding. These agreements establish the terms under which MASINT data, information, and results will be distributed to coalition partners, and the rules for protecting the information by the partners. The agreement would also define the ultimate disposition of the information, e.g. whether the material can be retained or must be destroyed following the operation.

Section 4 – Memorandums of Understanding

6.6 In cases where the sharing of MASINT results between nations are to be of a longer term basis, a memorandum of understanding (MOU) or memorandum of agreement (MOA) can be signed to define the long term use of MASINT information. Agreements of this type cover the need for sharing on a wide range of issues as perceived by the nations involved.

Chapter 7 – Training and Exercises

7.1 Given the technical aspects of the MASINT discipline, necessary education and individual training (E&IT) is a critical factor and should be undertaken at the earliest stages possible. Nations contributing to the NATO MASINT capability are responsible for the education and training of their personnel and forces allocated to the Alliance. NATO is responsible for establishing standards. For the necessary MASINT E&IT to be effective, efficient, and affordable, it will be developed in accordance with NATO education, training, exercises, and evaluation (ETEE) Policy (Military Committee (MC) 458/ 3), through Global Programming and by the utilization of NATO Education and Training Facilities (NETFs) and (Multi-) National Training Institutions (NTIs). Broader MASINT awareness training will be made available at the NATO School Oberammergau, or coordinated through the use of a mobile training team (MTT). Nations contributing to the NATO MASINT capability will ensure that all participants in a particular effort have received the necessary E&IT before deployment is considered. It is important that MASINT E&IT should include three tiers or groups of personnel.

7.2 The first tier of E&IT is for commanders and their staffs to learn the capabilities of MASINT assets at the highest level and understand how MASINT systems and sensors can contribute to the mission. This is important in order to properly direct the tasking of the systems and sensors and how to integrate MASINT results into the overall intelligence picture.

7.3 The second tier of E&IT is for staff elements supporting the IRM&CM process. The IRM&CM staff element must understand how the MASINT systems and sensors operate, how they can be tasked, and what products should be expected. This knowledge and understanding is required to task the MASINT assets to required objectives. The information provided in this E&IT should also be reflected in the collection manager's handbook developed for each operation.

7.4 The final E&IT requirement is for analysts using the MASINT data, either as a MASINT analyst or as an all-source analyst. The MASINT analysts will probably be provided with the systems and sensors from the contributing nations, and as such will likely be fully trained in their home nation. However, all-source analysts will be provided by multiple nations and will require additional E&IT on the MASINT systems and sensors provided by other nations.

Section 1 – Qualification Standards

7.5 Minimum qualification or certification standards should be established for each training course. While this is important for all course objectives, it is particularly important for the IRM&CM and the all-source analysts. These tiers of personnel

will determine the usefulness of MASINT sources in operations and can, without proper levels of proficiency, impact the effectiveness of the entire MASINT system involved. Improper or non-existent tasking of MASINT sources, or lack of understanding of the use of MASINT products by the all-source analysts will result in MASINT sources being relegated to a secondary role and can lead to unnecessary loss of life and/or other resources.

Section 2 – Exercise and Trial Participation

7.6 The MASINT community needs to continue to participate in exercises and trials where JISR capabilities and assets are employed. The best opportunity to test new concepts and systems is during trials and exercises where JISR is a major part. The Unified Vision Interoperability Trial series provides excellent opportunities to verify the interoperability of the MASINT sensors and their integration into the overall intelligence picture. Lessons learned from participation in trials and exercises should be used to update this doctrine, and the TTPs associated with JISR operations in NATO.

LEXICON
Part 1: Acronyms and Abbreviations

ACO	Allied Command Operations
ACT	Allied Command Transformation
AEDP	Allied engineering documentation publication
AIntP	Allied intelligence publication
AJP	Allied joint publication
ASIISG	All Source Intelligence Integration Working Group (subordinate to JCGISR)
CBRN	chemical, biological, radiological, and nuclear
CJ2	combined joint intelligence staff
CNAD	Conference of National Armaments Directors (NATO)
COP	common operational picture
CSD	coalition shared data (server)
DNA	deoxyribonucleic acid (biometric signature)
E&IT	education and individual training
ETEE	education, training, exercises, and evaluation
EMP	electromagnetic pulse
HUMINT	human intelligence
IMINT	imagery intelligence
IRM&CM	intelligence requirements management and collection management
IRST	infrared search and track (sensor)
J2	Joint Staff – Intelligence
JCGISR	Joint Capability Group on ISR (NATO)
JINTWG	Joint Intelligence Working Group
JISR	joint intelligence, surveillance, and reconnaissance
JTF	joint task force
KML	keyhole markup language
MASINT	measurement and signature intelligence
MC	Military Committee (NATO)
MWG	Measurement and signature intelligence Working Group (NATO)
NATO	North Atlantic Treaty Organisation
NMA	NATO military authority
RF	radio frequency
RFI	request for information
SIGINT	signals intelligence
STANAG	NATO standardisation agreement

TTPs	tactics, techniques, and procedures
UGS	unattended ground sensor
WMD	weapon of mass destruction
XML	extensible markup language

LEXICON
Part 2: Terms and Definitions

TERM	*DEFINITION*
biometrics	Recognition of individuals based on their behavioural and biological characteristics (NATO Term – NATO Agreed)
collection manager's handbook	A document prepared for specific theatres of operations that defines the collection systems available and the capabilities of each. The document is used by collection managers to ensure proper tasking to the various sensor systems. (This term is a new term and definition and will be processed for NATO-agreed status)
extensible markup language	A markup language that defines a set of rules for encoding documents in a format which is both human-readable and machine-readable, and is based on the World Wide Web Consortium (W3C) standards. (W3C agreed term, not NATO agreed)
hyperspectral	A sensor which collects images which have between 100 and 999 bands (IEEE agreed Term, not NATO agreed)
interoperability	The ability to act together coherently, effectively and efficiently to achieve Allied tactical, operational and strategic objectives. (NATO Term – NATO Agreed)
joint intelligence preparation of the operational environment	The process of defining all of the attributes of an operating environment prior to execution of operations. This process is performed by the Joint Intelligence Directorate (J2) to support operational planning. (This term is a new term and definition and will be processed for NATO- agreed status)
keyhole markup language	An XML notation for expressing geographic annotation and visualization within Internet-based, two-dimensional maps and three-dimensional earth browsers, and is based on an Open Geospatial Consortium (OGC) standard. (OGC Agreed Term, not NATO agreed)
	Intelligence derived from the scientific and technical analysis of data obtained from sensing instruments for the purpose of

MASINT; Measurement and Signature Intelligence	identifying any distinctive features associated with the source, emitter or sender, to facilitate the latter's measurement and identification. MASINT is divided into eight sub-disciplines in NATO: biometrics, radio, geophysical, electro-optical, nuclear, materials, multi/hyper-spectral, and radar. (NATO Term – NATO Agreed)
multispectral	A sensor which collects images which have between 4 and 99 bands (IEEE agreed Term, not NATO agreed)
refugee centre	A facility or area set up to provide basic humanitarian support to refugees (This term is a new term and definition and will be processed for NATO- agreed status)
ultraspectral	A sensor which collects images which have 1000 bands or more (IEEE agreed Term, not NATO agreed)

Intentionally blank

AJP-2.8(A)(1)