


2021

annual REPORT



www.japcc.org

**Joint Air Power
Competence Centre**

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foreword

The Alliance faces a dynamic security environment that foreshadows a future battlespace more complex than ever before, requiring a new level of interoperability and joint effort. To account for this phenomenon, the Alliance identified measures to adapt within the NATO agenda 2030 and presents possibilities which will shape the future. Now more than ever, building on its experience and successes, the JAPCC decisively influences the development of NATO Joint Air and Space Power through innovative, unconstrained thinking.

The Annual Report 2021 once again documents the JAPCC's high level of performance. It highlights last year's key achievements while providing an outlook on projects and research the JAPCC team will engage in across the Air and Space domains in 2022.

The COVID-19 pandemic tested our Allies, Partners, and NCS resiliency. We maintained appropriate response measures, reduced travel, and attended virtual meetings to mitigate the risks. However, despite limitations, we fulfilled our mission and focused on the strategic guidance set by the Sponsoring Nations.

In 2021, we also published the study 'Big Data Management in ISR and New Technology Trends'. It addresses the growing importance of the large data set (Big Data) collected by the Alliance, its management, and the required exploitation to maintain information superiority in operations.

Furthermore, we published the 31st and 32nd edition of the Journal of the JAPCC, our flagship product, and the white paper 'From Ground to Exosphere – 15-Years of the Joint Air Power Competence Centre'. It presents the JAPCC's organization, underscored its value to the Nations and NATO, and provides an extensive overview of the Centre's achievements since its establishment in 2006.

The recently initiated long-term project 'NATO Joint all Domain Operations' (NATO JADO) accentuates the JAPCC's dedication to provide NATO a strategic

advantage in executing Alliance Policy & Strategy. JADO expands NATO's Multi-Domain Operations concept (MDO). The overall goal develops achievable concepts to transition NATO capabilities from coordinated joint and operational activities to fully integrated actions across all domains in order to provide desired effects.

We held on to a well-established tradition this past year: the annual JAPCC Air and Space Conference themed 'Delivering NATO Air and Space Power at the Speed of Relevance'. High-ranking military, industry, and academia representatives took the opportunity to discuss and exchange ideas on Air and Space Power-related challenges and requirements for future joint military operations.

Looking ahead, 2022 will test and challenge us as well, and the JAPCC will continue its efforts to lead the transformation catalyst of NATO Joint Air and Space Power. Subject Matter Experts (SMEs) and financial contributions from our Sponsoring Nations are essential to remain viable and successful. These contributions are greatly appreciated and we aim to provide a substantial return on your investment.

This 2021 JAPCC Annual Report will highlight the key developments, projects, and research shaping Joint Air and Space Power.

I encourage each of you to review the JAPCC contributions to the Alliance and contact us with questions, feedback, or requests for support at any time.

Good Reading!



Jeffrey L. Harrigan

General, US AF
Director, JAPCC

who we are

Established in 2005, the JAPCC was the first NATO-accredited Centre of Excellence (COE). We provide subject matter expertise across a broad range of Joint Air & Space (A&S) Power topics including the development of Concepts and Doctrine, Capability Development, Education and Training, and Lessons Learned in accordance with NATO MC (M) 236.

The JAPCC seeks to maximize its contribution to the improvement and transformation of Joint A&S Power through a well-formulated engagement strategy. This strategy not only guides the Centre's approach to organizations within NATO and our Sponsoring Nations, but also enables outreach to other national organizations and academia, allowing the COE to tap into a comprehensive and diverse pool of Joint A&S Power subject matter experts.

The Joint Air Power Competence Centre (JAPCC) was formed on 1 January 2005 to provide a strategic level proponent for Joint Air and Space (A&S) Power that was missing in NATO.¹ Soon thereafter, JAPCC was accredited as NATO's first Centre of Excellence (COE) and, as such, is charged with the development of innovative concepts and solutions required for the transformation of A&S Power within the Alliance and the Nations.

Based on a Memorandum of Understanding (MoU), the JAPCC is sponsored by 16 NATO nations who provide a variety of experienced Subject Matter Experts (SME) that come from all services. Through its multi-discipline organization, the JAPCC chooses the most suitable SMEs for the task and combines their knowledge and experience to fully contribute to transforming NATO's A&S Power. Importantly, as the JAPCC is in support of,

1. The Concept for the JAPCC (31 July 2003, MoD Bonn) established that JAPCC would serve as the COE for Joint Air and Space Power as reflected in the statement: 'This synergistic application of air, space and information systems from and for all services to project military power is summarized with the term "Joint Air Power"'. This is also reflected by the inclusion of Space, Cyber, and Electronic Warfare positions in the JAPCC Peacetime Establishment in the JAPCC Operational MoU.



Director (US AF)
General Jeffrey L. Harrigian



Executive Director (GE AF)
Lieutenant General Thorsten Poschwatta



but outside of the NATO Command Structure (NCS), it can offer independent objective military advice across the spectrum of Joint A&S Power matters to NATO and national policymaking bodies.

A&S Power SMEs drawn from the Land, Maritime, Air, Cyberspace and Space components of the 16 MoU nations conduct collaborative research into areas in which JAPCC assistance is requested by leveraging their independent thought and a global network of experts that reach across the military, academic and industrial spheres. The resulting analysis and solutions are disseminated via studies, reports, journals, articles, seminars, panels and conferences.

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organizations within NATO and our Sponsoring Nations but also enables outreach to other national organizations and academia, allowing the COE to tap into a comprehensive and diverse pool of Joint A&S Power SMEs.

JAPCC's Vision

To be NATO's catalyst for the improvement and transformation of Joint Air and Space Power, delivering effective solutions through independent thought and analysis.

JAPCC's Mission

The JAPCC, as a team of multinational experts, is to provide key decision-makers effective solutions on Air and Space Power challenges, in order to safeguard NATO and the Nations' interests.

Leadership

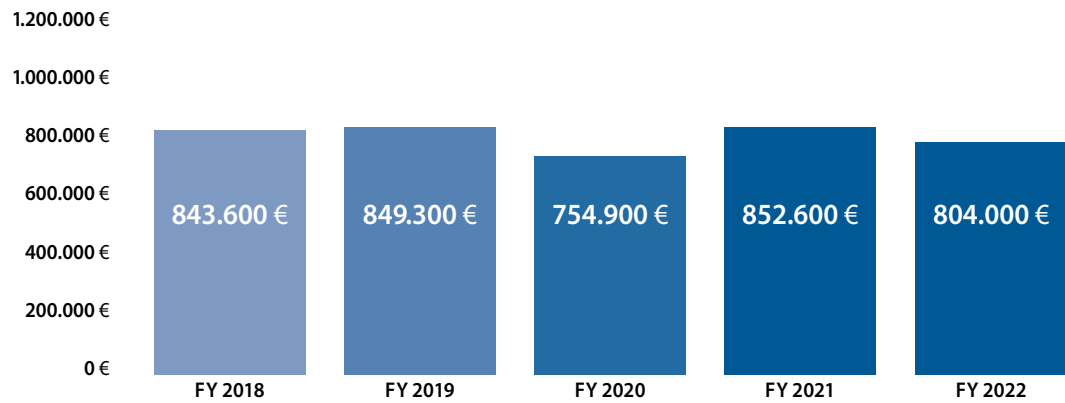
The JAPCC is headed by the Director, General Jeffrey L. Harrigian (US AF), who has led the Centre since May



Assistant Director (NE AF)
Air Commodore Paul Herber



Chief of Staff (US AF)
Colonel Matthew Willis



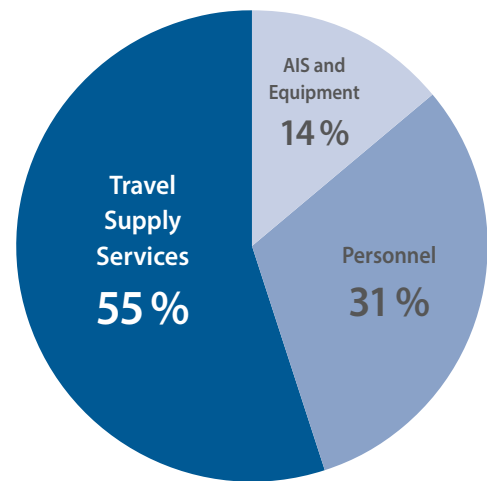
Approved JAPCC Budgets

2019. General Harrigan also serves as the Commander, Allied Air Command and the Commander, United States Air Forces in Europe and Air Forces in Africa (USAFE-AFAFRICA) at Ramstein Air Base.

The JAPCC's Executive Director, Lieutenant General Thorsten Poschwatta (GE AF), also commands the German Air Operations Command (AOC) and the German Joint Force Air Component Headquarters (GE JFAC HQ).

On-site, Air Commodore Paul Herber (NE AF) serves as the Assistant Director (AD), and together with the Chief of Staff (COS), Colonel Matthew Willis (US AF), provides day-to-day leadership for the JAPCC team.

The five JAPCC branches are headed by: Colonel Thomas Schroll (GE AF) – Assessment, Coordination and Engagement (ACE), Colonel Michael Adams (US AF) – Combat Air (CA), Colonel Maurizio De Angelis (IT AF) – Command, Control, Computer, Communication, Intelligence, Surveillance and Reconnaissance (C4ISR), Colonel Erik Rab (NE AF) Air Operations Support (AOS), and Lieutenant Colonel Heiner Grest (GE AF) – Space.



JAPCC Budget Spending in FY 2021

Personnel

As in previous years, a further reduction in JAPCC manpower was recorded in 2021. At the end of the year, the overall manning of the JAPCC was 57 percent, while the level of SME manning reached only 50 percent.

The JAPCC continues to actively mitigate these shortfalls through cross-utilization, internal education and training, as well as creative technological solutions. However, to better address the spectrum of A&S subject matter areas relevant to NATO, and to better support the Joint Warfare Centre (JWC) and

major NATO exercise programs, JAPCC needs Sponsoring Nations to consider increasing their participation.

In this sense, it is also important to encourage other nations to consider an active role in JAPCC either as a Sponsor or a Contributing Nation.

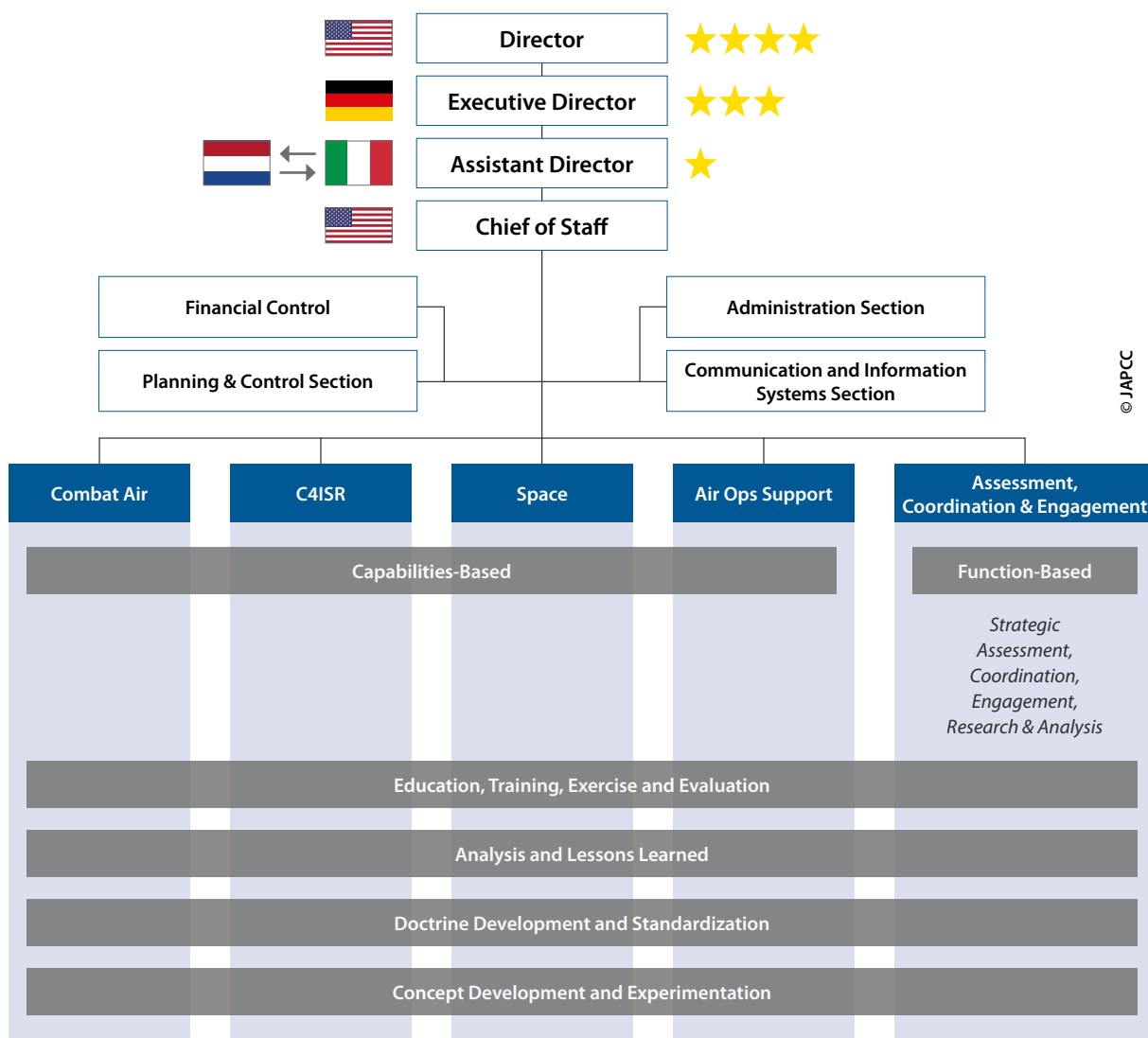
Budgeting and Finance

Based on the JAPCC Medium Term Financial Plan and taking into account the actual number of assigned staff officers, the JAPCC budget for 2021 remained just below 854,000 Euros. Our Senior Resource Committee

(SRC) continues to provide full support to our budget based on 'minimum military-requirements'. As described in the JAPCC MoU, the Sponsoring Nations contribute to the budget according to the number of staff officers in their bid. For the Fiscal Year 2021, the approved budget was 852,600 Euros.

The current corresponding annual cost per staff officer is 14,700.00 Euros.

The budget was expended primarily on travel, supplies and services (55%), personnel-related expenditures (31%) and replacement of furniture, as well as hard- and software upgrades for automated information systems (14%).





Stakeholders

The JAPCC's primary customers include NATO HQ, Allied Command Operations (ACO), Allied Command Transformation (ACT), NATO Joint Force Commands (JFC), Component Commands (CC) and Sponsoring Nations. However, the JAPCC also accepts Request for Support (RfS) from other sources as workload and staff availability permits. With a track record of successful products and ever-increasing connections to industry and academia, the JAPCC continues to build upon its reputation as NATO's preeminent advocate for the transformation of Joint A&S Power.

The JAPCC Provides Solutions to Address Air and Space Power Challenges

To fulfil our mission, the JAPCC conducts its own research and advocacy, as well as responding to the needs of NATO and its member nations. Our Programme of Work (PoW) comprises projects, activities, and tasks, which are dynamic in nature and are adjusted monthly based upon the acceptance of RfS. Independently, the JAPCC also hosts a number of

major events, including an Annual Joint A&S Power Conference, the biannual meeting of the Air Operations Working Group (AOWG), the Maritime Air Coordination Conference (MACC), one session of the biannual meeting of Air-to-Air Refuelling Working Group (AAR-WG), the JAPCC Steering Committee (SC) meeting and the SRC meeting.

JAPCC Support to the 'Pillars' of COE Work for NATO

Due to the breadth of A&S subject matter areas covered by the JAPCC, it is not practical for the Centre to be organized along the established model of the four pillars of COE work for NATO. Instead, four of the JAPCC branches provide SMEs on systems and capabilities whose work contributes to each of the pillar areas of Education, Training, Exercise and Evaluation (1), Analysis and Lessons Learned (2), Doctrine Development and Standardization (3), and Concept Development and Experimentation (4). The fifth JAPCC Branch, ACE, has at least two posts dedicated to each of the pillars to facilitate the alignment of JAPCC's PoW to NATO's needs.

key developments

The JAPCC is vigorously active in areas in which it has SMEs available. This section summarizes the organization's efforts in the past year in support of NATO's Joint A&S Power; however, due to size constraints in this report, these are top-level summaries of activity. For more detail on any specific area, please visit our website or contact us directly.

Concept Development

The JAPCC's support to Joint A&S Power development in 2021 included the following:

- NATO Joint All-Domain Operations (JADO);
- Air Force Protection Support to NATO Allied Air Command (AIRCOM), Ramstein;
- Alliance Future Surveillance and Control (AFSC) Project;
- NATO Science and Technology Organization (STO) study (AVT-359) Co-Chair: Hypersonic Operational Threats and Capabilities;
- Support of NATO STO study SCI-301 Defeat of Low Slow and Small (LSS) Air Threats;
- Space Support in Operations;
- Support of NATO STO AVT-329 study;
- Support to GE AF/ACT study Artificial Intelligence (AI) in Air Command and Control (AirC2);
- NATO Force Protection Decision Support Tool Development;
- Freedom of Manoeuvre (FoM) in the Cyberspace Domain;
- Big Data Management in Intelligence, Surveillance and Reconnaissance (ISR) and New Technology Trends;
- Joint Personnel Recovery (JPR) in the Urban Environment;
- Support of NATO STO HFM/AVT-340 study;
- Contribution to the STO-SCI-346 Space Risk Assessment activity;
- Contribution to the STO-SCI_SAS-ET-058 Space Deterrence Framework activity.

NATO Joint All-Domain Operations (NATO JADO). The JAPCC's NATO JADO project gained steam in 2021.

In May 2021, the Director endorsed the JAPCC-led effort to explore the impending future operating environment described generically as Multi-Domain, All-Domain, Pan-Domain, or Multi-Milieu. The NATO JADO project aims to comprehend the many efforts taking place within NATO, the nations, partners, and competitors and identify achievable concepts that transition NATO capabilities from 'component and domain coordination' to full integration across the domains and traditional operational boundaries.

In this effort, the JAPCC is actively engaged with ACT Alliance Warfare Development activities that seek to develop NATO definitions, concepts, and lines of effort. The NATO JADO team is comprised of SMEs from across four JAPCC branches, representing expertise in all NATO recognized domains and all four components. In conjunction with the Director's endorsement, the JAPCC published 'All-Domain Operations in a Combined Environment', an informational flyer highlighting the NATO JADO project and JAPCC lines of effort.

Air Force Protection Support to NATO Air Command, Ramstein. Supporting the Force Protection (FP) Cell at Ramstein is second only to JAPCC FP's primary objective to deliver, on demand, timely support to NATO operations when requested by SHAPE. While no face-to-face meetings have been possible, regular contact has been maintained to ensure ongoing situational awareness of both Air FP Cell and TACEVAL FP emerging challenges. This said, the ongoing review of ATP-3.3.6, NATO FP Doctrine for Air Operations as well as the development of a Force Protection Decision Support Tool (FPDST) have continued apace during 2021 and will both be delivered to AIRCOM FP during the course of 2022.

Alliance Future Surveillance and Control Project (AFSC). The NATO AWACS fleet is scheduled to retire from service in or around 2035. Consequently, the North Atlantic Council (NAC) tasked the Conference of National Armaments Directors (CNAD) to determine requirements and advise on options and possible ways to deliver a follow-on to the AWACS capability under the heading of the AFSC initiative.

At the 2016 NATO Warsaw Summit, the NAC approved the AFSC pre-concept stage report and the Heads of

State, as well as Government, declared: 'By 2035, the Alliance needs to have a follow-on capability to the E-3 AWACS. Based on high-level military requirements, we have decided to collectively start the process of defining options for future NATO surveillance and control capabilities.'

Based upon the NAC's direction and within the boundaries of the approved AFSC concept stage model, the concept stage will be conducted in three phases:

Phase 1 – Development of refined capability requirements and deliverance of AFSC capability architectures capturing alternative operational concepts. Furthermore, the conduct of knowledge gap analysis to identify study objectives to inform phase 2.

Phase 2 – Studies of selected AFSC High-Level Technical Concepts (HLTC) by capability architectures and related project architectures, including down-selection of the preferred AFSC capability architecture and project architectures for which materiel solutions have to be procured in phase 3.

Phase 3 – Development of programmatic arrangements necessary to initiate procurement programme(s) after the concept stage.

Throughout the Concept Stage, each phase will end with a decision point where allies will have the opportunity to examine the deliverables and provide direction and guidance to the NATO Support and Procurement Agency (NSPA) (AFSC Host Nation) on how best to proceed.

To govern and manage this effort, an AFSC Support Partnership Committee (SPC) and AFSC Project Office have been established.

The concept stage started in January 2017 and is expected to be concluded in quarter four of 2022.

ACT requested the support of JAPCC to contribute to the AFSC Project Office venues (i.e. multiple workshops on requirement development, requirement review and gap analysis). During phases 1 and 2, JAPCC personnel supported the preparation and the execution of the assessment of the HLTC delivered by industry. JAPCC sup-

ported the development of scenarios and vignettes and took an active part in the assessment of the HLTC and the assessment report writing. Currently, the JAPCC is involved in the preparation of phase 3 of the project.

Contribution concerns the preparation of risk reduction and feasibility studies, the development of an initial Concept of Operations (CONOPS) for AFSC and a review of the operational requirements.

NATO STO Study (AVT-359) Co-Chair: Hypersonic Operational Threats and Capabilities. Since June 2020, JAPCC has co-chaired the NATO STO Hypersonic study and supported research efforts with Integrated Air and Missile Defence (IAMD) expertise. The two-phased study focuses on the impact of hypersonic threats and capabilities by employing the Observe-Orient-Decide-Act (OODA) Loop model to frame the military decision-making and perspectives from the political/strategic to tactical level. Phase one (Observation, Orientation, and Decision) is drafted and submitted for editing, but the release has been delayed due to COVID. Phase two (Active Defence and Offensive Operations) research is underway since September 2021. JAPCC is working in close cooperation with the CC for Surface Based Air and Missile Defence (SBAMD) on this project.

Support of GE Workshop about Communication and C2 for Missile Defence. JAPCC continued to support the GE AF multi-year project to identify command, control and communications fundamentals for missile defence. JAPCC provided expertise on NATO IAMD, missile defence concepts and hypersonic threats during three workshops in 2021 and anticipate culmination of this effort in summer 2022.

Support of NATO STO Study SCI-301 Defeat of Low Slow and Small (LSS) Air Threats. JAPCC continued to contribute to this three-year study headed by the NATO STO on the future of Counter-Unmanned Aerial Systems (C-UAS). While conventional threats remain of concern, deployment of Small Unmanned Aerial Systems (SUAS) has provided one of the most significant military capability enhancements of recent years. Challenges posed by SUAS are many and range across the complete kill chain. Traditional systems and first-generation C-UAS may be unable to cope with this

challenge in the future. The goal of the study is to provide recommendations to support a 'Second Generation' C-UAS networked system. The group's final report has been provided to the STO in December 2021.

Space Support in Operations. JAPCC's Space SMEs continued their work in the evolution of Space Power within NATO, mainly through their participation in the current main forum for consultation and coordination of space-based matters, the Bi-Strategic Command Space Working Group (BiSCSWG). Besides, they improved NATO's 'Space Support in Operations' for Education and Training (E&T) as Department Head for this NATO E&T discipline and conducted the 5th Annual Discipline Conference (ADC) in November 2021 with main stakeholders. Also, the JAPCC contributed expertise to space-related documents and doctrines as well as designing and executing Space Opposing Forces (OPFOR) in NATO exercises. Finally, the unclassified version of the study 'Resiliency in Space as a Combined Challenge' was finished and published in summer 2021. The study of 'National Military Space Operations Centres' has been finalized and is in the publication process.

Support of NATO STO AVT-329 Study. The AVT 329 'Next Gen Rotorcraft Impact on Military Operations' activity assesses the impacts on military operations from developments in applicable science and technology in the 2035+ timeframe. Furthermore, it evaluates the military worth of adopting these new capabilities in representative operational environments against adversaries in the 2035+ timeframe. The results will provide trade study information in support of the NATO Next Generation Rotorcraft Capability (NGRC) concept.

In support of AVT 329, a multinational exercise occurred in September 2019 at the JAPCC. The exercise developed the plan for a trade space analysis (at both classified and unclassified levels). Combining a qualitative methodology with the results from the exercise, the NATO Unclassified Operational Assessment (OA) occurred virtually from 23rd – 25th November 2020. The OA used simple mission vignettes, general risks, identification of mitigation strategies, and broad assessment of military worth. A pre-release of the final report was completed and released in mid-July 2021. Results support the subsequent NATO Classified OA.

August 2021



Resiliency in Space as a Combined Challenge for NATO



Available online: www.japcc.org/publications/ (White Papers)

The NATO Classified OA is planned to take place at JAPCC in March 2022. The proposed schedule is subject to COVID19 related travel and meeting restrictions and is subject to confirmation. The assessment will refine the general information used during the NATO Unclassified OA with specific geographic locations, if applicable, with a projected threat environment to frame missions in 2035+. Scenario(s) and related CONOPS developed prior to the OA will leverage the draft Statement of Requirements from NATO NGRC and other NATO war gaming references. Execution of the NATO Classified OA will follow a similar risk-based approach employed during the NATO Unclassified OA at a classified level employing projected CONOPS, threat environments, and other supporting information.

Support to GE AF/ACT Study Artificial Intelligence in Air Command and Control (AirC2). JAPCC has participated in this study since its beginning, with stakeholders such as ACT (sponsor), GE AF (owner/manager), GE JFAC (AirC2 experts), FR AF (support), JAPCC (AirC2 experts) and CAE (contractor).

The study includes research on the AirC2 JFAC planning cycle and exploring and recommending applications of AI to support the planner and decision-maker in a more dynamic, complex and information-driven environment. Work packages will include overviews and analyses of concepts to be improved in both the planning cycle as well as during training (ETEE).

The first research results have been received and are contributing to more AI-related projects within the JAPCC. It was planned that the study would demonstrate, through a software demonstrator, the possible solutions to a more analytical and automated planning process within the JFAC in the 4th quarter of 2021. However, due to the project's complexity, the test is postponed to 2022. Nevertheless, JAPCC maintains close coordination with the GE Point of Contact (POC) of the programme to support the endeavour with expertise and knowledge in the field of JFAC processes.

NATO Force Protection Decision Support Tool Development. The genesis of this task lies within earlier work exploring the FP practitioners approach to Countering-Unmanned Systems (see JAPCC White Paper 'The Implications for Force Protection Practitioners of Having to Counter Unmanned Systems – A Think-Piece'). During the development of this earlier White Paper, it was discovered that threat analysis software existed that was not being fully exploited. At the same time, it became apparent that HQs were struggling to capture the entirety of the NATO FP challenge. This later issue had two principal elements: Firstly, the sheer size and complexity of the task for all NATO locations and second, the lack of a standardized approach. The problem was further compounded by the rapid turn round of staff in FP positions. Analysis of the FP task had been started on multiple occasions, but had been incomplete by the time staff were due re-assignment. Incoming staff either did not continue the task or, restarted it with a revised approach. This has resulted in a significant knowledge gap with potentially serious operational impact. This has led the JAPCC to explore whether existing, commercially available software could be utilized, with little additional development, to assist the FP staffs with the task of analysing and capturing the entirety of the NATO FP task, asset by asset. The defined output of this project is the delivery of a 'proof of concept' of a Force Protection Decision Support

Tool (FPDST). Development work with industry has continued throughout 2021 and at the time of writing, plans to do a 'roadshow' to expose the proof of concept to stakeholders are being developed. This proof of concept will be ready by the end of January 2022 and the first serials of a roadshow will be delivered in February of 2022.

Freedom of Manoeuvre in the Cyberspace Domain.

Cyberspace is a dynamic and constantly evolving domain. For the projection of A&S Power, the ability to continue to operate in Cyberspace in a contested environment is essential for the highly technical planning, Command and Control (C2), and execution of modern A&S as well as future JADO. Therefore, gaining and maintaining the requisite degree of FoM in Cyberspace toward achieving the Commander's intent is vital.

The project aims to present the criticality and challenges of establishing FoM in contested Cyberspace in modern conflict. In battles where the adversary is not always known nor the threats readily apparent, the ability to secure this domain completely is unlikely, increasing the requirement for forces to be able to fight through and succeed in an ever-increasingly contested environment. Understanding and leveraging Cyberspace through the successful exploitation of emerging trends and technologies is imperative. NATO and its partners need, more than ever, comprehensive insight into the increasingly contested Cyberspace environment, now and for the foreseeable future.

Joint Personnel Recovery (JPR) in the Urban Environment.

Urbanization and the explosive growth of digital technology have transformed the JPR environment from the rural and sparsely populated concept that has underpinned acquisitions, training, and concepts in JPR since the 1970s. This mid-term project seeks to identify current gaps and challenges in the planning and execution of JPR operations in the urban environment to provide recommendations for future requirements, education and training that will enable JPR to occur in increasingly contested environments, including urban and suburban. The project will characterize the urban environment and identify promising current and future technologies and operational concepts that can inform NATO and the nations. The project intends to encourage JPR stakeholders to significantly reassess all four phases of the personnel recovery system (Preparation, Planning, Execution, and Adaptation).

Support of NATO STO HFM/AVT-340 Study. HFM/AVT-340 (Neuroscience-based Technologies for Combat-oriented Crew Cockpit Design and Operations) is a NATO STO program that aims to evaluate a stress monitoring system developed to measure aircrew performance during challenging training events to assess Human Machine Interface (HMI) design effectiveness. It follows the HFM/AVT-ET-185 which identified the key scientific objectives for HMI assessment and recommended developing the stress monitoring system in use during this long-term study. JAPCC is supporting the study to provide military subject matter expertise and ensure relevance to military audiences. The JAPCC Team of Experts (ToE) have been tasked by the study group to brief envisioned scenarios and critical operations, develop a future war scenario for operators, and create Fixed and Rotary Wing (FW & RW) mission profiles for military operators to participate as test subjects. The drafted missions ensure a high workload and high level of difficulty forcing the aircrews to use all equipment/armament and possibilities offered by their platforms while applying the expected Tactics, Techniques, and Procedures (TTPs).

JAPCC ToE will support both theoretical and practical phases of this exploration.

Contribution to the STO-SCI-346 Space Risk Assessment Activity. The three-year NATO STO activity (2021–2024) focuses on identifying all terrestrial, man-made and environmental effects on satellite systems to assess the probability of event occurrence by defining risk levels, their probability and likelihood. One JAPCC SME is supporting this research for further operationalization of NATO's activities in, from and through space.

Contribution to the STO-SCI_SAS-ET-058 Space Deterrence Framework Activity. The main focus of the STO exploratory team, which is supported by one SME of JAPCC, is to develop within the timeframe 2021–2024 a methodology to conduct a high-level technical and capability assessment of Alliance options to counter adversarial space threats. This also encompasses identifying and evaluating mechanisms to facilitate NATO's space deterrence and defence in co-operation and coordination with the member nations.

Education and Training

In 2021, the JAPCC supported NATO Education and Training in the following areas:

- Support to major NATO Exercises;
- Air Force Protection (FP) partnership with the European Air Group (EAG);
- NATO FP on a Knife Edge – A Think Piece;
- NATO Force Protection Training (Introduction to Force Protection in NATO Course);
- NATO Advanced FP (Practitioners) Course;
- Air FP Support to the Baltic States;
- Cyberspace Support;
- Surface Based Air and Missile Defence;
- Common Education & Training Programme (IAMD);
- NATO Red Air Capability Study in support of IT;
- Education and Training on Space;
- JPR Education and Training.

Support to Major NATO Exercises. As in previous years, AIRCOM's exercise RAMSTEIN AMBITION 21 (RAAM21) was supported by the JAPCC with an OPFOR Air Team as part of Exercise Control (EXCON). The team participated in the Incident Development Workshop (IDWS) (held virtually because of COVID), the development of the Master Event List/Master Incident List (MEL/MIL), as well as during the EXCON training and execution of the exercise. The team's SMEs for Air Operations, SBAMD, Space, Cyber, and Air-Land Integration (ALI) provided the Red ATO and ACO for the exercise and dynamically managed the Red forces. The OPFOR air team was also responsible for managing much of the exercise injects for the training audience.

For exercise STEADFAST JUPITER 21 (STJU21), the JAPCC was asked by the JWC to provide support for the IDWS (virtual because of COVID), the MEL/MIL scripting and the EXCON training and execution of the exercise. The team provided JWC with SMEs for Air Operations, Space, and Cyber. The OPFOR Air Team provided the Red ATO and ACO for the exercise and dynamically managed the Red forces. During STJU21, the OPFOR Air Operations team was co-located with the AIRCOM Response Cell, which proved beneficial to both sides.

A few weeks before the exercise, the OPFOR Air team of the JAPCC was approached by the OPR of AIRCOM for urgent support of exercise STEADFAST LEDA 21 (STLE21), because OPFOR Air for STLE21 lacked an ICC database, resource allocation, ATO and ACO. Although the JAPCC had to decline the previous formal RfS for STLE21, the JAPCC OPFOR Air team was able to produce on short notice these products to support the last days of the execution of STJU21.

Air Force Protection (FP) Partnership with the European Air Group (EAG). JAPCC FP has a long-standing relationship with the European Air Group (EAG) FP section. The EAG is an independent organization with no relationship to the European Union (EU), equally, all EAG Nations are also NATO Nations, so there is no conflict of interest in developing projects in partnership. During 2021 work focused on three mutually beneficial areas:

1. Development of a FPDST;
2. Revision of ATP-3.3.6, NATO Force Protection Doctrine for Air Operations;
3. Development of the EAG Air Mobile Protection Teams (AMPT) Handbook.

Regular engagement has taken place throughout the year, with one face-to-face meeting in August 2021. The EAG has provided input and support into the development of the FPDST and doctrine revision. In turn, the JAPCC will look to incorporate EAG work from the

AMPT Handbook into future NATO Doctrine, possibly as a Standards Related Document (SRD) or as an adjunct to ATP-3.3.6.

NATO FP on a Knife Edge – A Think-Piece. This major FP project was delivered on 13 July 2021. Regular followers of the JAPCC's work will be familiar with the type of White Paper regularly produced. However, this paper is somewhat different, and some have said it is controversial. Like a number of previous FP products, the paper was styled as a 'Think-Piece'. This meant that it presented opinions, analysis, or discussion rather than straightforward facts. The reason for this was twofold: First, the subject of FP is huge and is not so much a capability in its own right, but a mechanism whereby multiple capabilities and actors are brought together to deliver a single seamless output, in an effective and resource-efficient manner. Second, while there is a single coherent view of what FP is (and is not), from a NATO doctrinal perspective, there remains a significant difference of opinion across the Nations and between the Components. Furthermore, like many enablers, FP resources have been mercilessly reduced as we have sought to fund new frontline capability. The underlying premise of this paper is that we (NATO) collectively no longer have the capability, or the capacity, to effectively protect ourselves against the plethora of threats we now face; some old, some new, some still emerging. More worryingly, we suggest that the Nations are each looking to one another to provide this capability, and all are look-



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ing at the Alliance to do so collectively. The bottom line is that we probably have a collective problem that requires a collective solution that all parties need to contribute to. The line of reasoning followed by the paper is that if we fail to act and act now to re-resource FP, we may find that the frontline capability we have worked so hard to procure is left as little more than piles of burning scrap, as our adversaries look to achieve their objectives by destroying our battle-winning advantage, our deterrent capability before it can be brought to bear.

NATO Force Protection Training (Introduction to Force Protection in NATO Course). The JAPCC has been primarily responsible for this course since 2008. During this time, the course has been re-written completely once and substantially revised twice; a further review will take place after the February 2022 iteration. During 2021, this course has been run on three occasions, once virtually and twice face-to-face. The course is consistently recorded as one of the top three courses out of the 120+ run by the NATO School Oberammergau (NSO) in terms of the overall student satisfaction rating recorded and the revenue generated through participation. Over 30 nations and 120+ students participated during 2021 despite Pandemic imposed restrictions.

NATO Advanced FP (Practitioners) Course. This course was developed for the NSO by the JAPCC at the request of the NCS. The development process from concept to delivery of the first pilot course has taken a little over seven years and has been delivered solely by the JAPCC. One iteration of the course, the first as a formally NATO approved course, was delivered in June 2021 for 28 students. Again, this delivery was done solely by the JAPCC, facilitated by the NSO. The course was considered a resounding success with almost unparalleled positive comments from those who participated. Two iterations are confirmed for 2022, with the possibility of running a third iteration being actively discussed at the time of writing.

Air FP Support to the Baltic States. This objective was initiated in 2015. The intent is to develop Baltic State FP capability by providing an analysis capability to review any current approach and recommend possible enhancements across all Capability Development, Lines of Development (LoD). The 2021 focus has

been on delivering a FP module for officers from all three Baltic Nations attending the Air Staff Course at the Defence Academy in Vilnius, Lithuania. While an extremely successful one-week package was delivered face-to-face in the past (2019), this year's module had to be condensed into approximately eight hours of training delivered virtually due to COVID restrictions and lack of available resources. However, the package delivered in November 2021 was well received, and a plan is already being developed to see a return to face-to-face teaching and a one-week package for 2022.

Cyberspace Support. JAPCC supported the ADC for Cyberspace for the third year and provided expertise once again for the Discipline Alignment Plan (DAP), specifically regarding the education and training requirements for both the training audience and the Cyberspace SMEs supporting the exercises either as OPFOR or as EXCON in the development and execution phases.

For the sixth consecutive year, JAPCC has provided Cyberspace expertise to the JWC in OPFOR/EXCON, Cyberspace for the development and execution phases of a major exercise. This year JAPCC assisted in the preparation of the Cyberspace injects during the MEL/MIL scripting phase and as Cyberspace EXCON/OPFOR during the execution phase of RAAM21 and participated in the execution phase of STJU21, as well.

Surface-Based Air and Missile Defence (SBAMD). In 2021, the JAPCC supported SBAMD courses at NSO and the GE/NE binational Competence Centre SBAMD at Ramstein. The JAPCC also participated in the European Ground Based Air Defence (GBAD) Working Meeting, an initiative (GE/NE framework lead) bundling the scarce GBAD assets in Europe to support education, training and exercises.

Since mid-2015, JAPCC has been an active member of the multinational Ballistic Missile Defence (BMD) Experiment Nimble Titan and serves as the War Game Control Group Deputy Chair while also supporting the analysis and reporting team. During 2021, JAPCC AD participated in the senior leader event, and JAPCC SMEs supported three major experiment events. 2022 will return to the beginning of the planning cycle for the biennial experiment.

JAPCC provides the Operational Control Group Deputy Chair for Joint Project Optic Windmill (JPOW). This biennial GE/NE exercise has been the main European IAMD exercise for over a decade and has significant ties to the STEADFAST ARMOUR series of exercises and the new RAMSTEIN CENTURY, which is planned to be executed in 2023.

SBAMD SMEs also supported preparation and execution of the exercise RAAM21 as well as the JWC's TRIDENT series of exercises.

NATO Common Education & Training Program (CETP). Under the leadership of AIRCOM, and in coordination with CAOC Uedem and Torrejon, the JAPCC SBAMD SME supports the NATO CETP. It focuses on the integration of SBAMD into AirC2 and consists of training of Alliance and partner SBAMD units on NATO C2 procedures and the training of NATO AirC2 personnel on C2 for SBAMD units in advance of Exercise RAMSTEIN LEGACY.

Red Air Capability Study. With the introduction of 5th generation fighters in NATO, there is a need for a new Red Air concept in which the use of new technologies such as Live, Virtual, and Constructive (LVC), augmented reality or the use of Unmanned Aerial Vehicles (UAV), help to fill the gap of 5th generation opponents in a sustainable manner. The study includes research on new technologies to replicate opponent airframes (OPFOR) in national and/or international military exercises to allow military pilots to achieve and maintain an appropriate level of proficiency in aerial combat. The study also looks at options for NATO cooperation for Red Air delivery. The study supports an Italian national request.

Education and Training on Space. Since May 2016, JAPCC is the Department Head for the discipline 'Space Support to NATO Operations'. In this function, the JAPCC coordinates findings and develops solutions for the E&T requirements identified by the Requirements Authority (SHAPE DCOS SDP). Due to the COVID pandemic, the 2020 ADC was postponed to 2021, and was conducted in November 2021 in Rome, immediately following the 20th meeting of the BiSC-SWG. This meeting joined almost 30 experts on E&T in

the Space Domain. They discussed current and future primary needs in E&T issues in the Space discipline. The DAP is currently under development and will list, among other things, the national courses in the area of Space, to provide as comprehensive as possible up-to-date course overview. Significant changes in NATO's newest operational domain will lead to major changes in E&T aspects in the Space Domain. The Strategic Training Plan (STP), re-elaborates all training requirements by a comprehensive survey done by ACO and ACT. This will lead to a complete rewriting of all follow-up documents in this domain.

JAPCC's specific role as Department Head in E&T matters for space will be passed to the future NATO Space COE, which is going to be established in Toulouse / FRA in 2022.

The JAPCC also continued to foster the integration of space into NATO operations by contributing to the STEADFAST exercise series. For this purpose, an OPFOR Space structure was designed for STJU21, all relevant documents required for the conduct were prepared, and the execution of the exercise in October 2021 was ensured as part of the JAPCC OPFOR team.

Also in 2022, JAPCC will support relevant NATO exercises in the role as OPFOR Space.

Implementation of space aspects has started not only in the NCS. Also, NATO Force Structure (NFS) entities have started initial activities for increased integration of space into their battle-rhythms. JAPCC Space SMEs supported efforts of the First German Netherlands Corps (1st GNC) in Muenster, Germany, in their development of becoming a Warfighting Corps HQ for NATO by giving virtual lectures and providing in-presence support within a staff functional integration training in spring 2021.

Joint Personnel Recovery Education and Training. JAPCC supported the 24th Joint Personnel Recovery Staff Course (JPRSC) conducted at the German AOC in October 2021. The JPRSC, as part of the European Defence Agency (EDA) Joint Personnel Recovery Education and Training Courses (JPR-E&TC), is aiming at generating well-trained personnel able to perform as a

Personnel Recovery Staff in a Personnel Recovery Co-ordination Cell (PRCC) or Joint Personnel Recovery Centre (JPRC) within EU, NATO or national HQs, in the planning and/or execution of military operations or exercises. JAPCC supported as well the advanced and basic AirC2 courses conducted in Kalkar in August and October 2021 respectively, by providing a JPR briefing.

Active Engagement

The JAPCC continues to actively engage with various air power stakeholders through working groups and other face-to-face meetings. These engagements included but were not limited to:

- Annual Joint Air and Space Power Conference;
- Think Tank Forum (TTF);
- Joint Air and Space Power Network (JASPN) Meeting;
- NATO's Long-Term Military Transformation (LTMT);
- CAOCs Inter-Services Coordination Meetings;
- CAS Conference;
- JTAC Program Manager Workshop;
- European Safety & Security Professionals Network;
- Aircraft Cross-Servicing (ACS);
- Joint Personnel Recovery (JPR);
- Air-To-Air Refuelling (AAR);
- Air Transport (AT);
- Maritime Air Coordination Conference (MACC);
- Participation in the Air and Missile Defence Committee and Subordinate Bodies;
- Aerospace Capability Group 2 (ACG2);
- Aerospace Capability Group 3 (ACG3);
- NATO Electronic Warfare Advisory Committee (NEWAC);
- NATO Electronic Warfare Working Group (NEWWG);
- Air Operation Working Group (AOWG);
- SATCOM Threat Assessment Study;
- 13th Cyber Conflict Conference;
- NATO SWEDINT Joint Synchronization Course;
- Air-Cyber Mission Assurance;
- NIFC Cyber Conference;
- 3rd Romanian Military Thinking Conference;
- TIDE Sprint;
- ISR Capability Study;
- JISR and Big Data;
- AirC2 Cluster;

- Support to IT AF AI Study concerning the use of AI within C2;
- White Paper Planning in JADO;
- Rotary-Focus Working Group F-35.

Annual Joint Air and Space Power Conference. The annual Joint Air and Space Power Conference convened with very distinguished speakers and high-level panellists from various nations in Essen, Germany, 7–9 September 2021 under the topic 'Delivering NATO Air & Space Power at the Speed of Relevance'. One panel dealt with the cancelled 2020 conference theme 'Leveraging Emerging Technologies in Support of NATO Air & Space Power'. A very comprehensive Read Ahead was published to provide a good foundation for further discussions.



Think Tank Forum (TTF). The 7th TTF took place from 24–25 March 2021, for the first time in a virtual format. The year before, in 2020, the TTF had to be cancelled on short notice due to the developing COVID pandemic on European soil. As in previous years, the objective of this forum was to provide a venue for the participating national Air Warfare Centres, national HQs/staffs and A&S Power related academic institutions to share perspectives and engage in collaborative discussions and critical thinking on current and emerging A&S topics. 13 topical areas, many of them supposed to be addressed as well at the JAPCC Conference in September 2021, were identified for further collaboration.

Joint Air and Space Power Network (JASPN) Meeting 2021. The JAPCC hosted the JASPN Meeting on 17 November 2021 with executive representatives from international organizations, including NATO HQ international staff, AIRCOM, NATO STO, NSPA, European Air Transport Command (EATC), EDA, European Air Group (EAG), SBAMD COE, IAMD COE, C2 COE and AO COE. Similar to the TTF, the JASPN meeting helps to develop better synergies within the A&S Power community by bringing together NATO and European international organizations (in contrast to the TTF as a meeting with national entities). The main objective of this meeting is to share information regarding the transformation of Joint A&S Power to gain awareness of functional areas and main interests and discuss potential areas of co-operation and prevent duplication of effort. Prominent discussion areas at the JASPN Meeting 2021 included the requirement to stipulate common terminology and definitions for the realm of Multi-Domain Operations (MDO) or JADO, cross-border mobility and necessary diplomatic clearances, emerging technologies in AirC2 and future of support of A&S operations. The overall list of topics and cooperation areas was recorded in the JASPN 21 Collaboration Matrix.

NATO's Long-Term Military Transformation (LTMT). The NATO Long-Term Military Transformation (LTMT) programme is ACT's process for anticipating and preparing for the ambiguous, complex and rapidly changing future security environment. To provide a foundation to this process, ACT (supported by Nations, NATO organizations and COEs) conducts a foresight analysis and a comprehensive look at the global security environment and describes it in two main documents, the Strategic Foresight Analysis (SFA) and the Framework for Future Alliance Operations (FFAO). In March 2021, the new LTMT programme of work was approved to be aligned and supportive to NATO Warfighting Capstone Concept (NWCC) and Warfare Development Agenda (WDA) development timeline. Wide-ranging SFA is therefore supplemented by strategic foresight analysis of specific regions of importance to the Alliance by strategic foresight regional perspective reports and papers oriented on North Africa and Sahel, Russia, Arctic, the Indo-Pacific and the Black Sea. Following SFA integration in WDA will result in an understanding and description of the 'Future

Operating Environment.' It will provide an analysis and a description of global trends, the future character of warfare and the military implications for the Alliance. JAPCC supported this programme in 2021 by participating in the Indo-Pacific webinar which was held 29–30 June 2021. Outcomes, development and publication are planned for late 2021. The Black Sea webinar was held on 16 November 2021. Development and publication are planned for March 2022. Implementation of their findings and conclusions across JAPCC activities ensures that its products are relevant to emerging security challenges and coherent with the coalition highest level guidance. JAPCC will continue to support the LTMT in 2022 as requested by ACT.

European Safety & Security Professionals Network. This activity provides the JAPCC with connections to both industry and academia and allows the sharing of best practices in near real time. The network is hosted and facilitated by The Hague University of Applied Sciences (THUAS) who benefit from JAPCC support in terms of a military perspective on safety and security as well as curriculum development. In the course of 2021, the JAPCC has provided a substantial briefing to Year 1 students to introduce them to the many NATO aspects of their chosen subject as well as supporting a Counter-Terrorism Minor. In addition, the JAPCC is mentoring three students who have chosen to pursue a military-orientated subject for their thesis in Year 4. The JAPCC set the study topic and is providing mentorship throughout a six-month internship during which the thesis is being developed. The intention is to publish the final thesis in the form of a JAPCC White Paper. The 2020 subject looked at 'Resilience against Hypersonic Threats' while the 2021 subject is 'Possible Future Approaches to Asset Protection'. The JAPCC will leverage THUAS support in developing a possible International Standard for Asset Protection, as discussed elsewhere in this report.

Aircraft Cross-Servicing (ACS). In 2019, SHAPE reactivated the ACS programme. JAPCC is supporting AIRCOM by providing guidance and recommendations on the most effective and efficient way to rebuild the ACS capability in the area of processes, organizational structure, and documentation, and assess potential additional ACS capability options for future employment to enhance

this operational capability. JAPCC, as the custodian of the Allied Aircraft Cross-Servicing Publication (AASSEP-13), provided the ratification draft of the publication. In April 2020, STANAG 3430 was promulgated. This version only focusses on the basic cross-servicing activities and constitutes the first level of implementation of the ACS programme. As of October 2021, 19 nations have ratified this STANAG. It is now part of the five-year cycle review. In December 2020, the custodian posted a comment matrix review on the NSO forum. Up and until now, no comments have been recorded in this file.

During the Spring ASSEWG, the JAPCC was asked to assist with exploring ACS opportunities for the Space domain and UAS/Remotely Piloted Aircraft Systems (RPAS).

JAPCC approached the Space domain tasking by mapping ACS activities with the architecture of Space domain elements. The outcome was that no viable ACS requirements could be identified. With respect to the RPAS tasking, the JAPCC, in close coordination with AIRCOM/A4, drafted an ACS/RPAS approach. Nations have been requested to assess this approach and provide additional input during the upcoming ASSEWG.

Joint Personnel Recovery (JPR). The JAPCC continues cooperating with the US Joint Personnel Recovery Agency (JPRA) within the Multinational Capability Development Campaign (MCDC) programme. The previous cycle's project (2019–2020) 'JPR 2040 – A global perspective' was completed, and the final document was published and released in March 2021. JAPCC is now directly involved in the 2021–2022 cycle's project, entitled 'JPR Self Evaluation Guide'. Currently, there is a lack of an internationally approved self-evaluation guide for partner nations and organizations to evaluate their respective PR programmes. The project scope is to examine the processes associated with each PR functional area of a partner's PR system with an aim to develop a common baseline in which each partner can then evaluate their own PR programme. Where there are gaps or seams, the baseline and other project work could allow for efficient closing of those gaps. Critically, this project will not make recommendations on specific types or quantity of hardware options – other than to make possible recommendations with respect to interoperability issues.

In 2021, JAPCC also supported organizations such as EDA and the Mountain Warfare COE attending their PR related event, providing expertise to exchange useful information and reinforce mutual knowledge through capability and organizational briefings.

JAPCC participated at the 40th Project Team Personnel Recovery (PTPR) meeting in Ferrara on 17 and 18 October 2021. The two main objectives of the meeting were to discuss the approaches to JPR capability development and declare the Initial Operating Capability (IOC) for the EDA Tactical PR Mission Simulator (TPRMS) project. During the meeting, the JAPCC project 'JPR in urban environment' was presented.

Air-to-Air Refuelling (AAR). JAPCC's AAR SME continued to lead NATO's Air to Air Refuelling Working Group (AARWG) in support of the NATO Air Force Armaments Group (NAFAG) and Military Committee Air Standardization Board (MCASB). In this role, the AARWG completed the ratification and promulgation of a new technical and procedural standard for Automated Air to Air Refuelling (A3R). Additionally, JAPCC AAR SMEs continued to conduct presentations focused on the education of AAR experts and increasing interoperability within the AAR enterprise worldwide, although at a reduced capacity due to the COVID-19 pandemic. The AAR SMEs continue to meet with NATO HQ IS-DI and EDA on a quarterly basis to ensure that the strategic direction of the three agencies remains pointed in the right direction.

Air Transport (AT). The JAPCC's AT SME organized the biannual meeting with allied partners to make progress in the field of Air Mobility. The presentations and discussions were conducted in a virtual environment due to the COVID pandemic. These meetings are also used to determine if the STANAG's, under the JAPCC custodianship, are still suitable, current and properly responding to the interoperability requirements. Also, the WG has discussed the standardization proposal for the Combat Control Team. This document describes the requirements, capabilities, training, and the certification and qualification programme. Moreover, a possible collaboration with the Air Force Operation Energy Department had been introduced. Finally, the AT SMEs continued to reinforce the importance of the relationship with NATO HQ IS-DI and EDA

to ensure that the partner's strategic directions remain aligned.

Maritime Air Coordination Conference (MACC). The JAPCC continues to represent ACT in the Bi-SC chartered MACC, which aims to advance Maritime and Air Component coordination and integration within NATO. The JAPCC hosted this year's MACC, in person, on 5 October 2021. The conference was co-chaired by the JAPCC AD and the Commander of Maritime Air NATO and met in conjunction with the Air Maritime Coordination Working Group (AMCWG) and the Maritime Air Controlling Authority (MACA) Conference. The theme of this year's conference was 'Carrier Strike Group – C2 within NATO'. This topic reflects the growing number of Carrier Strike Groups within Europe and the contribution their advanced weapons systems can bring to NATO operations. The conference also focused on maritime and air involvement in SACEUR's Deterrence and Defence of the Euro-Atlantic Area (DDA) efforts. The MACC was attended by a total of 24 participants from two NATO entities, two NATO COE's, and nine NATO nations.

Participation in the Air and Missile Defence Committee and Subordinate Bodies. The JAPCC is an active participant in the newly established IAMD Policy Committee and its subordinate working and focus groups. In 2021, the Air and Missile Defence Committee merged with the Defence Policy and Planning Committee on Missile Defence, forming the IAMD PC. While the exact composition of IAMD Policy Committee supporting bodies are being determined, the JAPCC maintains its engagement as a non-voting member of the IAMD Policy Committee (JAPCC AD) and through regular engagement supporting the development of IAMD policy.

JAPCC is a member of the Joint Capability Group on Surface Based Air Defence and supports the Capability Area Facilitator GBAD, under the Capability Development Establishment Board (IS/IMS); both under the responsibility of the CNAD. Furthermore, JAPCC SMEs support the Ballistic Missile Defence Operational User Group biannual meetings and the development of NATO BMD systems and concepts.

Aerospace Capability Group 2 (ACG2). During 2021, workshops on Multinational Cooperation Initiatives, Dig-

itally Aided Close Air Support (DaCAS), Weapon Effectiveness Assessment Methodology, and Airborne Electronic Attack (AEA), took place in the 31st and 32nd meetings of the ACG2 of which JAPCC SMEs are participants. The primary mission of ACG2 is to achieve interoperability between NATO and national forces in effective air engagement by developing and providing standardization in the area of air weapons systems. Among the relevant activities on the meeting agenda, support was provided by the ACG2 to future capabilities and weapon effectiveness methodology for NATO's targeting process.

Aerospace Capability Group 3 (ACG3). The JAPCC is an active participant in the ACG3. In 2021 workshops on C-UAS, NATO Electromagnetic Spectrum (EMS) Strategy, Electronic Warfare (EW)-related NATO terminology, Networked Enabled Weapons (NEWs), Airborne Electronic Attack and Suppression of Enemy Air Defences (SEAD) took place in 31st and 32nd meetings. ACG3 ensures survivability of NATO Nations aerospace assets and achieves interoperability within the organization, thus allowing coherent procurement strategies to be recommended to the member nations. The group drives this forward through a process of technical standardization, cooperation in research, development, demonstrations and equipment procurement.

NATO Electronic Warfare Advisory Committee (NEWAC). The JAPCC's SMEs participated in the 109th NEWAC Plenary Meeting on 15–16 June and provided an update report on the status of MC 485 NATO SEAD policy review. NEWAC enhances NATO's EW capability by providing the Military Committee with advice and recommendations on all EW policy, doctrine, programmes and requirements and implementing MC EW decisions.

NATO Electronic Warfare Working Group (NEWWG). During 2021, JAPCC participated in three workshops of NEWWG. Besides discussing EW issues, NEWWG advises NEWAC on NATO Joint, Air, Land and Maritime EW Doctrine and Policy. Specifically, current tasks are the review of MC64/V.12, ATP 3.6.2 and ATP 3.6.3. JAPCC's SMEs actively contribute to fulfil these tasks.

51st AOWG. The 51st AOWG 'hybrid meeting' was held on 26–27 October 2021 in Kalkar, Germany, and hosted

by the JAPCC. JAPCC AD chaired the meeting, which included 16 in-person participants along with seven virtual attendees representing 12 NATO nations and five NATO agencies. Fifty-three topics were covered in the meeting with a specific focus on ensuring the effectiveness and interoperability of NATO forces engaged in A&S operations. Major items discussed included liaison reports from 19 agencies whose work is pertinent to the AOWG, along with the review of 15 STANAGs. The group also revisited nine terms previously submitted to the NATO Terminology Office (NTO), conducted a final assessment of the AOWG Terms of Reference (TOR) and received briefings from the Senior Air Information Exchange Panel (SAIERP), ACT and the Joint Capability Group for UAS (JCGUAS). Finally, the working group proposed initiatives to expand the AOWG's ability to gather and communicate current issues to the MCASB. The 52nd AOWG meeting is expected to take place in Athens, Greece, in May 2022.

SATCOM Threat Assessment Study. JAPCC performed a Satellite Communications (SATCOM) capability threat and vulnerability assessment report after receiving the RfS from ACT. The report focused on threats and vulnerabilities across all DOTMLPF-I LoD affecting NATO's SATCOM space, static and deployed earth terminals and the supporting C2 segment architecture.

13th Cyber Conflict (CyCon) Conference. JAPCC participated in the first virtual edition of CyCon, organized by the NATO Cooperative cyber Defence COE (NATO CCDCOE), together with decision-makers, opinion-leaders, law and technology experts from governments, military, academia and industry. The discussions included but were not limited to specific topics related to technology and malware development, education and training issues, and provided practical hands-on training.

NATO SWEDINT Joint Synchronization Course. JAPCC's cyber SME prepared and delivered a presentation for the 1st and 2nd virtual Joint Synchronization Course with the aim to enhance the capacity of the practitioners to undertake their roles and responsibilities of joint synchronization more effectively. The purpose of the course is to facilitate the transition from planning to execution in exercises such as TRIDENT

and STEADFAST and teach how to successfully synchronize time, space, forces, and effects to create decision superiority and overwhelm an adversary, whilst protecting the force.

Air-Cyber Mission Assurance. JAPCC personnel participated in the Air-Cyber Mission Assurance virtual meetings hosted by HQ AIRCOM to discuss the different ways that Cyberspace can critically affect air missions. The preparation, execution, targeting and protection of air missions and capabilities prerequisite a solid Cyberspace understanding and integration.

NIFC Cyber Conference. JAPCC personnel participated in a virtual workshop hosted by the NATO Intelligence Fusion Centre (NIFC) dedicated to the various hostile cyber actors. It is crucially important that the Cyberspace Community of Interest (CoI) establishes a baseline on the capabilities, organization and intent of specific hostile cyber actors to be able to defend its infrastructure and assets in this highly contested and congested domain.

3rd Romanian Military Thinking Conference. JAPCC provided a speaker to the 'Emergent and Disruptive Technologies Applications in Planning Military Operations in Cyberspace' panel to present the role of Cyberspace in the future JADO, and specifically, how the integration of emergent and disruptive technologies in the planning process can enhance the resilience, situational awareness and speed of the Alliance across all domains.

TIDE Sprint. The 'Think-Tank for Information Decision and Execution (TIDE)' Sprint Events normally take place twice a year, every spring and every fall. This year both events took place virtually due to COVID-19. The aim is to bring together operators, managers, industry and academia to improve the interoperability, resilience and agility of NATO.

Intelligence Surveillance and Reconnaissance Capability Study. The JAPCC started and completed a new study on the feasibility of supporting NATO Intelligence Enterprise (NIE). This project is based on an RfS from SHAPE and aims at investigating new capabilities for NATO. The project will complement NATO Alliance

Ground Surveillance Force (NAGSF) and propose mitigating capability limits with new and innovative multi-domain approaches. The research was focused on establishing an ISTAR capability to complement NAGSF, mitigate ISR gaps, and ensure the availability of a capability to support SACEUR during the entire spectrum of conflict. The White Paper 'Establishing a NATO-owned Intelligence Surveillance, Target Acquisition, and Reconnaissance capability' assesses an ACO operational requirement statement to justify the costs (under the new common-funded Capability Development Governance Model) for establishing a NATO-owned ISTAR capability.

JAPCC has completed the study. The analysis was conducted by a team of SMEs to identify gaps in NATO ISR, propose solutions and future prospective. The ambition will be to obtain a study with a concept of proof on the way ahead to identify the requirements and increase NATO ISTAR capability.

JISR and Big Data. JAPCC was engaged (via RfS) by the IT AF to approach an initial study on Big Data and ISR. Starting from the idea of digital revolution, the endless use of data is transforming the way we live and work. Simultaneously, new technologies through data are providing great opportunities to make military operations different from the past. C2 and MDO are undergoing profound transformations as the availability and transmission of data increase exponentially. In this context, the use of the vast amounts of data enables ISR to provide more accurate and timely analysis to support the decision-making process and situational awareness at all levels. Recently, competitor countries have been exploring new technologies to gain an advantage in international competition and seek significant benefits from increasingly available data in military operations. The key challenge is the comprehension and ability to understand the significance of Big Data and manage it so that NATO can finally exploit its potential and maintain information dominance.

The project analysis includes addressing the problem of managing large volumes of data and information for supporting the decision-making process. This kind of approach aims to deliver the first assessment and recommendations with which nations and organizations can develop several new analysis models. In the future,



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it is predictable that data management and ISR will remain the key to success as long as decision-makers at every level understand and manage the chaotic world of data. Effective transformation of ISR through the combination of Big Data and other emerging technologies will result in enhanced fused-data analysis, timely information sharing, actionable intelligence and faster decision-making processes, which will ensure information superiority in both conventional and non-conventional warfare. The project is not limited to the ISR community but will engage many interested stakeholders. The White Paper 'Big Data Management in ISR and New Technology Trends' was published in May 2021.

AirC2 Cluster Kalkar and Uedem. In times of crisis or conflict, NATO will stand up a JFAC to plan and execute the air element of a joint operation. The JFAC contribution can be NCS or NFS-based. Training, preparation, stand-up and execution of NCS- and NFS-JFAC's must be standardized and streamlined to ensure smooth initiation, execution and, if required, seamless handover from one JFAC to another. The fact

that a CAOC, an NCS JFAC (GE) and the JAPCC are physically co-located in the Kalkar area offers the unique possibility to create a nucleus for a pool of knowledge in the field of C2, the AirC2 cluster. The cluster will not rewrite doctrine, policies or CONOPs. The cluster will support existing processes from a working level perspective with practical solutions for the work floor in the fields of training, preparation and execution. Practically, the cluster supported the review process of the AirC2 CONOPS. Furthermore, cluster efforts should highlight problem areas and shortfalls to develop solutions for mitigation measures. The JAPCC is contributing with experience and knowledge during workshops and product development.

Support to IT AF AI Study Concerning the Use of AI within Air C2. The HQ of the IT AF requested the support of the JAPCC to study current planning capabilities and possible adaptation of technology-assisted / AI applications within the area of AirC2. The study specifically looked into the possibilities to integrate operational and training systems (applications) that may assist the current planning process and/or decision cycle in general. The goal, to produce a study with a proof of concept of the way ahead to implement tools and applications usable for the AirC2 process within the military scope and in the context of AI, was achieved by delivering a White Paper in February of 2021.

White Paper Planning in JADO. NATO is facing new threats in the years to come. In order to be still dominant in the battlespace, the concept of JADO is introduced. JADO is meant to tear down domain boundaries to challenge the opponent with multiple dilemmas across domains simultaneously. JADO is on the verge of its development. Currently, the concept is approached mainly from a technological perspective. This is understandable, as technology will be the key enabler to increase NATO C2 agility. In the next step, JADO has also to be developed towards an operational concept and the related C2 constructs and arrangements. Planning will play a significant role in this. To speed up effect generation to the speed of relevance, planning has to be more flexible, faster and more collaborative. The White Paper will try to identify the factors of influence on planning to finally recommend possible ways and means to execute planning to leverage the concept of JADO.

The Rotary Wing Focus Group (RWFG). The JAPCC RWFG was established to increase awareness and coordination among the Rotary Wing SMEs on helicopter related activities and events. The group defines the way ahead for the different projects and objectives and shares workload in the different fields. The RWFG also reaches out to other organizations, e.g. CAOC Uedem and the GE AOC Kalkar, sometimes to the Allied Air Command Ramstein, to optimize results using SMEs' experiences.

Today the RWFG counts four JAPCC SMEs with varying backgrounds from three different nations, split between the AOS and CA branches within the JAPCC.

Examples of projects and objectives to be managed by the RWFG are studies and white papers regarding future rotorcraft in support of the NGRC concept for 2035–2040 and beyond, development and maintenance of NATO standardization, improvement of interoperability of helicopter operations doctrines in cooperation with the NATO Helicopter Inter Service Working Group (HISWG), as well as liaison with the Joint Capability Group Vertical Lift (JCGVL).

5th Generation Integration Efforts in the European AOR. Integrating 5th generation systems into existing allied forces has been an effort for many years. As the F-35 is now in the European theatre, the effort has been increasing, with much of the 'shared' work primarily being led by three organizations, with significant participation of partner groups, including the JAPCC.

JAPCC Involvement in NATO Activities and Working Groups

JAPCC personnel fill chairmen, co-chairman, and panel positions on numerous NATO steering bodies as well as providing custodianship to a number of NATO doctrine documents, as highlighted below.

Chairmanships

- Air Operations Working Group (AOWG);
- Co-Chair the Maritime Air Coordination Conference (MACC);
- NATO Air-to-Air Refuelling Working Group (AARWG);
- NATO Air Transport Working Group (ATWG);

- Doctrine, Organization, and Interoperability (DOI) Panel, NATO Force Protection WG;
- Co-Chair the NATO STO AVT-359 Study about Hypersonic Capabilities.

Exercise / Campaign

- Nimble Titan 20/23, Wargame Control Group and Analysis Team;
- Operations Control Group Joint Project Optic Windmill (JPOW);
- OPFOR Air-, Space- and Cyberspace Support to Exercise STJU21;
- OPFOR Air, SBAMD, Space, Cyberspace, and ALI Support to Exercise RAAM21;
- Exercise STLE21, Development of ICC Products, ATO and ACO.

Panel Member / Working Group

- Allied Future Surveillance & Control Project Group (AFSC PG);
- Air Capability Group 3 and NATO Electronic Warfare Air Group;
- NATO AEW&C Programme Management Organization Board of Directors (NAPMO BOD);
- JPR Forum;
- Integrated Air and Missile Defence Policy Committee (IAMD PC);
- NATO Special Operations Headquarters (NSHQ) in Support of Air Development Program (ADP) for SOF Aviation;
- Personnel Recovery / Search and Rescue Working Group (PR/SAR WG);
- Force Protection Working Group (FPWG) and Force Protection Advisory Group (FPAG);
- NATO Army Armaments Group / Joint Capability Group Vertical Lift (NAAG/JCGVL);
- Helicopter Inter Service Working Group (HISWG);
- Joint Capability Group Vertical Lift (JCG VL);
- Joint Capability Group Unmanned Aircraft Systems (JCGUAS);
- NATO Counter Unmanned Aircraft Systems Working Group (C-UAS WG);
- Joint Capability Surface Based Air and Missile Defence (JCGSBAMD);
- BMD Operational User Group (BMD OUG);
- GEWG on Communication and C2 in Missile Defence;

- Maritime Operations (MAROPS) Working Group;
- NATO Bi-Strategic Command Space Working Group (BiSCSWG);
- NE SBAMD Policy Group;
- NE Knowledge Network on SBAMD;
- European Air Group Cyberspace Working Group;
- Cyberspace Annual Discipline Conference;
- NATO Cooperative Cyber Defence COE (CCD COE) 13th International (virtual) Conference on Cyber Conflict;
- TIDE Sprint Events (virtual);
- CNAD/NAFAG/ACG3 – Aerospace Capability Group on Survivability;
- NEWAC/NEWWG – NATO EW Concept & Doctrine;
- STO AVT 329 study (Next Gen Rotorcraft Impact on Military Operations);
- STO SCI-301 Study Group;
- NATO Science for Peace and Security (SPS) – The Vulnerabilities of the Drone Age: Strategic Foresight Planning for 2035.

Doctrine Development and Standards

Over the last year, the JAPCC led and/or participated in the following doctrine efforts:

Author and Custodian of MC-0656, Military Committee (MC) Policy for Force Protection of Alliance Forces. Like ATP-3.3.6, the JAPCC is both the original author and remains the custodian for this policy document which is designed to set the context for the delivery of FP across the Alliance. The next review of FP Policy will commence once the current round of doctrine reviews is complete, probably sometime in the middle of 2023. However, as FP 'best practice' is continually evolving and new ideas and/or approaches are being captured during the current round of doctrine updates, the JAPCC has continued to maintain throughout 2021 a 'working master' of the FP policy documents so that once a formal review commences, a 'first discussion draft' is almost immediately available, thus saving both time and effort.

AJP 3.3 Allied Joint Doctrine for Air and Space Operations. The JAPCC is the custodian of NATO's doctrine on joint air operations, AJP 3.3, Allied Joint Doctrine for A&S Operations. JAPCC succeeded in drafting a new version of the AJP 3.3 and had it ratified and promulgated (old version was dated 5 November 2009). Simul-

taneously, JAPCC prepared the request for feedback required for the next edition of AJP 3.3. A new doctrine task was issued in early 2017, and the first draft of Edition C (Working Draft 1) was published in November 2017. The Study Draft 1 (SD1) was published in December 2018, and a new draft (SD2), incorporating all feedback coming from NATO nations and NATO bodies, was published in November 2021. Edition C will enter the ratification process in the 2nd quarter of 2022.

Custodian of AJP-3.14, Allied Joint Doctrine for Force Protection. JAPCC FP is the custodian of this publication and is immersed in conducting an in-cycle review of the publication; work that has continued throughout 2021. The review of this publication has become a protracted process given the myriad of inputs that have been received since the 'Request for Feedback' was initiated by ACT in late 2017. At the time of writing, a first Study Draft has been issued on 20 May 2020 and by the 5 October 2020 deadline for comments, a total of 742 comments have been received from 15 stakeholders. Of these comments, 382 came from 14 of the 15 stakeholders, all of whom had participated in the seven Writing Team meetings that the JAPCC ran during the period June 2017 to December 2019. These comments have subsequently been incorporated into what is described as Study Draft 1a which was posted on the Allied Joint Operations Doctrine (AJOD) Forum on 16 March 2021. Unfortunately, the remaining 360 comments come from a single stakeholder who has not so far engaged in the review process; this has created a challenge for the Writing Team as many of the comments are at odds with the work done to date. The proposal going forward is to hold a face-to-face Writing Team meeting at the JAPCC, at the earliest opportunity, with the specific task of adjudicating the remaining comment matrix with the intent of delivering a Harmonisation Draft to the Nations at the earliest opportunity – target date mid-2022. This meeting was scheduled for January 2022, but resurgent COVID infections and the emergence of a further variant has pushed this session back until at least March/April 2022.

Author and Custodian of ATP-3.3.6, NATO Force Protection Doctrine for Air Operations. This publication is JAPCC authored and was first produced in 2010 at the request of the NATO AOWG with the first edition being

promulgated in 2015. Since then, the JAPCC has maintained a 'working master copy' of the document where changes and developments have been captured as they have occurred. The AOWG mandated a review of ATP-3.3.6 in late 2019 and the JAPCC custodian delivered a Study Draft of this second edition to the nations on 28 October 2020. By the 12 March 2021 deadline for comments, a total of 224 comments from five stakeholders had been received. The intention is now to complete the ongoing review of the overarching AJP (also being undertaken by the JAPCC) before holding a face-to-face Writing Team meeting at the JAPCC with the purpose of adjudicating the 224 comments received and incorporating them where appropriate to develop what will hopefully be a Harmonisation Draft of a fully revised publication. It is envisaged that the Writing Team meeting will take place at the JAPCC in early summer of 2022 with the output being presented to the fall iteration of the AOWG. Note that a part of the revision of this publication is now titled 'NATO Force Protection Doctrine for the Force Protection of Air and Ground-Based Space Operations'.

Custodian of AD 80-25, Allied Command Operations Force Protection Directive. The JAPCC remains the custodian for this document on behalf of SHAPE. Like other documents that JAPCC FP is responsible for, a 'working master' of this document is maintained to ensure that when a future review becomes necessary, the task is much simplified because ideas and developments have been captured overtime to ensure that a first revised draft can be created almost instantaneously once a review is required. Work has continued in parallel to other doctrine development work throughout 2021 to ensure the 'working master' is maintained. On 6 September 2021, a discussion took place between SHAPE FP and JAPCC to establish a timeline for the review of AD 80-25 with the aim of having a Study Draft ready for COS SHAPE by the early part of 2023; this assumes the ratification by then of AJP-3.14, Allied Joint Doctrine for Force Protection, as discussed elsewhere in this report.

ATP 3.3.4.1/3/4 Custodianship. The new editions of these studies were reviewed and ratified during the year. The ATP 3.3.4.4 has been under review and may require an updated version. As the JAPCC chairs the NATO ATWG, it continues to manage the focus of the AT community. The JAPCC also continues to be a

contact point for coordination between NATO and EU organizations involved with AT.

ATP 3.3.4.2. The JAPCC remains active in the management of AAR doctrine, standards and procedures. The JAPCC continued its management of the global AAR compatibility and clearance matrix and built upon its relationships with other key AAR stakeholders, producing, updating and disseminating standardized AAR documents (six STANAGs/four NATO SRDs/one SRD template/26 national and organizational SRDs). While the pandemic prohibited in-person AAR working group meetings, the JAPCC continued to lead the working group, facilitating the updates for multiple STANAGs.

ATP-49 Custodianship. Within the HISWG, the Helicopter Operations Panel (HelOps Panel) is responsible for helicopter standardization. To improve the interoperability of staff and operators, the HISWG is tasked by the Military Committee Land Standardization Board (MCLSB) to restructure the entire HISWG standardization portfolio. The ATP-49 is being revised as ATP-3.2.49. This revised standard will consist of a top-level document supplemented with identified operational areas describing TTP. In coordination with the chairman of the HelOps Panel, the JAPCC, as custodian of the ATP-49, is leading the revision task, which started in April 2018 and is expected to be accomplished by mid-2022. The future ATP-3.2.49 custodianship will remain within the JAPCC.

Helicopter Underslung Load (USL) and Helicopter Underslung Load Equipment (HUSLE) Certification & Interoperability Database. On request of the HISWG and in close coordination with the HUSLE panel, the JAPCC is developing a helicopter USL/HUSLE certification & interoperability database. The request is in accordance with the recommendations of the USL certification study, published by the JAPCC in November 2017.

The database will provide NATO nations and partners an information and guidance tool regarding relevant helicopter USL and HUSLE aspects and procedures. Furthermore, the database is to be used as a reference guide to confirm and/or determine if a USL can be accepted for transportation by any available helicopter.

JAPCC has built a basic initial database with the information provided by NATO and partner nations. In the near future, with the help of better-suited software, a revised HUSLE database will come online.

Critical Asset Protection Handbook. JAPCC involvement in NATO Joint FP has been such that it has become apparent that one of the primary challenges in taking FP forward for the Alliance is the almost constant 'churn' in FP posts within the NATO organization. This means that every time NATO comes to review doctrine, all aspects of the delivery of an FP capability are discussed. However, it is offered that there are a significant number of enduring principles, that while they might require subtle development as a result of changes to the operating environment, remain in essence unchanged. The concept of this project is to capture these long-standing principles in a generic, component agnostic manner to create a document that reflects the rarely if ever-changing fundamental principles that are the core of effective and resource-efficient FP. The development of this document has been ongoing throughout 2021 with a view to publishing a discussion draft immediately after the ongoing doctrine work discussed elsewhere is complete. A releasable discussion draft is forecast to be ready by the end of 2022. The end result should be a document that requires little review and, in turn, reduces the burden of conducting a doctrine review because doctrine will be more succinct.

Development of an International Standard for Asset Protection. As a development of the Critical Asset Protection Handbook, the long-term goal is to capture in the form of an International Standards Organization (ISO) standard, the core of what we currently describe as FP. This work will ensure that an agreed, consensus-based approach to Asset Protection, captured in an international standard, will eventually sit at the heart of NATO's approach to FP. Work to develop both the content of the standard in the form of the Asset Protection Handbook and research to establish the approach necessary to develop an international standard has continued throughout 2021. The predicted timeline for the delivery of a standard is by the end of 2024.

NATO Cyberspace Annual Discipline Plan. JAPCC, for the third year, assisted in the writing of the Cyberspace

DAP, primarily in the area of identifying the education and training requirements for the training audience but also for the Cyberspace SMEs involved as augmentees supporting the exercises either as OPFOR or as EXCON in the development and execution phases.

JAPCC Doctrine Development (Custodianship and Contribution)

- MC 064/12 NATO EW Policy;
- MC-0610, FP Policy for NATO-Led Operations (Custodian);
- MC-0656, Policy for FP of Alliance Forces (Custodian);
- MC 485/2 NATO SEAD Policy (Custodian);
- AJP-3.3 Custodian;
- AJP 3.6 NATO Joint EW Doctrine;
- AJP-3.14 Allied Joint Doctrine for FP (Custodian);
- AJP-3.3.2(A) Allied Joint Doctrine for Close Air Support and Air Interdiction;
- AJP-3.3.3 Air-Maritime Coordination;
- AJP-3.7 Allied Joint Doctrine for Recovery of Personnel in a Hostile Environment;
- ALP-4.3 Air Forces Logistic Doctrine and Procedures;
- ATP-3.3.2.1 Tactics, Techniques and Procedures for Close Air Support and Air Interdiction;
- ATP-3.3.2.2 Joint Terminal Attack Controller Program;
- ATP 3.6.2 EW in the Land Battle;
- ATP 3.6.3 EW in the Air Battle;
- ATP-3.3.3.1 Maritime Air Coordination Procedures;
- ATP-3.3.4.1 Tactics, Techniques and Procedures for NATO Air Movement Operations (Custodian);
- ATP-3.3.4.2 Air-to-Air Refuelling (Custodian);
- ATP 3.3.4.2.1 SRD 1 Guide to Obtaining AAR Clearances and Compatibility;
- ATP 3.3.4.2.2 SRD 2 Recommended AAR Aircrew Certification and Currency;
- ATP 3.3.4.2.3 SRD 3 Tanker Capabilities;
- ATP 3.3.4.2.4 SRD 4 Tanker/Receiver Clearance Compatibility Matrix;
- ATP-3.3.4.3 Tactics, Techniques and Procedures for NATO Air Transport Operations (Custodian);
- ATP-3.3.4.4 Tactics, Techniques and Procedures for NATO Airborne Operations (Custodian);
- ATP 3.3.4.5 AAR Boom-Receptacle Requirements;
- ATP 3.3.4.6 AAR Pro-Drogue Characteristics;
- ATP 3.3.4.7 AAR Signal Lights in Hose and Drogue Systems;
- ATP-3.3.6 NATO FP Doctrine for Air Operations (Custodian);

- ATP-49 (STANAG 2999) Use of Helicopters in Land Operations (Custodian);
- AD 80-25 ACO Force Protection Directive (Custodian);
- MPP-02 Vol I Helicopter Operations from Ships Other Than Aircraft Carriers (HOSTAC);
- MMP-02 Vol II Multinational Through-Deck and Aircraft Carrier Crossdeck Operation (MTACCOPS);
- AASSEP-13 Allied Aircraft Cross-Servicing Publication (Custodian);
- Functional Planning Guide for Joint Air Operations Planning (FPG AIR);
- Cyberspace Discipline Alignment Plan (DAP);
- NATO IAMD Policy;
- NATO Concept of Employment (CONEMP) Digitally Aided Close Air Support (DACAS).

impact of COVID-19

Despite COVID-19, JAPCC was able to conduct the annual TTF, the annual Joint A&S Power Network Meeting and the annual Joint A&S Power Conference thanks to a lucky choice of dates almost undamaged. However, JAPCC was able to conduct its annual SC and SRC meetings via virtual means. Many activities and projects normally worked in face-to-face settings were transitioned to virtual coordination. Though some work slowed down or stagnated temporarily, the JAPCC continued to forge ahead and produce in its role as the catalyst for transformation of NATO A&S Power.

2022 outlook

2022 Focus Areas

Introduction. JAPCC regularly reviews and transforms its Focus Areas, PoW and organizational structure to ensure that it can continue to address current and future challenges and to provide key decision-makers effective solutions on A&S Power challenges, to safe-

guard NATO and the nations' interests. The JAPCC Focus Areas are approved by the SC at their annual meeting. In the broadest sense, the JAPCC could address any topic or capability within the realm of A&S Power, but closely following current developments throughout the world and within NATO, there are several topics requiring more focused attention than others.

NATO JADO. The JAPCC will continue to support ACT efforts to define MDO for NATO as well as broader support to the NATO Warfighting Capstone Concept. Although timelines are subject to change, JAPCC anticipates an early push to define NATO terminology and concepts in 2022.

The NATO JADO team will also support efforts to incorporate JADO/MDO concepts into Exercise JPOW during its 2022 exercise development cycle supporting 2023 execution.

Several research projects discussed in this report will continue under the JAPCC NATO JADO umbrella, including an exploration of possibilities for JADO education within NATO.

Space Support in NATO Operations. NATO operations are heavily dependent on data, products and services from Space assets, specifically in the areas of Communications, Intelligence, Surveillance and Reconnaissance (CISR), Global Positioning, Navigation and Timing, Meteorology, Friendly Force Tracking, Space Situational Awareness and Early Warning. In 2022, the JAPCC's effort is to ensure NATO's Space dependencies are understood and addressed appropriately, among other organizations, in particular within the BiSCSWG.

In addition, the JAPCC Space Team, in close cooperation with Space experts from the NCS, will support training and exercises, especially RAAM22 as well as STJU 22 to assess and refine operational concepts, C2, command relationships for NATO's newest operational domain Space and to deepen the understanding of the further integration of Space in exercises and operations.

In 2022, the newly established NATO Space COE in Toulouse, FR is expected to reach IOC. In the course of

the establishment of this COE, coordination between both centres will take place and depending on the situation, certain tasks and work packages will be transferred from the JAPCC to the Space COE, including the role as Department Head. An exact delineation of focus areas as well as future emphases in the respective portfolio cannot be defined at this time.

However, there is concern that the establishment of the NATO Space COE may have an impact on the JAPCC, particularly in the acquisition of experienced Space SMEs, who are already very limited in number and for whom multiple organizations in NATO, as well as in allied nations, are competing.

Exercise and Experimentation Support. JAPCC will continue to provide substantial support to NATO exercises in 2022 by providing highly dynamic and realistic OPFOR Air, Space as well as A&S related cyber play in support of OPFOR's CONOPS and exercise training objectives by building and executing an OPFOR Air Tasking Order (ATO) and injecting incidents through the Joint Exercise Management Module (JEMM). The expertise brought by the JAPCC OPFOR Air Team SMEs in a (multi-layered) Air Defence, Tactical Ballistic Missiles, Space, Cyber and Intel play will be integral for upcoming exercises such as RAAM22 at AIRCOM and the STJU series at the JWC. The JAPCC will continue to support the JWC in developing and updating exercise scenarios with the latest developments in joint warfare regarding air, space and the related cyber aspects.

Also, JAPCC will further support Nimble Titan and JPOW in core functions in developing, executing and analysing the overall campaign and events.

Surface-Based Air and Missile Defence. JAPCC will continue to support the constantly broadening field of NATO air and missile defence in various NATO and national committees, working groups and study efforts. Also, the emerging and disruptive technology of hypersonic capabilities will remain a significant focus area.

In the area of E&T, JAPCC will continue to support the NATO common E&T Programme by hosting the

first CETP course and coordinating with AIRCOM, CCSBAMD and the CAOCs for a smooth handover of CETP to the IAMD COE in 2023.

Logistics. NATO is required to be able to carry out a range of smaller but demanding operations, and the Alliance must retain the capability to conduct large-scale high-intensity operations, including in support of collective defence. To undertake these types of operations, the Alliance must be able to launch and sustain these missions. Since only a few allies can independently deploy and sustain their forces, it is important that NATO and its allies continue to pursue collective logistics to provide NATO commanders the greatest flexibility on current and future NATO operations. Therefore logistics work in NATO will be pursued along four main lines of effort:

- Develop more capable and interoperable joint logistics capabilities at the required readiness;
- Optimize C2 of logistics support;
- Improve deployability of NATO forces;
- Enhance sustainability of NATO forces.

JAPCC is engaged in these topics and will continue to be so.

Resilient Basing. Many allies and partners are replacing A&S Power capabilities with new technology, and their units are being prepared to receive, operate and maintain these new resources. Meanwhile, in the operational environment, new and emerging technologies continue to introduce different threat vectors that threaten these military capabilities to include through the increasingly contested domains of Space and Cyberspace. Increasing and evermore insidious threats to our main operating bases and force structures dictate the need to develop and, in some cases re-learn, how we can best protect both force and C2 structures to increase resilience and survivability.

JAPCC has identified the concept of 'Resilient Basing' as a new JAPCC Focus Area. In parallel, a Project Definition Report (PDR) has been developed and subsequently approved. The aim of this 'Resilient Basing' project is to enhance the overall resilience of NATO members A&S Power structures. The next step in this

work is to develop a hypothetical yet realistic base lay-down that will exist in the contemporary operating environment and will have ranged against a spectrum of current and future threats. Following on the development of this scenario, a questionnaire will be developed that will seek to identify, once completed by any 'real' location, how resilient that location is when faced with the threats identified within the scenario. The JAPCC intent is to work with the customer to identify weaknesses and recommend possible solutions in the short, medium and long term. Analysis of a number of locations will also allow trends to be identified that will likely lead to a set of generic recommendations presented in a JAPCC White Paper that will provide a roadmap to increasing resilience.

Joint Precision Strike, including PGMs. The JAPCC will continue to support ACG2 PoW, although COVID-19 restrictions dictate the use of videoconferencing. The advent of network-enabled weapons and recent advances in weapons capabilities have highlighted a need for the Alliance to survey the ACG2 on new issues (i.e. implementation of a Link 16 STANAG, demonstrations the group could support, mission planning tools used by allies, and information exchange requirements) to achieve cross-domain synergies on this subject. Since 2016, the JAPCC has assumed an important role in the ACG2, which will continue to devote much of its effort in the upcoming years toward addressing this priority area.

Electromagnetic Operations (EMO). Within NATO, EMO involves the deliberate transmission and reception of EM energy in the Electromagnetic Environment (EME) for military operations such as communications, navigation, attack, battlespace awareness, and targeting. EMO not only enables operations in each domain but is also the 'glue' that links and integrates military force across the domains of Air, Maritime, Land, Cyber and Space. Even though NATO still recognizes the EME as an operating environment, the Aerospace Capability Group 3 (ACG3) of NAFAG and the top-level EW military committee, the NEWAC/NEWWG, are evolving Electronic Attack (EA), EW, and SEAD to enable the missions and support a NATO Campaign. JAPCC will continue to engage with the aforementioned bodies to provide support with SMEs.

In 2022, JAPCC will deliver the review of the NATO SEAD Policy in support of a series of Military Committee tasks intended to facilitate the implementation of the SEAD Concept of Employment.

Cyberspace. JAPCC will continue to assist in the advancement of Cyberspace as an operational domain within NATO. This enhancement will be achieved by maintaining and reinforcing the network of collaboration within the NATO Cyberspace Col. The research will continue into current and developing trends and technologies in Cyberspace, some of which will be published so that JAPCC SMEs are in the best position to carry on support in the development and understanding of Cyberspace, particularly in how it relates to the projection of Joint Air & Space Power.

The FoM in the Cyberspace Domain project will remain our highest priority during the next year. In collaboration with internal and external experts in Cyberspace and other functional areas, this project will present the criticality and challenges of establishing FoM in contested Cyberspace and recommend approaches on how to proceed in the future with respect to the integration of Cyberspace for the projection of Air & Space Power.

Moreover, the Cyberspace SMEs will continue to support major exercises through the development and execution phases as both OPFOR and EXCON to ensure training objectives can be met, so challenging scenarios are created for the training audience and to raise the collective awareness of Cyberspace for all exercise participants.

JAPCC will also continue to support the development of Cyberspace as a NATO discipline through the ADC and provide expertise on the ADP development.

Exchanging information and collaboration will continue so that NATO and its partners can leverage each other's lessons learned and best practices to improve our levels of expertise and proficiency in the rapidly developing area of Cyberspace. This collaboration will include participation in the CCD COE International Conference on Cyber Conflict, EAG Cyber Committee, SWEDINT course, NEASCOG Cyber Security Task Force and the TSSA.

Of course, JAPCC will continue to assess where its expertise can contribute to cyber projects that emerge in 2022 at the request of NATO, its member and partner nations and JAPCC Sponsoring Nations.

Air Support to Special Operations Forces. JAPCC supported the NSHQ Air Development Program (ADP), participating in the 2021 NATO Special Operation Forces (SOF) Air Conference with a speaker. The conference provided the opportunity to align/update doctrine and training events to real world needs and supported the development of new concepts to counter enduring and emerging threats, such as lack of interoperability, standards and common procedures. It also allows key stakeholders and practitioners of the NATO SOF Air community the opportunity to share lessons learned, create synergistic relationships and discuss current issues and solutions related to developing NATO SOF Air capabilities.

Maritime Air Coordination Conference. The 2022 MACC is scheduled for spring at Northwood (UK). The main topic for the annual Bi-SC Conference is yet to be determined.

JAPCC Joint Air and Space Power Conference, Congress Centre Essen, Germany, 11–13 October 2022. The 2022 Annual Conference will again be the flagship event on the JAPCC's annual calendar. It will bring together senior NATO, national military and political leaders, members of academia and industry partners in a forum that encourages open discussion of issues of strategic interest to the Alliance and partners. The topic for the next JAPCC Conference will be 'Enhancing NATO Air and Space Power in an Age of Global Competition'.

Conclusion

Thank you for taking the time to read the JAPCC Annual Report for 2021. We hope you have found this report informative and that it has given you a greater understanding of and appreciation for the value and relevance of the JAPCC to the Alliance. For more information on the JAPCC, please contact us via email at contact@japcc.org or visit our website at www.japcc.org.

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