

Collective Training & Thinking in JAMD: The Italian JPOWX Experience

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ABSTRACT

Mission Training through Distributed Simulation (MTDS) has established itself as a powerful tool for collective training in the military domain. This potential has been recognized by the Italian Joint Forces Command and has led to the Italian participation in the 10th edition of Exercise Joint Project Optic Windmill (JPOWX) in September 2008. Over the past decade, JPOW has become the world leading Joint Air and Missile Defence (JAMD) exercise where, next to collective training, an important focus is on experimenting with novel air and missile defence concepts, new tactics, techniques and procedures, and testing future capabilities in a multinational live, virtual and constructive environment. In 2008, over 1500 participants from seven nations at three dispersed locations joined JPOWX. The Italian Services participated at AFB De Peel in the Netherlands with simulated capabilities of an AN/TPS-77 radar (Air Force), an Andrea Doria Horizon frigate (Navy), and a SAMP/T unit (Army). These simulations were developed by TNO in JROADS and by ELSAG DATAMAT in Kesem Battlemodel.

In this paper we will describe how the Italian Services used their joint participation in JPOWX to train, exploit, test, and evaluate their recently developed JAMD CONOPS for the first time. We will present the key lessons learned, both from the experimental and the actual mission execution phases of the exercise, with a special focus on mission objectives, analysis and assessment. We will also describe how the exercise participation and use of simulation supported not only joint training and cooperation but also enabled collective thinking on integrating air and missile defence concepts for the Italian Services through the key role of simulation in the envisaged comprehensive Italian JAMD approach. We will conclude this paper by elaborating on the operational, organisational and technical requirements that should be met to successfully accomplish this approach.

ABOUT THE AUTHORS

Lesley Jacobs is a member of the scientific staff in the Defence, Security and Safety Division at TNO since 2001. As training and simulation specialist she has been involved in various (inter)national projects concerning Mission Training through Distributed Simulation (MTDS) and Joint Air and Missile Defence (JAMD). Since 2006, she is programme manager of the Dutch national research programme on Collective Mission Simulation. In 2008, Lesley was also project manager for the Italian participation in JPOWX, for which TNO provided scientific exercise and simulation support. Lesley holds a MSc in Educational Science and Technology from the University of Twente in the Netherlands, with a specialization in Simulation.

Lt. Colonel Paolo Nuvoloni is an experienced Air Defence Officer having served in various national and international Command and Control echelons up to Director of Operations (DO) at ItAF 22nd Radar Squadron. His professional experience includes a tour of duty at the NATO E-3A AWACS Component being employed in a variety of operational and testing & evaluation (T&E) posts and also having held the post of Commanding Officer (CO) of the Italian Air Force Deployable Radar Unit, which was also deployed to the Balkans. He has been the chief of the Italian Air Force delegation at exercise JPOWX. He has been on the Italian Air Force General Staff since 2006, and is currently in charge of the C² and Missile Defence Section within the Plans & Policy Division.

Lt. Colonel Costantino Cioli is an experienced Air Defence Officer having served in various national and international Command and Control echelons, including a tour of duty at NATO Strategic Direction Centre of the Supreme HQ Allied Power Europe, mostly involved in planning and developing theatre operational scenarios. He has been the chief of the Italian delegation as National Representative at JPOWX. He is currently serving on the IT Air Staff in charge of M&S policy specifically on joint and combined interoperability and integration of Air and Missile Defence (AMD) assets.

Captain Roberto Manca is a system test engineer working at the Official Test Centre – Software Development Group of the Italian Air Force since 2002. He has been involved in various projects in the avionic software area, Link 16 integrations together with weapon systems modelling. He has also been involved in several M&S activities within the Italian Air Force including planning the participation and joining JPOWX as Joint Analysis Team member and being appointed as Chief Project Engineer for the Demonstration of the Italian Air Force M&S capabilities last November. He graduated as Computer Science Engineer at Federico II University in 2001. He also received a Master of Science in Scientific Computation from the Royal Military College of Science - Cranfield University in 2004.

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Yntze Meijer is a member of the scientific staff in the Defence, Security and Safety Division at TNO since 2005. He works as operational analyst and has been involved in various (inter)national projects concerning naval air defence. In 2008, Yntze was also responsible for the Italian Navy participation in JPOWX, for which TNO provided scientific exercise and simulation support. Yntze holds a MSc in Aerospace Engineering from the University of Delft, with a specialization in astrodynamics and earth observation.

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JPOW – AN INTRODUCTION

Missile Defence (MD) plays a key role in minimizing the threat of ballistic and cruise missiles to NATO and its deployed forces. Ballistic Missiles present a problem from their destructive potential not only from a military aspect but also from a political aspect due to their potential as a terror weapon towards population centres and debarkation points. Countering this threat is a combined and joint endeavour, and calls for extensive MD exercise opportunities amongst coalition partners.

In 2007, the Royal Netherlands Chief of Defence Staff (CDS) tasked the Royal Netherlands Air Force (RNLAf) to organize the tenth edition of exercise Joint Project Optic Windmill (JPOW), together with its new partners: The United States Strategic Command Joint Functional Component Command for Integrated Missile Defence (US STRATCOM JFCC-IMD), the US European Command (USEUCOM), the United States Missile Defence Agency (MDA), the NATO Strategic Command's ACO and ACT, the German Armed Forces (Air Force, Army, Navy and Joint Forces), the Royal Norwegian Air Force (RNLAF), the Spanish Army (ESPA Army), the Italian Armed Forces (Army, Navy, and Air Force), the Extended Air Defence Task Force (EADTF), and the Royal Netherlands Armed Forces (Air Force, Army, and Navy)¹

JPOWX was integrated with the US Strategic Command (USSTRATCOM) exercise Joint Project Optic Alliance (JPOA), focussing on global missile defence. JPOA-JPOWX was a Combined and Joint Air & Missile Defence (JAMD) Initiative. The main emphasis of the exercise was to conduct a (virtual) large scale "out of region" JAMD exercise focusing on the four pillars of Missile Defence: Passive Defence,

Active Defence, Counterforce Attack / Attack Operations, and BM/C4I. Secondly, the validation of a unique Defence concept with elements of the latest national and NATO Ballistic Missile Defence developments was conducted, with emphasis on the USA Ballistic Missile Defence System's Architecture, and the NATO Active Layered Theatre Ballistic Missile Defence (ALTBMD) Concept.

The exercise concept combined weapon system simulations with a command post exercise, supported by distributed interactive simulation with both distributed and co-located participants over multiple time zones. The simulation architecture combined the integration of live, virtual, and constructive simulation models. Standardized tactical communications combined secure voice and data links. Shared command and control networks made up the command control, and communications structure. JPOA-JPOWX was executed at three dispersed locations in The Netherlands and the United States, from the 1st until the 19th of September 2008, with over 1500 participants from seven nations and various other agencies as listed previously.

THE GROWING ROLE OF EXPERIMENTATION IN JPOW

Concept Development & Experimentation (CD&E), introduced in previous JPOWs, played a more significant and dominant role in this edition. Prior to the mission execution phase of the exercise, the participants were offered, for four days, a unique environment to explore near-term future capabilities and conduct concept development and experimentations. Explored areas included weapon system capabilities, novel concepts, and tactics, techniques, and procedures.

¹ Information on JPOW was obtained from www.jpow.nl

THE OVERALL EXERCISE GOALS

The keyword of the latest edition was “evolution”. Based on the lessons learned, and using the robust infrastructure and architecture, of previous JPOW exercises, it explored the latest US advanced concept of Ballistic Missile Defence Systems of Boost, Midcourse and Terminal Missile Defence.

NATO also played a major role by introducing elements of the ALTBMD Capability One Architecture, such as the Air Command and Control System (ACCS) and Bi-Strategic Commands Automated Information System (Bi-SC AIS), together with the national Theatre Ballistic Missile Defence (TBMD) contributions to the Alliance task. They were organized in accordance with NATO’s Combined Joint Task Force (CJTF) concept. NATO’s vision and preliminary findings of its feasibility report on its concept of Territorial Missile Defence was explored and demonstrated in an extensive manner (ref: www.jpow.nl).

ITALIAN PARTICIPATION - AN OVERVIEW

The main reason for participating in JPOWX with the Italian forces was to train, test, and evaluate the recently developed Italian JAMD Concept of Operations (CONOPS) for the first time in an international LVC exercise environment. With this objective in mind Italy carefully prepared and conducted two national experiments and supported three NATO led experiments. Also, with this overarching objective in mind, four High Level Objectives (HLO) and nine Supporting Objectives (SO), were designed for the mission execution phase.

The Italian Armed Forces participated in JPOA and JPOWX at AFB De Peel in the Netherlands with simulated capabilities of an AN/TPS-77 radar (Air Force), an Air Defence Ship Andrea Doria (Navy), and a SAMP/T (Sol-Air Moyenne Portée Terrestre) unit (Army), depicted from left to right in figure 1.



Figure 1: Italian Participating Units

The simulations of the systems were developed by TNO Defence, Security & Safety in JROADS and, for the

AN/TPS-77 radar model, by ELSAG DATAMAT in Kesem Battlemodel.

The AN/TPS-77 is a mobile, active phased array, long range, L-band, 3D solid-state radar designed to perform airspace surveillance missions. It operates in L-Band frequency, and consists of a Processor Control Group, Transceive Group, Integration Group, Decoy Trailer Assembly, and a Remote Control Terminal.

The Andrea Doria (Horizon) class is an AntiAir Warfare Destroyer. The anti-missile system is based on Principal Anti-Air Missile System (PAAMS) and the combat and control system DCN / Alenia CMS. The combat system is able to manage the arms, datalinks and tactical analysis of information submitted by a dozen of sensors, as well as the integration of data from other ships or aircraft, whether Italian or allies. The anti-missile system is able to launch Aster 15 and Aster 30 missiles, and also has three naval guns OTO Melara as close in weapon system.

The SAMP/T (Sol-Air Moyenne Portée Terrestre) is a Ground-to-Air Medium Range Missile System. A SAMP/T battalion consists of one BOC (Battalion Operational Center) and it’s subordinate Fire Units (FUs). The BOC is an automatic data processing command and control system (C2 system) that provides control and coordination functions to individual FUs that include target acquisition, tracking, identification, threat evaluation and weapon assignment, weapon control and motoring, and data exchange with other systems. Each FU consist a serial of launcher modules able to launch the Aster 30T missile for the medium range interception.

The Italian Armed Forces also contributed significantly to the manning in the C2 part of the exercise, in various planning cells of the Air Operations Centre (AOC), and various exercise support working groups. In total, 46 Italian militaries participated in JPOA-JPOWX. It is interesting to note that next to the operational war fighters, C2 liaisons and senior representatives, an extensive Italian analysis and assessment team, as well as a team of M&S specialists participated in the exercise. This was done to ensure that not only from an operational and organisational point of view but also from a technical point of view, Italy would learn and gain as much as possible experience out of the unique opportunity JPOW offers, as well in the areas of JAMD as in Mission Training with Distributed Simulation (MTDS) in a Live, Virtual, and Constructive (LVC) environment. Both proved to be the case, as will be described further in the final sections of this paper.

The Italian participation covered many “firsts”. It was a first time opportunity for:

- A joint services participation in an international JAMD exercise;
- Testing the recently developed Italian JAMD CONOPS and architecture in a complex LVC environment;
- Gaining actual experience with L-16 for the ADS Andrea Doria (Horizon Class) Link-16 implementation of the Italian Navy;
- Participating in the AOC with the Italian Navy in a complex NATO C2 structure;
- Gaining actual experience for the Italian Army with the SAMP/T system and foreseen TTP’s, since the actual Initial Operational Capability (IOC) of the SAMP/T took place later, in December 2008. This provided the Italian Army with the unique opportunity to work with, train with, and test a future capability directly in an integrated multi-national JAMD environment.

In the remainder of this paper we will present the key lessons learned², both from the experimental and the actual mission execution phases of the exercise. We will especially focus on exercise/mission objectives, analysis, and assessment. We will start, however, with summarizing the Italian road towards JPOWX participation, since the key to success was, despite the very short period of time available, a thorough exercise preparation and clear guidance under which the Italian Joint Forces undertook this endeavour.

THE ITALIAN ROAD TO JPOW

The preparation and organization of an exercise as JPOW is a lengthy and complex process, often taking up to two years of preparation time. However, for Italy, the road to JPOWX was substantially shorter and started at the end of November 2007.

An Italian senior representative joined the Senior Leadership Seminar (SLS) in Kalkar, Germany, in November 2007. In this seminar the senior and operational leadership of participating nations and organisations were informed on the latest developments of Missile Defence in the United States and NATO. In a comprehensive workshop followed by a war game, the

² The results in this paper are described at an unclassified level. More detailed results are described in the JPOA-JPOWX AAR Report, the Italian AAR Report and daily exercise analysis and assessment reports/debriefings.

participants refined the guidance and directives for the execution phase of the exercise.

The official Italian JPOWX ‘project’ kick-off was done in Rome in January 2008, two weeks prior to the JPOWX Mid Planning Conference (MPC) in Berlin, Germany, where a larger delegation of Italian representatives joined the JPOWX exercise preparations. Over 1000 participants and supporting agencies were working during a whole week on the successful preparation of the exercise. Main purposes of the MPC were, from an Italian’s point of view:

- Providing a final list of national objectives to be met by the experimentation and exercise scenarios;
- Detailing an overview of the Italian systems architecture;
- Giving an overview of participating units, systems, and personnel;
- Participating and co-delivering various products in various exercise working/control groups³, and
- Detailing the logistics with the Host Nation Support.

To provide the Italian Armed Forces with scientific exercise and simulation support, The Netherlands Organisation for Applied Scientific Research (TNO) was hired. TNO has extensive experience with JPOW exercises and providing similar support to, e.g., the Royal Netherlands Armed Forces with the JROADS Simulation Suite (Stamm, M., Kuijpers, E. & Hein, W., 2009).

Use of Simulation Models

The Joint Research On Air Defence Simulation (JROADS) simulation model is developed by TNO to support armed forces in exercises, analysis of systems and operations, and as a test bed for future system development. During various other international exercises, war games, and seminars, JROADS was also successfully used by the Dutch, German, Russian, US, and NATO armed forces.

To enable the Italian Air Force to use the recently developed radar model of the AN/TPS-77 by the Italian

³Examples of these working groups are: the Operations Control Group (OPCG), Scenario, Intelligence, and Simulation Control Group (SISCG); Concept Development & Experiments Control Group (CDECG); , and Analysis Control Group (ACG) (Jacobs, L.R.M.A., Wiel, R., van de., Bosch, J.J.M., & Olthoff, W.R.J., 2009)

company ELSAG DATAMAT in Kesem Battlemodel a JROADS/Battlemodel integration was foreseen. However, due to the limited time available for the system design, development, and accreditation, the feasibility of this integration needed to be investigated first.

Systems Specification

To ensure a solid representation of the participating systems, i.e. a SAMP/T Battalion Operating Centre (BOC) and four Firing Units (FUs), the ADS Andrea Doria (HORIZON), and the AN/TPS-77 radar, a system specification workshop with operational and technical experts of the Italian Services, TNO, and ELSAG DATAMAT was conducted at AFB Pratica Di Mare, Italy, in April 2008.

While the SAMP/T and ADS Andrea Doria were completely simulated in JROADS, the AN/TPS-77 radar simulation model was developed and provided by ELSAG DATAMAT, and needed to be integrated in the JROADS suite to enable a tactical data link connection in the JPOW exercise environment. The AN/TPS-77 radar model was able to acquire “truth data” from the DIS network and interface with the Link 16 network through JROADS, which acted as a Link 16 gateway, via an ad-hoc developed protocol. Prior to the system accreditation- and user tests, extensive remote testing between ELSAG DATAMAT and TNO for the AN/TPS-77 implementation was successfully accomplished.

Figure 2 depicts the Italian Air Force architecture for the AN/TPS-77 integration into JPOW. Please note that this “exercise architecture” differs from the envisioned architecture for integrating the live platform into a NATO C2 structure with the Air Command and Control System (ACCS), via AWCIES, the sensor integration protocol for ACCS.

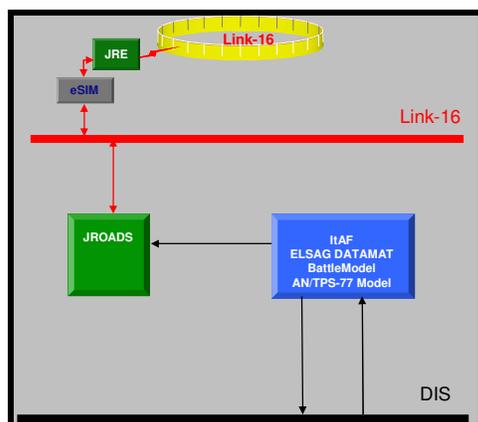


Figure 2: Italian Air Force Architecture

During the exercise, JROADS was connected to the DIS network and the Link-16 network. This allowed JROADS to interact with both real weapon systems and simulated ones, and enabled the war fighter to exchange tactical information (such as an air picture) and coordinate engagements. The DIS network transfers the ‘truth’ data between JROADS and the JPOW simulation network. Link-16 messages were transmitted via TCP/IP to JPOW provided equipment that eventually transmitted the message over a RF Link-16 network. JROADS is capable of handling an extensive set of DIS PDU and Link-16 message types.

Systems Accreditation

JPOW exercises are conducted with both ‘live’ hardware as well as simulations of air defence systems. To limit the risk involved and to ensure a flawless cooperation between the fielded systems and (conceptual) simulations, the simulations have to be tested and accredited by the JPOW organization before entering the exercise. Prior to the start of the JPOW build up each simulator participant had to deliver its simulation to be accredited both on the correct working of DIS and Link-16 protocols and behaviour. This was done, on behalf of the JPOW Project Office (PO), by two specialist firms responsible for the DIS and Link-16 networks on JPOW.

The first accreditation test week, for simulations, took place at AFB De Peel in May 2008. They were followed by, if necessary, another test week in June, and the final integration and accreditation test during the system build up phase of JPOWX at De Peel in August and September 2008. In this period the fielded hardware systems were also accredited.

The Italian simulations were successfully accredited on both L-16 and DIS networks during the first accreditation test week at AFB De Peel in May 2008. After accreditation the simulations needed to be “frozen” with respect to DIS and L-16 developments. However, final adjusting and fine-tuning the working of the internal simulation models and/or the Operator Interface for a simulated capability remained possible. Further testing of the simulations in realistic and complex scenarios was also possible within the JROADS test environment, located at the premises of TNO in The Hague, The Netherlands.

The Importance of User Tests

Despite the fact that JROADS offers a generic operator interface of air defence systems, such as ADS Andrea Doria and SAMP/T, the actual modelling of weapons

and sensor capabilities are tailored to the needs of each operator and type of event to be supported (Stamm & Kuipers, 2009). Based upon the Italian objectives, available system performance parameters, and user preferences with respect to the operator interface, the SAMP/T, ADS Andrea Doria (HORIZON), and AN/TPS-77 simulations were thoroughly reviewed and tested by military operators and technical specialists of the Italian Services in the JROADS test bed in June 2008. Figure 3 gives an example of a JROADS workstation/ operator station as used during JPOWX by Italian operators.

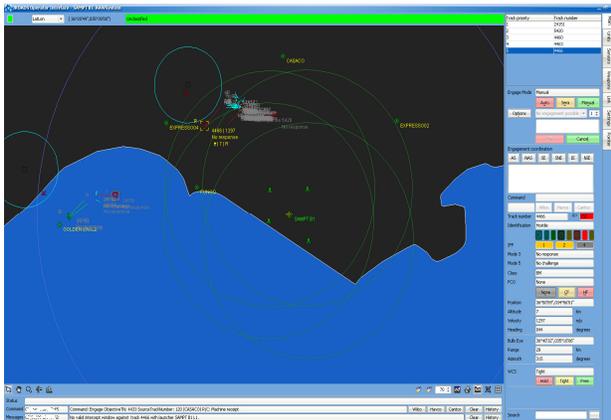


Figure 3: Example of a JROADS Operator Interface

Final Exercise Preparations

Similar by intent to the Senior Leadership Seminar (SLS), but quite different in nature was the Tactical Leadership Seminar, conducted at AFB de Peel in June 2008. The purpose of this event was to conduct the planning for the participating units and systems at the tactical level, based upon the guidance derived from the SLS, and final set of exercise objectives, and henceforth designed scenario.

The foreseen Final Planning Conference (FPC) was altered into a smaller Final Planning Review (FPR) for approximately 50 senior representatives of the exercise control groups, JPOW project office, participating nations and agencies, due to the fact that the final exercise preparations were on schedule. The FPR was conducted at the end of June at the Norwegian AFB in Bodo.

To conclude the extremely busy June period, a two day Italian Analysis Team (IAT) Conference was conducted in Rome, Italy. The Italian Joint Forces Command gave its final directions and guidance to the Italian PO and IAT team, led by a senior Italian officer, recently posted

from the NATO Joint Analysis Lessons Learned Centre (JALLC) to the Lessons Learned Section of the Italian Air Force Operational Command. Also the first draft of the Italian JAMD CONOPS was made available, to be validated, tested and extended in the exercise.

During this conference, an Italian analysis and assessment framework was designed, next to the overall JAT support that Italy provided to the Analysis Control Group (ACG). Main objective of the Italian assessment framework was to develop a practical data collection plan, based upon good analysis and assessment practises, as defined, for example, in the JALCC handbook (Eaton, Redmayne & Thordsen, 2007), and availability of loggers, analysis, and replay facilities, supporting the assessment of the two main Italian objectives:

1. For the Joint CONOPS Development: on testing, identifying and defining novel concepts, tactics, techniques and procedures (TTPs) within the foreseen Italian Armed Forces Architecture (see also Figure 4).
2. For the experiment and exercise participation: on operational, technical and organisational Lessons Identified (LI) and Lessons Learned (LL).

In order to support both a Concept Development and a Joint / Combined Training objectives, participants' expertises needed to be spread among several areas. Those areas of interest were carefully identified and personnel selected to be employed as C2 operator, (Weapon) System Operator, M&S engineer, Analyst / Data Collector. About a third of the participants was therefore employed in different C2 echelons ranging from HICON to BOC level passing through CJFACC/AOC and D-CRC; about a quarter played the role of (weapon) system operator; another quarter was responsible for M&S technical aspect and analysis of simulation results and the remaining part was concerned with National representative roles and supporting the exercise execution. This mixture of professional expertises and exercise responsibilities proved later to be very effective in achieving the Italian participation objectives.

Changing the mindset

Combining Concept Development & Experimentation (CD&E) with mission training requires a substantial change in the mindsets of both operators and assessors, compared to more regular exercises and/or evaluation events. It is essential to keep in mind that data-collection and assessment for such purpose needs to abstain from product oriented metrics as main results, especially given the mixed fidelity of participating

systems in the exercise. Looking however more deeply into the followed tactics, techniques, and procedures, and analysing why something did or didn't work out as expected will give a more profound understanding and testing of the CONOPS. With this approach in mind, all operators became the key members of the IAT, supported by on and off-line data collection and analysis conducted by the regular IAT members and TNO. For a successful experimentation and exercise, it was essential that analysis and assessment of the used Concepts and Architecture became the central focus over assessing the participants. This required an open, flexible and less hierarchic mind set of the Italian operators.

In fact, the Italian Armed Forces recognised that the competence needed to succeed in analyzing the implications related to this application field were both collective and distributed, grounded in the everyday practices of each service military. Therefore, it was constantly reaffirmed that the exercise was not to be regarded as a standard tactical evaluation. Moreover, the participating operators needed to be transformed in assessors of their own job in order to contribute, not as individuals but as part of a team on a collective analysis of the various aspects of an air and missile defence architecture.

With this important need for addressing the participants mind set, in July 2008, all Italian participants were briefed by their senior officers on the objectives and goals for participating in JPOWX. In The Netherlands, the final testing of the Italian simulations continued during weekly integration tests in the TNO test bed where also, simultaneously, the other JROADS simulations for the Royal Netherlands Armed Forces were developed and tested.

A BRIEF EXERCISE OVERVIEW

The exercise flow included 3 distinct phases: The systems build up and final systems integration, which took place from August the 19th until September the 4th; The Experimentation Phase, which took place from September the 5th until September the 9th, and the Mission Execution Phase, which took place from September the 6th until September the 18th. JPOWX, focussing on theatre and regional air and missile defence, was divided in two mission phases with two different C2 structures. JPOA, focussing on global missile defence, took place from September the 10th until September the 18th. The redeployment of personnel, systems, and materials to their home locations started on September the 19th.

A typical JPOW workweek comprised six days of action, from approximately 07:30 LT (e.g. CECG meeting, JAT and participants briefings) until 21.00 LT (end of daily debriefings). STARTEX for the experimentation and mission phase was 08:00 LT and ENDEX 17:00 LT. Daily debriefings started at 18.30 LT and could also be joined by remote sites via a VTC connection.

BUILD UP PHASE

The Italian simulations were together with the Dutch simulation equipment transported by the RNLAf from The Hague to AFB De Peel on August the 19th. The systems build up started on August the 20th, after which the integration tests with the other simulated and live systems, present at that time, started. An Italian Advanced Party arrived in the Netherlands on August the 25th. The rest of the 46 militaries arrived on September the 1st. The remaining three days prior to the start of the Experimentation Phase were used, after a thorough in-briefing for the participants, conducted by the Italian Senior Representatives, for operator training

(simulations and various planning tools used in JPOWX) and familiarisation (e.g. ensuring that all players had relevant accounts on various nets and information systems, especially the Joint Operational Internet (JOI)). Due to extensive challenges with integrating the live Patriot Platforms from Germany, Spain and the Netherlands, testing and integrating the simulations simultaneously within the short period of time available became challenging too, and caused, for example, for the Italian AN/TPS-77 a need to extend some part of the integration testing during the experimentation phase.

For the experimentation phase of JPOWX the Italian Armed Forces designed two experiments to test and validate certain parts of the Italian (national) Joint Air and Missile Defence Concept of Operations and Architecture.

In the first experiment the main objective was to verify the working and coordination procedures of the SAMP/T unit and the ADS Andrea Doria to engage on remote using external track information from the AN/TPS-77 as directed by a CRC element. In the second experiment the main objective was to engage TBM targets using national sensors as Early Warning and delegating tactical controls from CRC level to the SAMPT BOC and the ADS Andrea Doria. To support the NATO ALTBMD Programme with their Integrated Test Bed (ITB) Experiments, testing the interoperability

of the NATO ITB and national assets, the SAMP/T unit and the ADS Andrea Doria participated in three ITB experiments.

EXPERIMENTATION PHASE - EXECUTION

Figure 4 shows the Italian national BMD architecture designed for JPOWX. This architecture was used for both experimentation and mission execution phase, together with especially designed experimentation scenario's, tailored to the specific experiment objectives.

EXPERIMENTATION PHASE - RESULTS

The two national experiments showed that the Italian assets were successful in engaging ABT and TBM targets using national sensors as Early Warning capability. The Italian assets were also able to coordinate remote engagements effectively in silent mode. It was also possible to delegate applicable tactical battle management functions from CRC level to BOC and ADS Andrea Doria (HORIZON) if/when required. Varying operating modes were tested and executed successfully, including Centralized vs. Decentralized, and Remote vs. Autonomous modes. The

three experiments led by NC3A testing the interoperability between the Italian platforms and NATO ITB were also successfully accomplished.

With these positive outcomes in mind, the Italian operators were challenged to participate in the mission execution phase as “test pilots” actually using, testing and expanding the recently developed Italian JAMD CONOPS further, besides training and getting used to the working of a novel system such as the SAMP/T. Therefore, reviewing and developing the CONOPS further as well as own understanding of both the unit's capabilities and system's role became the main focus for the mission execution part. Exemplary for this focus were the, prior to the exercise not yet foreseen, participation of the Italian Navy in JPOA for two days, and Army crews changing regularly from positions to increase both the understanding of the SAMP/T, which was at that time a future capability, and enabling a CONOPS review from multiple roles and positions by different operators.

MISSION EXECUTION PHASE - OBJECTIVES

For the mission execution phase, four High Level Objectives (HLOs) were formulated by the Italian Joint Forces Command and correlated to nine Subordinate

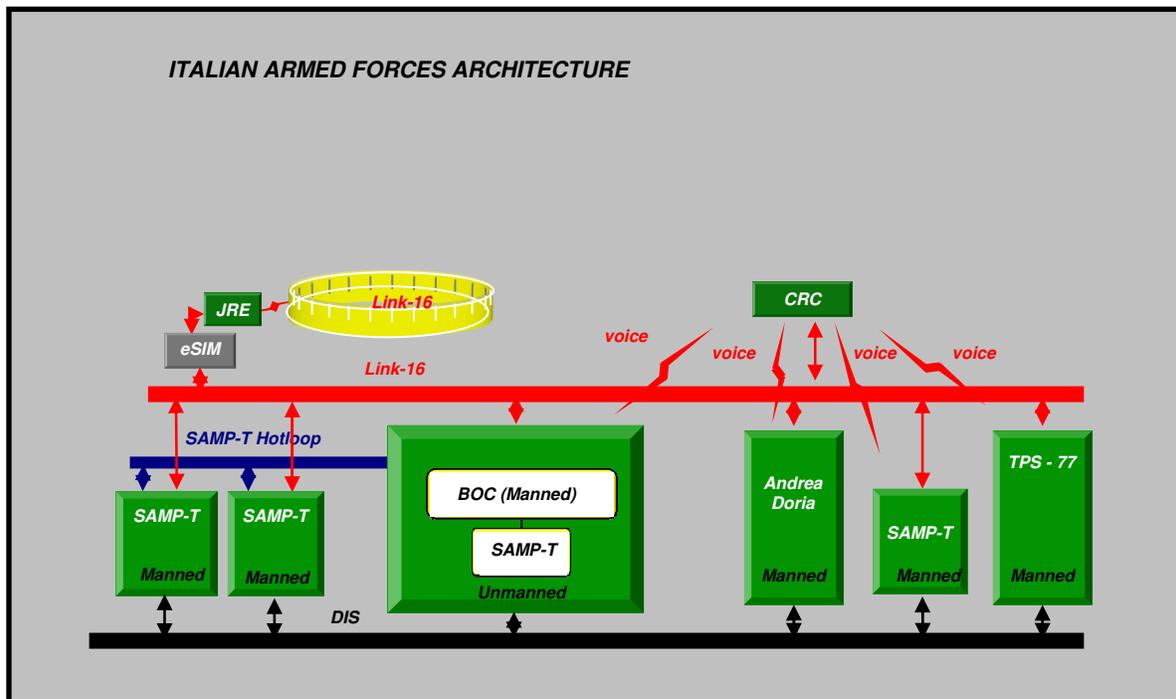


Figure 4: Italian Armed Forces Architecture

Objectives (SOs) which could be either service unique or joint in nature. The four HLOs were:

1. Experiment with and validate air and missile defence JOpsC constructs and architectures;
2. Enhance Italian know how in relation to ALTBMD development;
3. Conduct interoperability field tests for Italian sensors and systems;
4. Assure positive growth of joint/combined expertise in a TBMD environment.

MISSION EXECUTION PHASE – RESULTS

With reference to the aforementioned HLOs, the data gathered from the IAT have led, as described later, to the conclusions drawn in a national After Action Report.

In summary, as far as HLO 1 was concerned, JPOWX has been an excellent test bed for the envisaged national architecture which has proved to be successful both when only national assets (AN/TPS-77, SAMP/T, ADS Andrea Doria) were available and when the same assets were integrated as part of a broader multinational coalition.

Regarding HLO2, JPOWX has been a successful exercise giving all the participants the possibility to assume a primary role in facing the operational as well as the technological challenges in a complex JAMD scenario.

Considering HLO 3, JPOWX represented a good opportunity for a first validation of the capability that national assets could share within a TMD scenario. It should be noted that the simulators used within the exercise do not necessarily replicate the original systems in terms of performance and interfaces to other system. Therefore, with reference to architecture performances and/or interoperability aspects, no definitive indications could be gained.

Finally, as far as HLO 4 was concerned, JPOWX was an outstanding opportunity to employ plans and procedures related to TMD and to test the integration into a NATO C2 structure. During the exercise, various C2 echelons activities (ranging from CJFACC to units level) had a very positive trend, in terms of quality of the overall situational awareness. JPOWX was an excellent training and professional expertise exchange opportunity between the typical Air Battle perspective and the TMD side of the house, which is increasing in importance.

Correlating the four HLO's to those of the nine underlying SOs, revealed that 1 SO was not accomplished, 3 SOs were partially accomplished, and all remaining other SOs were fully accomplished.

Figure 5 shows the Italian analysis team in action during the data-collection and analysis, preparing for the daily team and collective debriefings.



Figure 5: Italian Operators and Analysis Team in Action during JPOWX

The remainder of this section focuses on summarizing the key lessons identified and learned from the Italian player's cells.

AOC- Key lessons

From an operational point of view JPOWX offered an outstanding opportunity to employ plans and procedures related to TMD and experimenting with the integration into a NATO C2 structure. Especially for the Italian Navy, JPOWX provided a first experience with operating in a TBMD environment. This also applied for the planning and coordination at the Component Command (CC) level. As a result, more knowledge within the Italian Navy was gained about the ATO coordination, liaison with the Air Operations Centre (AOC), and execution at the CC level. Under manning at the joint staff, however, was an issue, resulting in a heavy workload in the planning and C2 cells of the AOC. From a technical point of view it was noted that information sharing between different nets was slow.

SAMP/T- Key lessons

The Army was able to achieve its objectives and had a very successful first (virtual) test for SAMP/T Operations. From an operational point of view, the difference in operating of one of the four fire units, which coordinated directly with the CRC for ABT engagements, was successful. Also, the (TBM) engagement coordination via L-16 and between the BOC and the remaining fire units was successfully accomplished. Rotating crews significantly enhanced

the experience gained from JPOWX. Situational Awareness (SA) was sometimes hampered by heavy workload. Also insufficient debris & consequence management was experienced. The coordination between Upper Layer and Lower Layer Air Defence Systems should be improved to maximize the effectiveness of TMD plans. From a technical point of view, the use of loggings and replay capabilities enhanced the effectiveness of the After Action Reviews, and also enhanced the operator's insight in their actual performance. Major technical challenges involved the recurrent L-16 network issues, and the integration between live and virtual players.

AN/TPS-77- key lessons

The Air Force objectives for the AN/TPS-77 were successfully met. The radar contributed successfully to the SA and provided a (TBM) EW capability.

Operational improvements for future JPOWS are to include sensor planning and sensor management. By the end of the exercise all technical issues related to the AN/TPS-77 were resolved, giving the technical experts of the Air Force the opportunity to gain very useful knowledge in solving problems together with TNO experts in a complex LVC exercise. The insufficient testing (time) for the Final System Integration Test at AFB De Peel demonstrated that more thorough testing is required for future exercises to ensure proper systems interoperability and avoid unexpected issues during the experimentation and mission execution phases.

ADS Andrea Doria (HORIZON) - Key lessons

JPOA-JPOWX provided the Navy with a valuable first experience for dealing with TBM threats in a combined and joint environment. As a result of this exercise, there is now more substantial knowledge on threat characteristics, capabilities of the ship, and how to communicate these to other players. Practising TBMD coordination in joint and combined setting was worthwhile. The ADS Andrea Doria (HORIZON) was able to join the L16 network and coordinate with other units in TBMD environment. During the mission execution phase, having more operators and operator stations available would be useful to enhance SA/task allocation.

POST EXERCISE OVERVIEW

After JPOWX all participants contributed to the extensive overall JPOA-JPOWX AAR Report, detailing the Lessons Identified (LIs) and Lessons Learned (LLs),

both from the exercise preparation and execution phases.

JPOW CONCLUSIONS & RECOMMENDATIONS

The Italian participants stated that JPOW offers unique opportunities for exercising, exploring and demonstrating multinational Missile Defence Operations. Events such as JPOW enable participants to gain *actual experience* in integrated JAMD.

As it is becoming easier and easier to use systems in parallel, it is more difficult to operate effectively within today's increasingly complex, joint and multi-national environment. Furthermore, on one hand threat systems have continued to improve in effectiveness and, on the other hand, complex rules of engagement need to be taken into account in today's theatres. It was confirmed that the degree of coordination required to achieve mission success in these complex battle spaces asks for specific skills. Therefore, providing a synthetic environment where personnel from diverse backgrounds can come together to plan and execute JAMD operation is of utmost importance to ensure mission readiness (Saltmarsh J., MacKenzie S. 2008).

The use of Distributed Interactive Simulations supported not only joint training and cooperation but also enabled collective thinking on integrating air and missile defence concepts for the Italian Services. The approach used turned each operator in assessor of his own job. Extensive collective Italian team debriefings instead of individual reports were conducted to exploit brainstorming on issues and ways ahead. In fact, the holistic approach proved to be successful in allowing the operators, coming from various services and with different experience levels, to express a shared common view with much more value than the sum of all the single contributions.

The participation has offered Italy many valuable lessons learned in the areas of exercise preparation, exercise management, CD&E for JAMD, M&S, Doctrine Development, and the operational, organisational, and technical requirements that should be met to successfully accomplish this in a multinational LVC exercise environment.

It was highly recommended to distil, disseminate, and incorporate the LI /LL from the Italian and overall AAR JPOWX reports for future exercise participation and further development of the Italian JAMD CONOPS. Two other general recommendations were to ensure a timely project start for the next JPOW participation, and last but not least, to continue the joint approach!

WAY AHEAD - FROM CONCEPTS TO CAPABILITIES

The Italian Joint Staff has identified Modelling and Simulation (M&S) as one of its fundamental enabling technologies for the transformation of the Armed Forces according to a more Net-Centric approach. In order to optimize the efforts and avoid duplications, the Joint Staff asked each Service to organize a demonstration in 2008 which had to show the state of the art in the area of M&S with respect to the Service's past and current activities.

Italian Air Force LVC Demonstration

To demonstrate the interoperability between LVC assets in a Joint distributed environment to achieve the objectives stated in the Italian Air Force Guidelines for M&S the Italian Air Force conducted a LVC demonstration that was held at November 27th, 2008 (Argiolas, Wood & Montrucchio, 2009).

Lessons learned from JPOW X were applied and an extensive set of systems, some of which were originally conceived for stand-alone use and various purposes, worked together through geographically distributed simulations. Distributed Interactive Simulation (DIS), High Level Architecture (HLA) as well as real Link 11b, Link 16, IDM and SIMPLE networks were used. Exploiting the available simulation tools, it was demonstrated how future capabilities could integrate with the current ones in a joint synthetic environment comprised of Extended Air Defence (EAD), Conventional Counter Force (CCFO) and Suppression of Enemy's Air Defence (SEAD) operations.

From the feedback from the audience and participating units the demonstration was perceived as an overall success. Many positive issues were identified, amongst others: the interoperability of the different Link 16 systems in use in the Air Force was once more proven; it was possible to perform the demo in a joint distributed environment; the command and control structure used was real and the Live systems were seamlessly integrated in the Synthetic Environment. Most of the encountered problems were technical by nature and were related to the extremely tight schedule of the project (two months) and probably could have been solved with a month or two more to do the job.

OVERALL CONCLUSIONS AND RECOMMENDATIONS

Participation in exercises such as JPOW and conducting demonstrations of the Italian military LVC capabilities as described in the previous sections are the only way to get from a concept to a fielded JAMD capability. Collective training, exploiting various experiences and different perspectives, and allowing collective thinking on newly developed concepts, has proven to be a very effective way to adapt architectures, doctrines and TTPs to complex and evolving scenarios. The Italian Joint Forces Command can use this substantial experience to guide its future JAMD developments, for which the founding of a national Joint Centre of Excellence in the areas of JAMD and M&S, and continuous flow of experimentation and exercise participation via Distributed Interactive Simulation, are seen as key enablers in further accomplishing a comprehensive Italian JAMD approach.

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