The Technical Cooperation Program
Joint Systems and Analysis Group

JSA Master List of Issues

Preface

In the course of its business, TTCP's JSA Group regularly identifies, discusses and acts upon diverse issues affecting the context and content of collaborative activities both across the TTCP Groups and within the JSA itself. The **JSA Master List of Issues** is a management tool for assisting the Group's National Representatives, the NAMRAD Principals, the Washington Deputies and other TTCP senior representatives in remaining aware of the various issues under consideration, and of their status. The Master List is maintained through the office of the JSA Executive Chair. An on-line version of the Master List is available on the TTCP Web Site at http://www.dtic.mil/ttcp.

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[1] Hyperlinks are used to aid navigation through the Master List. Click on the hyperlink to access the referenced text. You can return to the Index by using the arrows in the Hyperlink Menu.

Summary of Active Issues

Issue Number	Description	Date Entered	Status
JSA-ML-0201	Logistics-Driven Investment	June2002	Champion is JSA-TP-3. The nations will identify members that will progress the examination of Logistics Driven Investment using the JSA-AG-08 developed methodology for assessing new defence capabilities and for identifying key technology shortfalls and drivers
JSA-ML-0202	Counter-Terrorism and the role of TTPC/JSA	June 2002	Champion JSA- Group. Look to what extent should TTCP and JSA Group focus on counter-terrorism. Present options at NAMRAD 2002.
JSA-ML-0203	Systems of Systems Issues for Land Force Transformation	June 2002	Champion JSA-TP-1. This master issue was initiated at the June 2002 JSA Group meeting. JSA-TP-1 is requested to consider the issue as providing a major strategic thrust for the future program.
JSA-ML- 0204	Network Enabled Capability	June 2002	JSA-TP-3. The TTCP nations have each developed programmes to explore capability developments which support whole force action rather than individual platforms using approached based on networked systems. It is proposed that a joint research program be established to explore concepts associated with Network Enabled Capability
JSA-ML-0205	Systems of Systems Implication for the Human	June 2002	JSA Group. Was initiated at the June 2002 JSA Group Meeting. As the next step, the HUM Group is requested to consider it and offer feedback. The JSA CA NR participated in the July 2002 annual meeting of the HUM Group to introduce the proposal.
JSA-ML-0101	Capability-Based Force Development	June 2001	Champion is JSA-TP-3. The TP has initiated information exchange in the area of national approaches to Capability-Based Force Development, with the intention of identifying opportunities to improve the OA tools available to support the approach.
JSA-ML-0102	Methods for Analyzing Complex Systems	June 2001	Champion is JSA-TP-3. The TP has initiated an examination of the application to emerging defence problems of methods designed for analyzing complex and/or open systems and for dealing with non-linear behavior. A workshop will be conducted late in 2002.
JSA-ML-0103	Methods and Approaches for War-Fighting Experimentation	June 2001	Champion is JSA-AG-12. JSA has created the AG with a 2.5-year mandate to advance the nations' understanding of the optimal methods for planning, conducting and analyzing war-fighting experiments involving live and virtual elements. The activity is viewed as the first under its System-of Systems Experiments for the Land/Air Battle (SELAB) concept. Interactions with QWG-AOR and other ABCA experimentation programs to examine the feasibility of observing planned experimentation opportunities should substantiate AG-12 work.
JSA-ML-0104	Knowledge Management for the Warfighter	June 2001	Champion is JSA CA NR. The JSA NRs will maintain a watching brief on emerging interest in the nations in the application of Knowledge

			Management for the warfighter.
JSA-ML-0001	Analysis Methodologies and Technologies that Support Effects-Based Operations	July 2000	Champion is JSA-AG-10. The AG was formed in July 2000 to advance the understanding of methodologies and technologies that support effects-based operations by (1) determining the state-of-the-art, (2) identifying methodologies/ technologies for exchange, and (3) recommending future avenues of development. JSA-AG-10 was extended by two years in June 2002. Interim and final reports will be presented at the 2003 and 2004 JSA Group meetings, respectively.
JSA-ML-0002	TTCP M&S Roadmap for Enabling Experimentation in System-of-Systems	July 2000	Champion is JSA-TP-2. At NAMRAD 1999, the Principals requested that JSA develop a strategy for increasing the use of Advanced Distributed Simulation in TTCP. To this end, JSA-TP-2 provided a draft TTCP M&S Roadmap for Enabling Experimentation in System-of-Systems at the JSA 2000 Annual Meeting. Through 2001 TP-2 analysed M&S issues for "use cases" associated with Operations-Other-Than-War (OOTW) and with military operations associated with the Land-Air Battle (see ML-0103).
JSA-ML-0004	Emerging Distributed Intelligent Systems and their impact on Operations/Systems in 2015	July 2000	Champion is JSA-AG-11. At NAMRAD 1999, the Principals requested that JSA consider leading a pan-TTCP effort to better understand emerging technologies and related operational/system issues for sharing intelligence among machines and humans, on a 10-15 year horizon. Based on its preliminary analysis of the potential impact of emerging technologies, JSA decided at its June 2001 meeting to create JSA-AG-11 on Technology for Distributed Intelligent Systems. The AG has a 2 year mandate to examine the emerging technologies and their implications for defence, and to develop recommendations with regard to future TTCP collaboration.
JSA-ML-9905	Modeling and Simulation-Enabled Visualization for Systems/Concept Development	July 1999	Lead is JSA-TP-2. The TP was been requested to examine the direction of M&S-enabled visualization technologies as applied to the development of new concepts, systems and models. Progress was reported at the JSA 2000 Annual Meeting with a final report now due in 2003 as the TP's related focus area takes up the issue.

Issue Ref No: **JSA-ML-0201**

Issue Name: **Logistics-Driven Investment**

Date Entered: **June 2002**

Champion: **JSA-TP-3 *(Joint Concepts and Analysis)***

Status:
The nations will identify members for the team that will progress the examination of Logistics Driven Investment using the JSA-AG-8 developed methodology for assessing new defence capabilities and for identifying key technology shortfalls and drivers.

Context:
Recent experiences have reinforced the critical importance of effective logistics to the success of military operations in the post-Cold war era. In addition, logistics cost have often proved to be the dominating and least predictable expense in the operation. The US Joint Vision 2020 has identified *Focussed Logistics* as a key element of the future warfighting capability. Notwithstanding this, logistics is still perceived as an area for savings and efficiencies and of lower priority for investment than major equipments such as aircraft or ships. A significant part of this problem is the difficulty in evaluating the contribution made by logistics to warfighting capability. In general, the warfighting systems and the logistics systems are treated as separate interacting systems rather than a systems-of-systems.

We need methodologies that will link warfighting capability with logistics capabilities and with technologies. This will ensure that future warfighting capabilities and concepts are appropriately enabled through logistics concepts and capabilities as they are being conceived and designed.

The JSA Group was impressed by the methodology developed by JSA-AG-8 for assessing new defence capabilities and for identifying key technology shortfalls and drivers. The intent of this Master List Issue is to extend the AG-8 methodology to the examination of the logistics drivers and shortfalls of new capabilities and concepts, which we term logistics-driven investment.

Previous Collaboration:
As part of the response to JSA-ML-9802, TP-3 conducted a workshop in June 2000 on the subject of *Logistics for the Future Battlespace.* The workshop identified several logistics concepts that offered promise for future operations. These included:

?? more extensive use of civilian logistics systems,
?? more extensive use of contractors in the area of operations,
?? more use of web-based technology to manage and coordinate logistics activities,
?? more use of visualisation tools to identify and track the stockholding and distribution of critical consumables and spare parts, particularly in-theatre,
?? more use of health and usage monitoring systems,
?? more interconnection of multi-security level databases.

Program:
It is proposed to apply a systems methodology (as developed by JSA AG-8) to the analysis of the scope of potential benefits of new logistics concepts in meeting warfighting requirements. The intent is to be able to assess the interactions between the logistics system and the warfighting systems in achieving an overall warfighting capability and the implications thereof.

By the nature of this process and the available national resources, it is likely that the effort will need to focus in a small number of warfighting and logistics concepts. Among candidates for consideration are:

?? implications for warfighting capabilities/concepts arising from new logistics concepts.
?? assessment of readiness,
?? estimation of work-up period and cost,
?? risk to contractors in and near combat areas,
?? benefits of visualisation,
?? assessing coalition trade-offs, including degradations,
?? assessing risk to operational security of sharing low-level data for situational awareness,
?? critical factor sensitivity (i.e. impact of one item or service becoming unavailable),
?? development of synthetic environments to link models and packages,
?? logistics command and control,
?? information and knowledge management,
?? logistics decision support systems
?? next-generation logistics software design and validation..

Where appropriate, the US Future Logistics Wargame (FLOW) may be used as a vehicle to develop and evaluate new concepts and analysis techniques.

This activity will be managed by JSA-TP-3 and is expected to deliver its final findings to TP-3 and JSA by no later than May 2004.

Issue Ref No: JSA-ML-0202

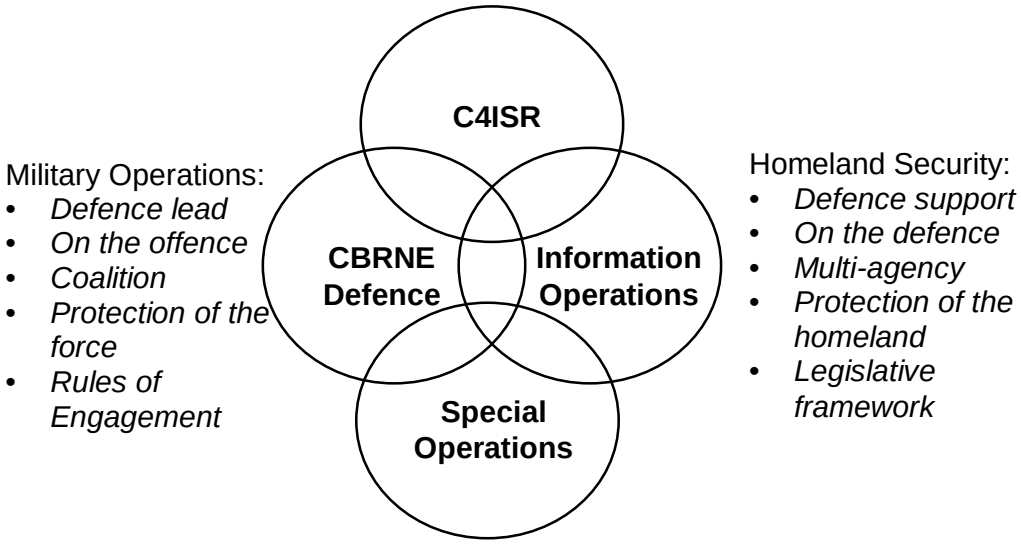
Issue: Counter-terrorism and the role of TTCP/JSA

Date Entered: June 2002

Champion: JSA Group

Status: Over the last nine months, the issue of counter-terrorism, and more particularly the role of TTCP and JSA Group in counter-terrorism research, has been much discussed.

Traditionally the TTCP program of work has focused on science and technology issues associated with military operations. Counter-terrorism generally falls outside the mandate of many Defence Departments, and is aligned more with national homeland security issues. Whilst many of the associated technologies have dual purpose, the operational frameworks are significantly different. This is illustrated in the graphic below.



DUAL USE TECHNOLOGIES
COUNTER TERRORISM AND MILITARY PERSPECTIVES

The issue at the heart of this discussion is where and to what extent should TTCP focus its efforts on counter-terrorism issues. The options below will be presented to the TTCP Principals and Executive Chairs at NAMRAD 2002.

Context: Traditionally, the TTCP work program has supported the military client. This fits in with the mandate, tasking and funding mechanisms of all the organizations that participate in TTCP. TTCP works on a volunteer basis, in that nations contribute to TTCP activities to further their own national interests.

Within TTCP, the JSA Group role is broader than simply technologies. Its focus is primarily that of an integrator at the joint level, supporting either military operations or Defence processes. As such it brings together an understanding of technologies, systems, doctrine and organizations in addressing most issues.

The extent to which Defence Departments support the science and technology efforts for counter-terrorism differs amongst the TTCP nations, and is, in fact, somewhat of a moving target in some nations at present. Within the counter-terrorism community, there exist a number of alternate fora that are used by the five nations to achieve information exchange in a manner similar to TTCP. These fora tend to be focused on the counter-terrorism role itself, rather than at the science and technology issues that support it (with some exceptions).

Counter-terrorism is a broad subject area, with many players and influences. The JSA Group role of taking a broad view on issues has a certain similarity with a number of counter-terrorism issues. As with many current JSA issues, the solutions may not be technology based.

The JSA Group already has some activities in its work program that are dual use, to the benefit of both the military and homeland security communities. Because of their military use, these activities are fully supported by Defence Departments. Where appropriate, the homeland security communities may have also been involved in these activities, or been made aware of the results of activities. This has happened on a national basis, generally as part of the regular program of work for the organizations that support TTCP.

On the surface therefore, there may appear to be a degree of fit between the JSA Group and the counter-terrorism role. However, the JSA Group has been successful in its military role because of the breadth and depth of its Group and sub-activity members in national defence issues. By contrast, at present the links of JSA members to national counter-terrorism communities are weak.

Consequently the need exists to establish a consensus and provide guidance on the future role of TTCP in general and the JSA group in particular with respect to counter-terrorism. Some potential options are set out below.

Options for the future role of JSA in counter-terrorism:

1. Baseline Case: This case reflects the current reality of the TTCP program. Membership and activities are focused on supporting military operations. Where appropriate other national counter-terrorism communities will be involved in, or made aware of, relevant dual-purpose activities on a national basis.

2. Middle Ground: The baseline case but with improved communications protocols and increased effort to include counter-terrorism communities in appropriate TTCP/JSA activities. Communications would need to be improved across TTCP with respect to the work programs of individual groups. These communication processes are somewhat ad-hoc at present. If efforts to be more inclusive of the counter-terrorism community were required, then this problem would need to be addressed.

   A more pro-active stance of involving the counter-terrorism communities in activities would largely depend on the links between TTCP members and their own respective national counter-terrorism communities. This currently varies by nation, but is currently assessed as being weak. Unless this falls within national mandates it is difficult to envisage a significant change.

3. Extended Role: Have TTCP become the S&T exchange forum for homeland security issues in addition to military operations. This is currently assessed as not being tenable given the mandates, tasking and funding arrangements of those organizations supporting TTCP. If this option were to be considered seriously, then both the national organizations that support TTCP, as well as TTCP management, would need to embrace the change in role.

Consultation: Weapons Group, C3I Group

Recommendation: JSA Chair consult with Executive Chairs and seek guidance from NAMRAD Principals on preferred option, noting that the Baseline Case is the current de-facto option.

Issue Ref No: JSA-ML-0203

Issue: Systems of Systems Issues for Land Force Transformation

Date Entered: June 2002

Champion: JSA-TP-1 Land Systems (CA Chair)

Status: This Master List Issue was initiated at the June 2002 JSA Group meeting. JSA-TP-1 is requested to consider the issue as providing a major strategic thrust for their future program. TP-1 should report its initial findings and observations to JSA Group by end May 2003 in order to facilitate further discussion at the 2003 Annual JSA Meeting.

Context: The land forces of the TTCP nations are entering a period of rapid change to meet revised perceptions of their role in national military structures. In the USA this process is known as "Transformation" and this term has been widely accepted. Key issues concern the balance between forces that are "light" enough to be rapidly deployed and easily sustained with low reliance on host nation support, yet which generate sufficient military capability in theatre to produce rapid and decisive military effect and to achieve the political objectives of the mission. Such operations will always be essentially joint in nature; this MLI concentrates on the land force contribution but it should be addressed in a joint context and across the full spectrum of military operations.

The aim is to identify, develop and evaluate novel systems and systems of systems concepts for land forces to achieve these objectives. Suggested areas to explore are:-

?? Trade-offs between alternative systems of systems concepts to achieve force capabilities using appropriate measures of effectiveness
?? Identifying unique capabilities driven by the need to conduct operations in urban areas. It is recommended that the Report from the NATO RTO Study SAS-030 "Urban Operations 2020" be considered as an important input.

However TP-1 is encouraged not to regard these suggestions as limiting, but to take a broad strategic approach to issues that will enable the process of land transformation to be successful. TP-1 is also strongly encouraged to interact with their national military representatives who are in the process of developing and structuring new concepts of operation to further transformation.

Methodology TP-1 should be aware of the relevance of systems of systems development methodology being addressed in JSA-TP-4 and of analytic approaches identified in the collaboration under JSA-TP-3 as well as TP-1's own land analysis work.

It is desirable that the work should eventually include broad comparisons of cost-effectiveness between alternative systems and systems of systems concepts but the challenge of achieving this aim in a multi-national context is realised.

Issue Ref No: JSA-ML-0204

Issue: Network Enabled Capability

Date Entered: June 2002

Champion: JSA-TP-3 Joint Concepts and Analysis (AS Chair)

Status: TP-3 will examine mechanisms to more effectively link the nations' collaborative efforts to advance network Enabled Capability/Network Centric Warfare, and will report on the progress at the 2003 JSA Annual Meeting.

Context:- The TTCP Nations have each developed programs to explore capability developments which support whole force action rather than individual platforms using approaches based on networked systems.UK Military and Scientific staff have opened discussions with the US DoD on a joint research program to explore the concepts associated with Network Enabled Capability (NEC). The UK working definition of NEC is:

> *Network Enabled Capability (NEC) allows platforms and C2 capabilities to exploit shared situational awareness and collaborative C2, to communicate and understand command intent and to enable seamless battlespace management in order to create decision superiority and the delivery of synchronised effects in the joint and multi-national battlespace.*

The UK approach recognises that this initiative is one which necessarily involves all Lines of Development and therefore there will be a need for coordination of activity across a wide stakeholder community. Thus a collaborative approach to the issue within TTCP JSA Group needs to be closely linked to related activities; some specific interactions are addressed below.

The US has already embarked on a major research program in support of Net Centric Warfare (NCW), with a particular emphasis on experimentation. Achieving the full potential of NEC or NCW requires consideration of the cognitive and informational domains as well as the physical; as such exploration and assessment of NEC/NCW concepts must address the socio-technical system, and experimentation is one of the key mechanisms to achieve this understanding. The US and UK research communities, and their military sponsors, are engaged in the development of a joint research program which will include a joint, parallel experimentation campaign.

Similarly Australia has a developmental research program in Network Enabled Warfare with links to the US programs and also has personnel exchanges and involvement in the CCRTS.

Finally, Canada has initiated both Technology Demonstration and Concept Development and Experimentation activities to assist in realizing the network centric/enabled paradigm, again with links to US programs.

Initial Activities:- Initial technical meetings have already been held between UK and US and future meetings are planned to coincide with the International CCRTS in Quebec in September 2002. The following points have been established:-

?? Research and customer representatives in US and UK agree that the most practical and desirable way to share existing NEC and NCW related research and to enable future joint work is via JSA-TP-3. This would have the major advantage of bringing in the other TTCP nations to the collaboration. The US and UK would like to continue with their current plans whilst at the same time looking for input and involvement from the other TTCP nations. This approach is consistent with recent guidance received from NAMRAD Principals.

?? AS, CA, UK and US staff have agreed to work together to produce several collaborative research papers to present at ICCRTS which will also be distributed through TP-3.

?? The UK, at the US's suggestion and supported by AS and CA, is considering hosting a future ICCRTS in either 03 or 04.

?? Initial discussions were held on the advantages to be gained from exchange of research staffs to provide continuity and the nations will continue to explore this possibility.

?? National programs in AS, CA, UK and US have strong military customer involvement and support across a wide spectrum; future activities will encourage the continuation of this active dialogue across all the nations.

Related Activities:- Related TTCP JSA Group activities includes Action Groups on Effects Based Operations (AG10) and Warfighting Experimentation (AG12); close contact will be maintained with these communities. The development of Best Practice in Experimentation under AG12 will be a key enabler for the NEC work.

Further, Professor Jim Moffat of Dstl has been engaged in collaborative work over a number of years with Dr. Alberts and the US research community on the representation of command and control in modeling and simulation and this work has also been facilitated recently through TP3.

Within TTCP there is scope for identifying aspects of NEC/NCW which would benefit from input from other Groups. MAR Group has work in place in MAR-AG-1 on some specifically Naval aspects and inputs from both C3I and HUM Group activities are potentially valuable. These issues will be addressed in formulating the future programme.

Benefits of International Collaboration and TP3 Involvement:- NEW, NEC and NCW are high profile initiatives in AS, CA, the UK and US respectively. Bringing together these related research programmes in the form of both joint and parallel activities will bring significant advantages to the research communities, and thence to the military sponsors in both countries. Collaboration will allow maximum value to be gained from the national experimental programmes; this is particularly important given the complexity and cost of well-designed experimental campaigns.

There will be immediate benefit to the existing research communities in the involvement of TP3 in the exchange of information and in the linkages to other TP3

activities. There is great potential for additional benefit by engaging all the TTCP nations via the TP3 National Leaders resulting in a broader and richer collaborative programme.

Issue Ref No: JSA-ML-0205

Issue: Systems of Systems implications for the human

Date Entered: July 2002

Champion: JSA Group

Status: This Master List Issue was initiated at the June 2002 JSA Group meeting. As a next step, the HUM Group is requested to consider it and offer feedback. The JSA CA NR will participate in the July 2002 annual meeting of the HUM Group to introduce the proposal.

Context : The human is acknowledged as a key element in military systems-of-systems: complex systems of the kind employed for joint military operations involve the interaction of a number of individuals and groups with and through the systems components. These human-system interactions are a key component of overall effectiveness and performance and as such are an important consideration in the design of system architecture and the technologies employed within the systems-of-systems. Within TTCP, HUM Group has carriage of human sciences and the development of techniques that enhance the performance of individuals and groups in military systems. The analysis, modeling and measurement of the human's interaction with the system constitutes a major part of the activities within HUM Group. These issues are of direct relevance to JSA Group, with its focus on joint and land missions, systems and systems of systems, including enabling methodologies and technologies. JSA's concern with analysis, modeling and measurement of total systems-of-systems performance needs to be informed by the outputs and activities within HUM group. Similarly JSA interests in analysis, simulation and modelling tools, synthetic environments, system-of systems experimentation methodologies and the systems engineering methodologies and tools, for example as they relate to simulation based acquisition and safety-critical systems, are of particular relevance to HUM Group.

Methodology. HUM and JSA need to work together to explore and identify common areas of interest and endeavor. This should occur both at a group level, perhaps facilitated by a joint or overlapping meeting in the coming year, and at the panel and action group level.

For the JSA perspective, the interactions at panel and action group level that appear particularly appropriate are as follows:

- ?? JSA TP-2: Modelling and Simulation, JSA AG-11: Technology for Distributed Intelligent Systems and HUM TP-2: Training Technology and HUM AG19: Personnel and Human Performance Modeling.
- ?? JSA TP-4 Systems Engineering for Defence Modernization and HUM TP-7 Human Factors in Aircraft Environments, and HUM TP-9 Human Factors Integration for Naval Systems.
- ?? JSA TP-1 Land Systems, JSA TP-5 Dismounted Combatant Operations and HUM TP-6 Physiological and Psychological aspects of personnel using

protective clothing and personal equipment and HUM TP-8 Physical and Cognitive Performance Enhancement for conventional and special operations.

?? JSA TP-3 Joint Concepts and Analysis and HUM TP-11 Human Concepts of Command.

Issue Ref No: JSA-ML-0101

Issue: Capability-based Force Development

Date Entered: June 2001

Champion: JSA-TP-3 Joint Capability and Analysis (AS Chair)

Status: In preparation for this year's JSA-TP-3 meeting, this issue arose as a point of concern to all. Thus JSA-TP-3 decided to hold a workshop on this issue just prior to their meeting. The conclusions of those participating in the workshop were:

?? all nations were in various stages of adopting a form of capability-based force development;
?? there were many similarities but some differences in the various implementations; and,
?? the tool-set used to support the process was, in many cases, in its infancy.

JSA-TP-3 included two presentations on this subject at their 2001 annual meeting: one covering capability-based force development and another focussing on the analytical tools to support it. JSA encourages JSA-TP-3 to further collaborate in this area.

Context: In recent years all TTCP countries have had to re-examine the way they develop future forces and force plan. All have adopted capability-based force development. However, in many cases the move to capability-based force development is in its infancy, as are the analytical tools to support it. This is a relatively new area for nations as well as TTCP.

Through capability-based force development countries are attempting to bring together all aspects of military capability (including equipment, people, training, infrastructure etc) as well as attributes of that capability (readiness, sustainability etc). In this way coherent, force level, balance-of-investment decisions can be made.

In efforts to learn from and assist each other JSA-TP-3 has been requested to further dialogue, exchange and collaborative activity in the following areas:

?? An improved understanding of capability-based force development
?? Discussions/exchange on how the nations have implemented capability-based force development
?? Discussion, exchange and collaboration on the tool-set required to support capability-based force development

JSA TP-3 will conduct a further workshop on this subject in November 2002. The workshop will include discussion of the system engineering approach being advanced by JSA TP.

Issue Ref No: JSA-ML-0102

Issue: Methods for Analyzing Complex Systems

Date Entered: June 2001

Champion: JSA-TP-3 Joint Concepts and Analysis (AS Chair)

Status: Initiated at the JSA June 2001 Annual Meeting. The last two JSA-TP-3 meetings have raised the issue of "Complexity Science" and its place in future modeling and analysis programs. A workshop on Complexity Science and Open Systems was held in NZ in March 2002 with participation from all five nations. The US will host a second workshop in 2003.

Context: A range of scientific techniques are emerging to assist in the analysis of complex or open systems that exhibit non-linear behavior, for example multiple agent/automaton models, genetic algorithms, neural networks, self-organising systems, artificial intelligence; and exploring multidimensional parameter spaces. It has potential in the areas of exploring swarming and other behaviors more reminiscent of biological systems than of traditional combat models. In particular, these methods seem to offer hope in modeling such complex fields as Operations Other Than War, C2, and ISTAR.

These methods inherently imply that for most problems, the traditional methods of OR are limited to well-behaved cases. Unfortunately, due to the dramatic nature of this conclusion, there has been much rhetoric associated with this field, but few examples of useful applications. Often cited examples of success in this area have more to do with common sense than the actual application of a model. However, NZ, the US and others have over the last two years produced some tangible examples of work in this area that appear to be useful. A good deal of this work is associated with the US Marine Corps' Project Albert.

This field has the potential to dramatically change the way OR is conducted, and may be the driver for major changes in doctrine in the future. Given the immaturity of this field, only a small portion of this work is currently widely available. But the key point is that more than models need to be developed. Appropriate methodologies and understanding need to be developed in parallel. Bearing these things in mind, it is recommended that TP3 set out to gain an understanding of this field, explore the merit of this work, and consider the value in disseminating it to the wider OR community.

Issue Ref No: JSA-ML-0103

Issue: Methods and Approaches for Warfighting Experiments and Experimentation Programs

Date Entered: June 2001

Champion: JSA-AG-12 Methods and Approaches for Warfighting Experimentation (CA Chair)

Status: JSA-AG-12 was created at the JSA June 2001 Annual Meeting with a two-year mandate and commenced work in the Winter of 2002. It delivered an initial report to the JSA at its 2002 Annual Meeting which identifies the scope for substantive collaboration and presents a plan to achieve its identified aims. The approved work plan ends May 2004, at which time AG-12 final report should be provided to the JSA for review at its 2004 Annual Meeting. An interim report of progress should be provided at the JSA 2003 Annual Meeting.

Context: In developing advanced concepts to support the warfighter, significant emphasis is currently placed by the nations on experiments and experimentation programs that bring together live and virtual elements. They are usually characterized by a combination of advanced technology and a systems-of-systems approach combined with novel concepts of operation and doctrine. The scale and scope of such experiments and programs may vary widely, but there are common principles in their conception, development, execution and analysis. The TTCP JSA Group wishes to stimulate a collaboration which improves the value which participating nations gain from such experiments and programs that identify and facilitate opportunities for nations to conduct or participate in such experiments and programs together. In approaching this task, the Action Group is requested to interact with QWG-AOR and other ABCA experimentation programs to examine the feasibility of observing planned experimentation opportunities to further the work of the AG, and should pay attention to the work on SELAB (see JSA-ML-9902) already undertaken by JSA-TP1 and the expertise of JSA-TP2.

In scoping its work AG-12 should consider the following general issues:

- ?? The sharing among AG-12 overview texts including TOR, draft minutes, summaries and material agreed, distribution list, and distribute abroad the collection, discussion and dissemination of the approaches to and methods for conducting warfighting experimentation currently used among the nations;
- ?? the production of a taxonomy and rationale for the application of warfighting experimentation;
- ?? the development and publication of mutually agreed best practice which emphasizes clear experimental design, robust analysis of results and the planned and coherent use of experimental results to guide decisions on the development of future military capabilities;
- ?? the identification of any tools used to facilitate experimentation which could be shared between nations;
- ?? the eventual sharing of such tools;

?? the creation of a network of individuals and information which acts to inform nations of future experiments in collaborating counties, and
?? the facilitation of such collaboration.

It is considered by JSA that any such collaborative experiments facilitated by the Action Group would be furthered by a specific activity outside the scope of AG-12, or as a follow-on activity of JSA.

The immediate task of the Action Group is:

?? to identify and bring together a group of national experts in this domain (Sep 2001) completed March 2002;
?? to discuss, review and refine the guidance contained in this MLI revised 7/72002 and
?? to suggest an appropriate plan for further work of the AG to JSA (Dec 2001) provided at June 2002 JSA annual meeting.

Next tasks includes:

?? to continue the sharing of information and documents;
?? to advance a taxonomy and rationale for the application of warfighting experimentation , and
?? to develop an agreed code of best practice for Methods and Approaches for Warfighting Experiments and Experimentation Programs (draft elements for JSA 2003 meeting and final report ready for JSA 2004).

Issue Ref No: JSA-ML-0104

Issue: Knowledge Management for the Warfighter

Date Entered: June 2001

Champion: JSA CA NR

Status: Initiated at the JSA June 2001 Annual Meeting. Recently, JSA C3I and HUM Groups have developed a proposal to hold a pan-TTCP workshop prior to NAMRAD 2002, to specifically examine the application of KM to the intelligence Function. Final commitment to this effort will be sort at NAMRAD 2002,

Context: There is growing interest among the nations in the field of Knowledge Management, both as an enabler for the Warfighter in improving mission success and as an enabler for more effective business processes within the defence enterprise.

JSA-AG-9 on Defence Technology Management was originally mandated during its 3 year lifetime (completed in June 2001) to examine the application of Knowledge Management (KM) to the nations' approaches to managing their respective S&T technology programs. In the course of its work, the Action Group held a number of workshops involving national experts that exchanged information on Data Mining Tools and Techniques and on Knowledge Management Strategies. However, identifying follow-on collaborative activities in KM proved particularly challenging in view of the infancy of the subject area and its broad potential application ranging from KM for Laboratory Management to KM for managing the defence enterprise to KM for the Warfighter. There was also not common agreement of what constitutes KM and what is its relation to Information Management.

As a summary of the AG-9 deliberations on potential future collaboration, the US presented a proposal for further collaboration in Knowledge Base Technology (it is provided below). Canada and the UK were both interested in supporting and encouraging ongoing activity in the area of knowledge discovery, particularly in text mining and visualisation. Australia expressed general interest in the area, but requested that TTCP first sort out what were the key technical issues that would be addressed and the desired outcomes. If the issues are technology-related, then the view was expressed that a more suitable home for collaboration might be in the C3I Group rather than JSA.

Discussion at NAMRAD 2001, the Principals requested that JSA continue to examine the potential for KN to enhance defence capabilities, with a particular focus on the command function, and to report at NAMRAD 2002. The principals agreed to also pursue the potential to TTCP work in KM to address the intelligence function.

In summary, the Action Group developed many potential areas for collaboration but was not able to agree on a specific proposal for a follow-on Action Group or a Panel to address KM issues. As a result, and supported by NAMRAD 2001 discussions, JSA agreed to continue to monitor national interests and emerging programs over the course of the coming year, and to reassess the potential for future collaboration during

its 2002 Annual Meeting. The JSA CA NR agreed to lead this discussion at the meeting.

Subsequent to these discussions, and building on the results of the Canadian Defence KM Symposium held in September 2002, the JSA, C3I and HUM Groups have proposed that TTCP host a classified pan-TTCP workshop prior to NAMRAD 2003, to specifically investigate the application of KM to the intelligence function. The workshop proposal is currently being discussed among the nations' technical and intelligence communities, with a final decision expected to be taken at NAMRAD 2002.

The following is the US proposal submitted to JSA-AG-9 in May 2000 for JSA collaborative activities in basic knowledge technology R&D. This proposal, and others, will be reconsidered by JSA at its 2002 Annual Meeting.

The US is actively engaged in fundamental Knowledge-Base Technology research and development to explore innovative solutions to turning large volumes of data and information into knowledge for enhanced defense planning, intelligence, and execution of military applications. This area of research is one of the most rapidly evolving technologies for transforming traditional operations to more responsive, deployable, and agile forces capable of quickly responding to missions across the full spectrum of global conflict. Knowledge-Base Technology solutions are inherently systems solutions, exploring ways to integrate large or small amounts of information coming from diverse sources in a way that quickly creates the knowledge essential for today's defense. Knowledge-Base Technology is of special interest in the defense domains of battlefield knowledge, force-on-force engagement, global awareness and information exchange, and military business operations that form the infrastructure for force transformation. The ultimate user of Knowledge-Base Technology for each of these domains is the warfighter.

The US proposes that a JSA Knowledge-Base Technology Panel be established to address collaboration opportunities in this emerging systems research field. The initial scope and objectives of the panel would be Knowledge Extraction technology, Knowledge Discovery technology, and Knowledge-Base Systems Architecture for implementing these technologies.

Knowledge Extraction applies to developing technologies to automatically extract and derive relevant information from multiple, heterogeneous knowledge sources. Knowledge sources include text documents, Web pages, structured databases, sensors, voice/natural language, and images. Knowledge Extraction technology deals with finding ways to quickly extract and fuse information from large volumes of information coming from multiple sources to provide high-level facts and relationships critical for decision-making in the domain of interest. The technology deals with finding ways to analyze the extracted facts, hypothesize or determine relationships/links among the extracted facts, and methods to enable humans to interpret the results to form knowledge. Natural language understanding, text summarization and understanding, and the development of Knowledge-Base trusted domain library collections are also included in this research area.

Knowledge Discovery applies to developing technologies that automatically present humans with enhanced information formulations and tools that aid in the formation of a mental picture that leads to the discovery of new knowledge. Knowledge Discovery technology deals with machine learning, case-based reasoning, similarity metrics and pattern learning. Data Mining and Text Mining are subsets of Knowledge Discovery, which deals with visualization of fused information from multiple sources, information relationships, and pattern variations.

Knowledge-Base System Architecture applies to developing software architectures for advanced knowledge-based systems and environments. KB System Architecture technology deals with formulation of concepts and designs for implementing highly scalable, component-based systems that fuse multiple Knowledge-Base technologies to deliver domain-specific knowledge solutions. Research includes scaleable, working KB system architectural models that demonstrate the integration of two or more KBT technologies using reusable components whose addition or removal impacts multiple knowledge objects.

Issue Ref No: JSA-ML-0001

Issue: Analysis Methodologies and Technologies that Support Effects-Based Operations

Date Extended: June 2002

Champion: JSA-AG-10 Technologies for Effects Based Operations (US Chair)

Status: Initiated at the JSA July 2000 Annual Meeting, the JSA-AG-10 was extended by two years in June 2002. Interim and final reports will be presented at the 2003 and 2004 JSA Group meetings, respectively.

Context: Modern conflict management across the spectrum of conflict by coalition partners will demand an analytic foundation for the generation of effects based options for operations. Those options must be cognitively connected to the effects desired by the national decision making authorities, efficient, effective and accrue minimum collateral damage with unambiguous effectiveness indicators. To do this, substantial analytical technologies are needed, technologies that should be commonly understood among the traditional allies. Allies need not have common options derived from the technologies but should understand the analytical basis by which each is generating their options for operations.

The Action Group has been active for the past two years. The Action Group was successful in meeting the objectives in the original Terms of Reference: (1) determining the state of the art, (2) identifying methodologies and technologies for exchange, and (3) recommending future avenues of development. The Action Group believes that there are still multiple opportunities for technology exchange and several well-defined tasks still to be addressed. The Action Group will pay particular attention to information exchange and collaborative experiments in Virtual Network modeling and analysis and will continue to monitor national methodologies and technologies in engineering, physical network and operations modeling domains and associated integration and visualization challenges. Information and product exchange in these areas, particularly Physical Network modeling, may also lead to collaboration.

The Action Group will conduct its work for the next two years through information and product exchange, correspondence, meetings, workshops and collaborative experiments of the full action group and sub-groups as appropriate. The Action Group will specifically address the following:

(1) Develop a concept paper detailing the definition of Effects Based Operations as defined by each of the participating countries. This paper will include an EBO taxonomy and a description of the underpinning concepts.
(2) Conduct an exercise to showcase virtual network modeling and analysis tools and approaches from each member nation.
(3) Continue to monitor the current state-of-the-art and capability among members in technologies and methodologies for modeling, simulation and data base generation to support effects based operations.

(4) Continue to identify opportunities for exchange among members as appropriate of technologies and methodologies for models, simulations and databases to support effects based operations.

The proposed schedule of events can be found in the June 2002 Annual Report to JSA.

Issue Ref No: JSA-ML-0002

Issue: TTCP M&S Roadmap for Enabling Experimentation in System-of-Systems

Date Entered: July 2000

Champion: JSA-TP-2 Modeling and Simulation (UK Chair)

Status: JSA-TP-2 has prepared a M&S Roadmap. The roadmap received endorsement in principle at the 2000 Exec Chairs Workshop and at NAMRAD 2000. TP2 has refined the M&S roadmap for enabling experimentation in system of systems, and revised the delivery of the roadmap into key focus areas and action areas to reflect national investment priorities.

Context: At NAMRAD 1999, the Principals requested that JSA develop a strategy for increasing the use of Advanced Distributed Simulation in TTCP. To this end, JSA-TP-2 provided a draft TTCP M&S Roadmap for Enabling Experimentation in System-of-Systems at the JSA 2000 Annual Meeting.

Through the roadmap, JSA-TP-2 will identify the M&S requirements and shortfalls by carrying out an analysis that will involve:

?? identification of a set of “use cases” that require a significant system-of-systems perspective;
?? identification of the M&S capability required to support the “use cases”;
?? identification of the shortfall in M&S capability for each “use case”;
?? analysis of the shortfalls to derive the priority areas of M&S research required.

The Roadmap currently identifies four "M&S use cases" defining challenging system-of-system scenarios against which to explore the key M&S issues:

?? Common situational awareness for coalition operations in the Land/Air Battle
?? Coalition based Operations Other Than War (OOTW)
?? Maritime skills training in a coalition context
?? Littoral operations - deriving the needs of the joint and common battlespace

JSA-TP-2, with the support of the JSA NRs, will begin to deliver the Roadmap through opportunities to link its investigations to specific collaborative activities and experiments being planned by nations in the next 1-3 years. Over the next year TP2 will focus on OOTW and SBA use case studies, plus associated VV&A and federated simulation interoperability.

Issue Ref No: JSA-ML-0004

Issue: Emerging Distributed Intelligent Systems and their Impact on Operations and Systems in 2015

Date Entered: October 2002

Champion: JSA-AG-11

Status: At the JSA's 2001 Annual Meeting, it was agreed to initiate JSA-AG-11 on Technology for Distributed Intelligent Systems. The AG has a 2-year mandate. A workshop on Distributed Intelligent Systems was held in Quebec, Canada on September 23-24, 2002 with participation from all five nations. The US may host a second follow on workshop in April 2003 prior to June 2003 JSA meeting in London. The workshop produced insight in the following areas:

1. Definition and scope of efforts enabling distributed intelligent agents
2. Problem domain characteristics
3. Technology expertise from all five nations
4. Areas of collaboration between countries
    a. Aiding Human Understanding/Decision Making through intelligent software agents for information management and to overcome information overload
    b. Balancing and Maximizing human/machine team effectiveness, achieving interoperability, coordinated situation awareness
    c. Standardized interfaces between sensor, weapon/actions, manoeuvres, and common ontologies
    d. Hierarchical Uses and issues in Distributed Intelligent Agents;
    e. Application in Military & Counter Terrorism Operations in a Network Centric Environment, such as Surveillance, Mobile communications network, Mobile sensor networks; collaborative situation awareness, Weapon systems (effect delivery), Rescue operations, Homeland defense, crisis and disaster response

Context: At NAMRAD 1999, the Principals requested that JSA consider leading a pan-TTCP effort to better understand emerging technologies on a 10-15 year horizon for sharing intelligence among machines and humans and related operational/system opportunities and challenges. The vision is that future military systems will increasingly become "intelligent networks of intelligent systems".

To initiate the discussion, the JSA NRs provided the following to the US.

1. The perceived or declared national interest in the concept of distributed intelligence among intelligent systems and humans;
2. The national interest or concern in tradeoffs between the burden on the human and the burden on automation in realizing intelligence derived from diverse sources;
3. Brief descriptions of national initiatives that would be relevant to the topics of intelligent systems, distributed intelligent systems, or distributed intelligent systems integrated with human intelligence; and

4. National technology explorations that could be enablers for the concept of distributed intelligence.

Based on this assessment, the US NR drafted a Terms of Reference for a new Action Group (JSA-AG-11) on Technology for Distributed Intelligent Systems. The purpose of the AG would be to examine the status of relevant emerging technologies in a selected application area, to assess their potential impact on defence, and to recommend a way forward for TTCP. The JSA accepted this proposal at its 2001 Annual Meeting. As an initial step, the AG members will identify the application focus for the work and adjust the TOR accordingly, with feedback to be provided to the JSA NRs by September 2001 for their consideration. Further work of the AG will be dependent on JSA concurrence.

Issue Ref No: JSA-ML-9905

Issue: Modeling and Simulation-Enabled Visualization for Systems/Concept Development

Date Entered: July 1999

Champion: JSA-TP-2 Modeling and Simulation (UK Chair)

Status: JSA-TP-2 has been requested to examine the direction of M&S-enabled visualization technologies as applied to the development of new concepts, systems and models. Progress was reported at the JSA 2000 Annual Meeting. The topic was kept open for one year as requested by JSA, but there were no national activities or effort to produce a report. TP2 reported that ML 9905 will be addressed as part of the proposed M&S enablers for Simulation Based Acquisition activity. JSA has requested a report for 2003.

Context: Recent years have witnessed the convergence of rapidly-advancing Modeling and Simulation technologies with modified business management practices in both the civilian and defence environments. Dramatic improvements are being witnessed across a variety of domains such as concept exploration, acquisition, technology development and insertion, training and decision support. These improvements are being manifested, for example, by reduced costs during the development cycle and by shorter times from concept to product. Continuing advances in M&S enabling technologies and further maturing of the new business process models that exploit these technologies offer the potential for even more dramatic changes in both the civilian and defence sectors.

Within the TTCP community, the principle focus to date of M&S collaboration has been in the technologies enabling distributed simulation for applications such as training, constructive simulations for concept exploration, and virtual simulations for system development. Key issues for study have included network effects such as latency; architectures, software infrastructure and standards to facilitate ADS application development and re-use; and model issues such as data management, aggregation and fidelity.

An emerging M&S domain being driven by the rapid improvements in f high-performance computing, 3-D graphics and related software is that of visualization. Increasingly, M&S-enabled visualization is permitting the coupling of the human to complex synthetic environments in which the human user is able to “visualize” the environment and adaptively adjust the situation through the natural human senses (i.e. sight, speech, touch, etc.).

M&S-enabled visualization offers the potential for dramatically affecting the paradigm in which defence systems and related technologies are conceived, researched and developed. Through M&S-enabled visualization, it becomes possible for researchers to examine the interactions of complex devices and systems with their environment through high-fidelity engineering-level computer models, wherein the researcher can adaptively adjust the device or system design to achieve a desired response to the environmental stimuli by visualizing the cause-and-effect

relationships at play. In another area, Test and Evaluation (T&E) via M&S-enabled visualization during product acceptance or in failure forensics offers the potential to improve system reliability and safety by more rapidly identifying unexpected failure modes and relating these to the optimum changes in design parameters.

To further its understanding of the potential afforded by M&S-enabled visualization, particularly in the area of system, concept and model development, JSA has requested that its JSA-TP-2 examine the trends in the related enabling technologies and their application in the areas indicated. It is expected that the Panel will identify where the greatest opportunities for process improvement appear to lie, and suggest whether there are areas for potential TTCP collaboration, either to advance the enablers or to demonstrate to process owners the benefits to be derived. The preliminary findings of the TP were presented to the JSA at its 2000 Annual Meeting, with a final report now due at its 2003 Annual Meeting.

Summary of Closed Issues

Issue Number	Description	Entered/ Closed	Status
JSA-ML-0003	*Enhancing Effectiveness of Small Dismounted Combatant Units in the Future Battlespace*	*Entered July 2000/ Closed June 2001*	*Issue Closed. At the 2000 Annual Meeting of JSA, JSA-AG-7 presented its analysis of Technology Requirements for Soldier System Modernization in the 2015 Timeframe. JSA subsequently tasked AG-7 to develop the TOR and detailed 3-year work plan for a new JSA TP that would lead TTCP efforts to address the integration of these technologies into future soldier systems so as to enhance individual and unit effectiveness in the future battlespace. Based on these recommendations, JSA decided at the 2001 Annual Meeting to create a new panel, JSA-TP-5 on Dismounted Combatant Operations.*
JSA-ML-9901	*Operational Analysis issues in Information Warfare*	*Entered July 1999 Closed June2002*	*Issue closed. At the 2002 meeting, JSA decided that, although there was still a long way to go, there were limited national programs for leverage.*
JSA-ML-9902	*System Challenges for the Land/Air Battle of 2015*	*Entered July 1999/ Closed June 2001*	*Issue Closed. JSA-TP-1 was tasked in July 1999 to provide a TTCP perspective of the concepts and technologies important to the future land/air battle, and the key challenges that need to be addressed. The TP has prepared a report on the subject that was presented at the JSA 2000 Annual Meeting. JSA has requested that the TP explore, in consultation with other Groups, the feasibility of a series of TTCP-led System-of-Systems Experiments for the Land/Air Battle (SELAB) to address these challenges, with recommendations to be presented at the JSA 2001 Annual Meeting. As a result of these recommendations, JSA agreed to create the new JSA-AG-12 on Methods and Approaches for War-fighting Experiments, as the first activity to progress the SELAB concept Completed (see JSA-ML-0103).*
JSA-ML-9903	*Systems Engineering for Defence Modernization*	*Entered July 1999/ Closed June 2001*	*Issue Closed. The new JSA-TP-4, created in July 1999, began with a 2-year transition period where it would initiate collaboration in the areas of Simulation Based Acquisition, Safety-Critical Systems and others. The Panel presented a comprehensive work program to JSA at its 2000 Annual Meeting to successfully complete the transition period.*
JSA-ML-9904	*Whole Life Cost Reduction*	*Entered July 1999/ Closed July 2000*	*Issue Closed. Champion is UK NR. JSA considered the way ahead at its 2000 annual meeting in a debate led by the UK NR. Further progress on the issue will be addressed via JSA-ML-9903.*
JSA-ML-9906	*Scientific Methodologies Applied to Lessons Learned from Military Operations*	*Entered July 1999 Closed June 2002*	*Issue Closed June 2002. Report issued. No further national program synergies were identified.*
JSA-ML-9801	*US Army*	*Entered*	*Issue Closed. As a follow-on to TTCP*

	Technology and Materiel Seminar Game	*June1998/ Closed July 2000*	*participation in the July 1998 wash-up of the first US Army-After-Next Technology Seminar Game, the US NR pursued direct TTCP participation in the 2000 US Army Technology and Materiel Seminar Game. The 2000 game was ultimately cancelled, but will be conducted in the next 1-2 years. The JSA NRs will remain alert to future opportunities for TTCP participation..*
JSA-ML-9802	Logistics for the Future Battlespace	June 1998	Champion is JSA-TP-3. The TP was originally tasked to champion pan-TTCP consideration of the concepts and technologies for future logistics. TP-3 provided initial recommendations at the 2000 JSA Annual Meeting, with a further report based on findings of a workshop delivered at the 2001 meeting. .
JSA-ML-9803	*Exploitation of Space*	*Entered June1998/ Closed July 2000*	*Issue Closed. At its July 1999 annual meeting, JSA examined current TTCP activities in space systems and technologies in a discussion led by the AS NR. JSA Exec Chair tabled the subject at the 1999 Exec Chairs Workshop, where it was agreed to maintain the current level of TTCP activity in space cooperation.*
JSA-ML-9701	*Simulation-Based Acquisition Processes*	*Entered June1997/ Closed July 1999*	*Issue closed. JSA-AG-5 was formed in June 1997 to develop recommendations. Its final report was reviewed by JSA at its July 1999 annual meeting. JSA has agreed to pursue further SBA work under its new JSA-TP-4 (see JSA-ML-9903).*
JSA-ML-9702	*Wide Area Surveillance/ Recognized Picture for Coalition Operations*	*Entered June1997/ Closed July 1999*	*Issue Closed. JSA-AG-6 was formed in June 1997 to develop recommendations. Its final report was reviewed by JSA at its July 1999 annual meeting. The strategy to implement the AG recommendations was addressed by JSA, C3I and SEN in Sep-Oct 1999. The TTCP Exec Chairs agreed at NAMRAD 99 that C3I would lead a pan-TTCP activity to progress the AG recommendations.*
JSA-ML-9703	*Planning/Analysis for Coalition Operations*	*Entered June1997/ Closed July 1999*	*Issue Closed. JSA-TP-3 was requested in June 1998 to consider cooperative development of the appropriate OA tools to improve decision making in coalition planning A workshop was held at the May 2000 JSA-TP-3. Further development of these tools will be progressed within the TP-3's program of work.*
JSA-ML-9704	*Vulnerability of Information Operations across Joint/ Common Operations*	*Entered June1997/ Closed June 1998*	*Issue closed. To be subsumed by the TTCP Information Warfare way ahead to be discussed at NAMRAD 98.*
JSA-ML-9705	*Unmanned Aerial Vehicles*	*Entered Oct 1997/ Closed June 2000*	*Issue Closed. After the pan-TTCP UAV workshop held in June 1998, the JSA-AG-8 was formed with a 3 year mandate to consider future UAV concepts. A suitable methodology has been defined, Concept of Use workshops held to develop notional UAV concepts and identify capability needs, and followed by a Technology Assessment Workshop to identify critical technologies. Also, planning was undertaken for Global Hawk overflights of Canada, now to occur in late 2001, with TTCP observation of AS*

			overflights having occurred in May 2001. Transition of the AG activities to AER-TP-6 has been completed, thereby closing the AG.
JSA-ML-9706	*Defence Technology Management Practices*	*Entered Oct 1997/ Closed June 2000*	*Issue Closed. A mini-conference was held in conjunction with the June 1998 JSA annual meeting, comparing UK and CA experiences in S&T management. As a result, JSA-AG-9 was formed in June 1998 to progress collaboration in the area of defence science and technology management practices with a particular focus on knowledge management. The AG has published a compendium on S&T management best practices among the nations. It also provided technical advice to TTCP efforts to institute both an electronic library and technology watch function using knowledge management principles. The AG provided recommendations for further TTCP collaboration in the area of Knowledge Management at the JSA 2001 Annual Meeting. JSA agreed to address future collaboration in KM via JSA-ML-0104.*

***Issue Ref No**: JSA-ML-0003 (Issue Closed)*

***Issue**: Enhancing Effectiveness of Small Dismounted Combatant Units in the Future Battlespace*

***Date Entered**: July 2000*

***Champion**: JSA-AG-7 Small Unit Land Operations (UK Chair)*

***Status:** The JSA-AG-7 has prepared a report on Technology Requirements for Soldier System Modernization in the 2015 Timeframe. It provided JSA with the TOR and 3-year workplan for a new JSA Technical Panel, with a decision taken by JSA at its 2001 Annual Meeting to create JSA-TP-5 on Dismounted Combatant Operations.*

***Context**: At the 2000 Annual Meeting of JSA, JSA-AG-7 presented its analysis of Technology Requirements for Soldier Modernization in the 2015 Timeframe. As emphasized in the AG-7 report, and supported by the JSA NRs, small units of dismounted combatants will remain essential to the effective conduct of a wide range of military operations. Such units will be required increasingly to:*

- ?? *operate both independently and when integrated into large units, frequently in coalition,*
- ?? *operate in complex terrain and situations, and*
- ?? *respond to a variety of complex mission types characterized by challenging Rules of Engagement.*

Similar issues appear to exist across the spectrum of small units including Special Forces, Commandos, Marines and Infantry Soldiers. The potential exists for performance optimization of these units to be informed by systematic Operational Analysis and system level design and integration studies, in particular that meld the human, technological, and system dimensions.

To build on these findings, JSA requested that the AG-7 submit the TOR and 3-year work plan suitable for a TTCP Technical Panel. The expected focus of the Panel would be to lead TTCP efforts to address the integration of enabling technologies into future systems so as to enhance the effectiveness of individual and small units of dismounted combatants in the future battlespace.

The proposal was to include the following elements:

- ?? *Terms of Reference consistent with the scope of a TTCP Technical Panel,*
- ?? *identification of core work themes and the work program for the next three years, articulating the linkages to the AG-7's technology requirements document, and*
- ?? *potential resource contributions from the five nations.*

The proposal was to take into account the JSA Strategic Plan, to highlight the systems aspects of Dismounted Combatant Science and Technology, and to note the likely interactions with other JSA and TTCP Technical Panels, and external organizations.

The proposal was drafted by the end of September 2000 so as to allow a credible case to be put to the NAMRAD Principals in October 2000 by the JSA Exec Chair. At NAMRAD 2000 , he Principals endorsed the concept of JSA work in this area.

JSA examined the AG-7 recommendations presented at the 2001 Annual Meeting and agreed to create a new JSA-TP-5 on Dismounted Combatant Operations. The TP will have the following focal areas:

?? *Equipment based technologies and concepts for the 2020 timeframe (co-led by AS and CA).*

?? *Models, wargames and simulations (led by US).*

?? *Data collection and collection techniques (led by UK).*

?? *Innovative integrated protective concepts against novel weapons (lead nation TBD).*

***Issue Ref No**: JSA-ML-9901 (Issue Closed)*

***Issue**: Operational Analysis Issues for Information Warfare*

***Date Entered**: July 1999*

***Champion**: JSA-TP-3 Systems Concepts and Analysis (UK Chair)*

***Status**: JSA-TP-3 was requested to examine and report on the Operational Analysis issues in Information Warfare, as a JSA contribution to the TTCP way ahead in IW. The initial TP-3 perspective was reported at the JSA 2000 annual meeting, and further work reported at the JSA 2001 annual meeting. In 2002, the TP focused on the cultural aspects of Information Operations, with a report on findings presented at the 2002 JSA annual meeting.*

***Context:** The emerging warfare area referred to as Information Warfare (increasingly referred to as Information Operations) - to suitably protect own-force information and related processes, or to disrupt the enemy's information and processes - is viewed to be critical to success in the modern battlespace. In a recent effort led by the C3I Group and involving EWS and JSA Groups, TTCP has examined its way ahead for collaboration in Information Warfare.*

In establishing the TTCP focus for work in IW, it has been recognized that the issues of context, domain and function as outlined below provide an appropriate taxonomy through which the collaboration focus can be established. Specifically:

- ?? *the context in which IW is executed is established by the following factors: Mission; Partners (Single Service, Joint Coalition, OGD, NGO); Conflict Spectrum (OOTW to High Intensity Conflict); Threat (Symmetric/Asymmetric, Motivation, Technology, Capability); Policies (Government, DoD, OGD, Legislation, Industry, Motivation); Culture; Doctrine, Tactics, Techniques, Procedures (TTP); and Rules of Engagement*
- ?? *the domain to which IW is applied can be divided into: Communications/Networks; Information Systems; Weapon Systems; Sensors; Platforms; and People.*
- ?? *finally, the specific IW function can be one of: Protect; Deter; Detect; Recover (Forensics); React (Pursue, Forensics); or Engage (Destroy, Deceive, Deny, Jam, Corrupt)*

An initial focus for TTCP collaboration has been bounded as follows:

- ?? *Context: Non-high intensity conflict; asymmetric threat; effect of partners, policies, culture, doctrine and ROE;*
- ?? *Domain: Communications/Networks; Information Systems; and People; and*
- ?? *Function: Protect; Deter; Detect; Recover; and React.*

A pan-TTCP Workshop on "Information Operations to Counter Asymmetric Threats" was held in Ottawa in March 1999, involving the technical, operational, and intelligence communities (including the computer emergency response community). The Workshop identified the following issues for further consideration:

- ?? *TTCP involvement in the "Human Issues" (PSYOP) in IW;*
- ?? *TTCP involvement in offensive Information Operations;*
- ?? *linkages with the Operational Research community; military operational staffs and with CERT activities; and*
- ?? *implications for the Critical National Infrastructure*

It was recognized that existing TTCP Groups and Panels are well positioned to pursue these issues, including C3I (notably C3I-TP-11), JSA, EWS and possibly HUM.

In order to further explore these issues, JSA requested at its July 1999 Annual Meeting that JSA-TP-3 examine the various Operational Analysis issues in IW as identified in the findings of the above Workshop and through other pertinent national activities. The initial focus was to be on the deficiencies in OA tools and methodologies currently available to examine IW within the above taxonomy and on topics ripe for collaborative OA.

JSA-TP-3 addressed these issues in a broad context of Information Operations at a classified workshop in May 2000. The preliminary findings were reported to JSA at its 2000 Annual Meeting and the Workshop report will be published in mid-2000.

In taking this issue forward, TP-3 has identified that there is interest among the nations in comparing methodologies for cultural mapping, which its workshop identified as an important element in understanding IO issues; the TP conducted a second workshop specifically on this issue in the coming year. Whilst some progress was made, there is clearly a long way to go but the TP felt that its membership had really exhausted all of its skill set in addressing the issue. No new national programs were identified.

A workshop on the subject of Cultural Mapping was held in the UK in March 2002. This workshop discussed techniques for the understanding of activities of different communities and their likely reaction in a range of situations. These seem to be little opportunity for the exchange of models at this time.

The Group agreed to close this ML issue in June 2002.

***Issue Ref No**: JSA-ML-9902 (Issue Closed)*

***Issue**: System Challenges for the Land/Air Battle of 2015*

***Date Entered**: July 1999*

***Champion**: JSA-TP-1 Land Systems (AS Chair)*

***Status**: JSA-TP-1 has been requested to champion pan-TTCP consideration of the concepts and technologies important to the future land/air battle. A report of the TP's findings was presented at the JSA 2000 Annual Meeting. Building on these findings, the TP has been requested to examine, in consultation with other Groups, the feasibility of TTCP System-of-Systems Experiments for the Land/Air Battle (SELAB) to be led by JSA-TP-1. Recommendations were to be presented by TP-1 at the JSA 2001 Annual Meeting, with the decision by the Group to move forward with the first SELAB related activity under the new JSA-AG-12 on Methods and Approaches for War-fighting Experiments Completed (see JSA-ML-0103).*

***Context**: The Land/Air battle of 2015 will be technologically sophisticated, complex, and will involve a large number of entities, both manned and unmanned. Sensor-to-shooter technology will allow weapons to be activated remotely. Consequently, land/air battle management will have problems similar to those in air traffic control, but much more varied and extensive. Air Defence must be organic - all elements must work as a coordinated group. Several important aspects of Land/Air, include: Joint command and mission planning; Air Defence - both the fighter and SHORAD aspects; Joint picture compilation - both air and ground, given that both affect the outcomes of the Land battle; Manoeuvre Air Battle - helicopters, fixed wing aircraft and UAVs sharing the same airspace; Combat Identification (air-to-ground is the biggest issue, as in the Gulf War); common planning; layers of surveillance. Thus, there is a need to study the future battlefield as an entity, with a protective, layered cocoon around it (the Land equivalent of a US Carrier Task Force). This leads to considerations of the Land/Air battle as a system.*

JSA-TP-1 was tasked at the JSA 1999 Annual Meeting to provide a TTCP perspective of the concepts and technologies important to the future land/air battle, and the key challenges that need to be addressed. In response to this task, the TP has prepared a report "System Challenges for the Land/Air Battle 2015" that was presented at the JSA 2000 Annual Meeting. To build on the findings of the report and to pursue the key challenges so identified, JSA requested that the TP explore, in consultation with other Groups, the feasibility of a series of TTCP-led System-of-Systems Experiments for the Land/Air Battle (SELAB) to address these challenges. Recommendations were presented at the JSA 2001 Annual Meeting.

Specifically, the JSA-TP-1 was requested to organize and conduct a workshop to be led by AS in conjunction with the TP's Annual Meeting held in Canada in October 2000. The workshop explored:

?? *the identification of the candidate scenario(s) and coalition/warfighter issues to be the focus for SELAB-1;*

- ?? *the architecture, components and connectivity of the synthetic environment necessary to conduct the experiments, examining in particular the feasibility of internationally-distributed SE;*
- ?? *the participation and resources necessary to establish the synthetic environment and to conduct the experiment; and*
- ?? *the linkages to other TTCP Groups and external organizations (e.g. QWG AOR, JBLNet) and their contributions necessary for effecting the experiment.*

The JSA Exec Chair provided a brief on the concept of the SELAB at the Exec Chairs Workshop and NAMRAD 2000. The principle received broad approval, while recognizing the significant challenge that such experiments would entail.

At its 2001 Annual Meeting, the JSA agreed that the logical starting point for such activity would be in the collaborative study of the methods and approaches for war-fighting experiments. To this end, it created JSA-AG-12 to progress this work (see JSA-ML-0103). The intent is that JSA-AG-12 would be followed up with further collaboration consistent with the SELAB concept described above. Recent considerations impose that AG-12 interact with QWG-AOR and other ABCA experimentation programs to examine the feasibility of observing planned experimentation opportunities to further its work.

***Issue Ref No**: JSA-ML-9903 (Issue Closed)*

***Issue**: Systems Engineering for Defence Modernization*

***Date Entered**: July 1999*

***Champion**: JSA-TP-4 Systems Engineering for Defence Modernization (UK Chair)*

***Status**: JSA created the new JSA-TP-4 in July 1999 to address the issue. The Panel began with a 2-year transition period where it initiated collaboration in the areas of Simulation Based Acquisition, Safety-Critical Systems and others. TP progress was reported at the 2000 JSA Annual Meeting, with its work plan described in detail at the 2001 Annual Meeting.*

***Context**: The field of systems engineering[2] has evolved a range of processes, methodologies and tools to meet the demands of large complex development projects, largely in the defence and aerospace domains. These are enshrined in recognized standards, such as the EIA (Electrical Industries of America) 632, and the emerging ISO 15288 on Life Cycle Management – Systems Life Cycle Processes.*

These disciplines are now being seen as offering a new and systematic way of approaching a new range of challenges facing the defence communities as a whole. These include:

- ?? *Speeding up the acquisition process*
- ?? *Acquiring whole military capabilities, including 'systems of systems',*
- ?? *Minimizing whole life costs*
- ?? *Controlling the evolution of systems throughout their operational life, to respond to user feedback, changes in the threat and the march of technology*
- ?? *Linking the acquisition projects to decision processes in the customer environment, such as approval, acceptance and technology investment.*

JSA-TP-4 will review and exchange best practice and latest research in the application of systems engineering techniques to the enterprise of defence in the TTCP nations. Its considerations will cover - but not be confined to - the following technical areas:

- ?? *Integrating advanced simulation and modeling techniques into the acquisition process (Simulation Based Acquisition)*
- ?? *Information management, both within and across projects*
- ?? *Through-life requirements management*
- ?? *Integrated design techniques*
- ?? *Cost modeling techniques, and their integration into the early design and trade-off processes (Cost as an Independent Variable)*
- ?? *Reliability modeling and prediction*
- ?? *Acquiring systems of systems*

[2] For the purpose of this work, we define systems engineering as 'The set of activities which control the overall design, implementation and integration of a complex set of interacting set of components, systems or applications in order to meet the needs of all stakeholders, within the constraints arising from the system's operational and development environment'

- ?? *Linking the organizational decision and monitoring processes to those of individual projects*
- ?? *Integrating the management of technology and technology demonstration for 'just in time' insertion*
- ?? *Obsolescence management*
- ?? *Techniques for test and evaluation, including safety and assurance*
- ?? *Education and training programs aimed at improving systems engineering skills*

In conducting its work, the Panel will liaise closely with acquisition reform activities in the nations, commercial industry and relevant research in defence agencies and academic institutes.

It is recognized that the potential scope defined for TP-4 is very broad, and that there are considerable differences between the nations in their practice of systems engineering, and their commitment to the acquisition reforms that will enable the adoption of some of the techniques involved. Also, the focus on process issues, rather than conventional technological research, is outside the normal range of TTCP activities. The program of work is therefore to commence with a two-year start-up phase, to be followed by a longer-term program.

Stage 1 – Start-up (July 99 – May 01), during which the Panel will:

- ?? *conduct a review of relevant activities in the nations;*
- ?? *establish relations with those responsible for advanced process initiatives, where they exist;*
- ?? *carry forward the recommendations of JSA-AG5 on Simulation Based Acquisition, working as required with JSA-TP2 on Modeling and Simulation;*
- ?? *pursue other opportunities for initial joint activities and information exchange*
- ?? *subsume the activities of JSA-AG4 on Safety Critical Systems (from July 00)*
- ?? *put forward a longer-term, sustainable program of collaboration within the scope of Section 3.*

The Panel will submit reports to JSA Group as follows:

- ?? *May 00: Interim Stage 1 Report, initial findings (including barriers to progress) and plans for the integration of AG4*
- ?? *May 01: Final Stage 1 Report on the way forward.*

Stage 2 Longer-term (July 01 onwards).

- ?? *Substantive joint program of information exchange, collaborative research and studies, leading to working papers and reports of benefit to S&T and Acquisition Managers in the nations. Special consideration should be given to experimental demonstrations of the application of advanced techniques of distributed collaborative working, for example in the form of technical demonstration program.*

At the 2001 JSA Annual Meeting, TP-4 met its first major milestone in providing the Final Stage 1 Report. It recommended, and JSA accepted an on-going program of work that will focus in the following areas:

Joint Advanced Acquisition Concepts Studies

Initial definition of required enablers (Oct 01).
Baseline definition of key concepts updated (Apr 02).

Coalition Aspects of the Single Integrated Air Picture

National Perspectives on SIAP Acquisition Process Workshop - National Organizational, Technical and Programmatic Papers (Oct 01).
Integrated Findings from National Papers (Sep 01).

Safety Critical Systems

Follow-on LRAAM workshop at DERA (Malvern) with participation from UK and AS (and possibly the US) (Aug 01).

Inter-Group Use Case

Communication requesting appropriate projects (May 01).
Identify system of system projects and selection of the most suitable (Dec 01).
Agree proposal for study (March 02).

System Engineering for Future Offensive Capability

Inform and agree with Project offices (Jul 01).
Definition the current approaches, including initial use of SBA and IDE Apr (02).

Establish and Maintain Interactions with External Groups

Draft action plan by next TP4 meeting (Oct 01).
Refined list of enablers by next TP4 meeting (Oct 01).
INCOSE 2001 Academic Forum report at next TP-4 meeting (Oct 01).

Workshops, Conferences, and Symposium

Panel presentations in the INCOSE proceedings (July 01).
Integrated findings from National Organizational, Technical and Programmatic papers (Oct 01).
Three year plan of actions and milestones (Oct 01).

***Issue Ref No**: JSA-ML-9904 (Issue Closed)*

***Issue:** Whole Life Cost Reduction*

***Date Entered:** July 1999*

***Champion:** UK National Representative*

***Status**: JSA will consider the way ahead at its June 2000 meeting in a debate to be led by the UK NR.*

***Context**: Statistics show that the costs of supporting military equipment in service exceed those of initial development by a factor of between 3 and 4 times. The pressure on defence budgets in all the nations means that there is great potential pay-off in finding ways of understanding and reducing these costs.*

Within TTCP - as in the individual national S&T programs - the great majority of the research investment is devoted to the initial development of systems, with relatively little attention paid to their operational costs. The challenges of addressing this position are considerable: real statistics are difficult to find and analyze, and it is even harder to trace these back to decisions made in the early conceptual and development stages. In the civilian world, however, whole life costs have been addressed in a systematic and determined manner, with major investments in manufacturing technology, reliability, component-count reduction and logistics.

JSA is currently making small but significant inroads into the problem in a number of areas: support for simulation technology for the reduction the costs of training and exercises in JSA-TP-2, the intended involvement in the forthcoming US Focused Logistics Wargame (FLOW) in JSA-TP-3, and the request to the new JSA-TP-4 to address Cost as an Independent Variable.

The potential for broader TTCP involvement in research and studies into whole life cost reduction was addressed at the JSA 2000 annual meeting, where the UK NR led the debate. The NRs agreed on the opportunity for TTCP to demonstrate leadership for the nations in improving their capabilities to address whole-life cost issues and related defence modernization issues by the application of emerging system engineering concepts.

Further progress on the issue will be progressed under JSA-ML-9903 System Engineering for Defence Modernization.

***Issue Ref No**: JSA-ML-9906 (Issue Closed)*

***Issue**: Scientific Methodologies Applied to Lessons Learned from Military Operations*

***Date Entered**: July 1999*

***Champion**: JSA-TP-3 Joint Concepts and Analysis (UK Chair)*

***Status:** At its 2000 annual meeting, JSA compared lessons-learned methodologies among the nations, and identified the potential to improve the national lessons-learned processes through the application of the scientific process and the exchange of national practices. JSA-TP-3 was requested to progress the debate, to identify opportunities for TTCP collaboration, and to present recommendations at the JSA 2001 Annual Meeting.*

***Context**: With the increasing diversity and complexity of missions which allied forces are undertaking, it becomes critical that sound practices are in place by which one identifies and adjusts to the key lessons coming out of these operations. The implications from these lessons can be far-reaching and can affect all aspects of defence, including how defence forces are organized, trained, commanded, equipped, and supported. Given the potential impact of implementing these lessons, it is equally critical that the lessons themselves be subjected to suitable rigor, challenge and analysis.*

At its 2000 annual meeting, the JSA compared the lessons-learned methodologies currently employed in the TTCP nations. From these discussions, it examined the potential benefit to be derived from collaborative efforts in improving these methodologies. Approaches could include the joint development of improved methodologies for more systematically collecting operational information, for subjecting such information to more rigorous analysis and to quantify how different military solutions or approaches would have had improved results.

As a result of these deliberations, the JSA members agreed on the need for further study of the opportunities and to examine the feasibility of a specific collaborative work program, exploiting links with QWG AOR where possible. JSA-TP-3 was asked to further this task, and requested to provide findings and recommendations to the JSA at its 2001 Annual Meeting. At the meeting, TP-3 reported that while there is benefit to be derived from a sharing of approaches among nations through the TP-3 forum, that in general it was felt that the current practices are relatively mature and suitably rigorous, and therefore not suitable for significant collaboration. TP-3 circulated an ABCA OWG-AOR report which includes a summary of the nations' lessons-learned and collection processes.
(Issue closed).

***Issue Ref No**: JSA-ML-9801 (Issue Closed)*

***Issue**: US Army Technology and Materiel Seminar Game*

***Date Entered**: June 1998*

***Champion**: JSA US National Representative, JSA-TP-1 Land Systems (AS Chair)*

***Status**: Issue Closed. As a follow-on to TTCP participation in the July 1998 wash-up of first US Army-After-Next Technology Seminar Game, the US NR pursued direct TTCP participation in the 2000 US Army Technology and Materiel Seminar Game. Unfortunately, the Seminar Game was cancelled. JSA NRs will remain alert to future opportunities.*

***Context**: The US Army leadership has initiated the Army After Next (AAN) program, as its coordinated intellectual investment in conceptualizing the capabilities and attributes that will define the US Army in the 2020-2025 timeframe.*

The AAN program is pioneering a number of innovative methodologies for stimulating debate on the challenges facing future armies, to capturing new ideas on how changes to force structure, doctrine and technology could address these challenges, and to analyzing and validating their potential effectiveness.

One of the new methodologies of the AAN program is the annual US Army AAN Technology Seminar Game. The principle of the Game is to engage leading military, academic and industrial experts in identifying the key technologies that will shape military operations in the 2020-2025 timeframe.

The first annual AAN Technology Seminar Game was recently conducted at the US Army War College in June/July 1998. On the initiative of the JSA National Representative, the TTCP Nations were invited to have a representative present at the one-day wash-up for the Game, held 30 July.

Since this first Seminar Game the US Army's futures program has evolved to include a new Technology and Materiel Seminar Game, by which the linkage of new technologies is made to new system concepts and existing systems. The US NR has agreed to seek approval for the participation of the TTCP technical community in the 2000 version of this Seminar Game. This involvement would serve to enrich the intellectual discussions on technology and the future of military science across the TTCP nations, providing in particular a deeper understanding of the implications of technology choices on coalition operations.

Should this participation prove feasible, then JSA-TP-1 Land Systems has been requested to coordinate and lead the participation.

At the JSA 2000 Annual Meeting, it was reported that the 2000 Seminar Game was cancelled in favor of conducting these games less frequently than annually. The JSA NRs agreed to remain alert to future such opportunities and to champion the participation of the TTCP nations wherever possible.

***Issue Ref No**: JSA-ML-9802 (Issue Closed)*

***Issue**: Logistics for the Future Battlespace*

***Date Entered**: June 1998*

***Champion**: JSA-TP-3 Joint Concepts and Analysis (UK Chair)*

***Status**: JSA-TP-3 was tasked in June 1998 to champion pan-TTCP consideration of the concepts and technologies for future logistics. TP-3 reported on progress at the JSA 2000 Annual Meeting, with the intention to participate in the US Focused Logistics 2001 (FLOW01) wargame. A small team of national experts examined the feasibility of a pan-TTCP workshop in 2002 as a venue for identifying technology opportunities to enable future logistics concepts.*

***Context**: Recent experiences have reinforced the importance of effective logistics to the success of military operations in the post-Cold War era. In fact, there is a growing consensus that the rapidly evolving nature of military operations, driven by the myriad of global political, economic, social, environmental and technological pressures, requires significant innovation in the manner in which military operations will be supported logistically. For example, in its Joint Vision 2020, the US military has identified Focused Logistics as a critical capability for success of future US military operations. While the current interest among western armed forces is in adapting best practices and technologies from civil industry, it is also recognized that the complex and unpredictable nature of modern military operations will require prudent adaptation of civil concepts.*

In the past, TTCP was conducted extensive collaborative research focused in particular on the military capability of logistics. However, given the potentially radical changes that logistics may undergo in the coming decade, it is timely for TTCP to review the current thought on logistics for the future battlespace, and to consider whether there are opportunities for collaborative research under TTCP to contribute to the concepts, technologies and/or processes that will shape this future.

To this end, JSA-TP-3 was requested to consider the challenges for future logistics and to stimulate pan-TTCP consideration of its potential role in addressing these challenges. To progress the task, it convened a workshop in May 2000, reported the results to the JSA Group in July 2000 and produced a report on the workshop. The JSA Exec Chair provided a summary of these findings at the 2000 Executive Chairs Workshop.

In addition. TP-3 confirmed the value of participation by the TTCP nations in the US activity "Future Logistics Wargame 2001" (FLOW 01). This follows observation of the previous game in 1999. The invitations for the nations to participate has been issued outside of TTCP, but TP-3 identified high value in providing a means for data to support collaborative analytic efforts for FLOW 01 to be exchanged, and for the participating analysts to coordinate their efforts. TP-3 also identified the possibility of a follow-up workshop on the issue, which could provide a forum for the nations' technology communities to assess potential technology contributors to future logistics concepts.

Following September 11, the FLOW game for 2001/2 was cancelled. At its 2002 meeting, the Group decided to refocus logistic systems collaboration by better linkages to warfighting capability. As a result, ML0201 has been entered and this ML issue closed.

***Issue Ref No**: JSA-ML-9803 (Issue Closed)*

***Issue**: Exploitation of Space*

***Date Entered**: June 1998*

***Champion**: AS National Representative*

***Status**: Issue Closed. At its July 1999 annual meeting, JSA examined current TTCP activities in space systems and technologies in a discussion led by the AS NR. The JSA Exec Chair tabled the subject at the 1999 Exec Chairs Workshop to discuss future TTCP investment, where it was agreed that a significant increase in TTCP activities targeting space was not warranted at this time.*

***Context**: Full-dimensional exploitation of space is seen to be essential to the success of future military operations, either as an extension of the future land-air battlefield itself, or as an environment offering unique opportunities to enhance the effectiveness of weapons systems and C4ISR.*

While TTCP is currently engaged in collaborative research in selected technologies that support space exploitation, it is timely to consider whether these collaborative activities are sufficiently focused on the key issues of interest to the TTCP nations. Further, given that there are other vehicles available for collaboration, it is unclear whether an expanded or refocused mandate for TTCP would be appropriate.

In order to further the consideration of the possible future role for TTCP in space exploitation, the topic was debated at the JSA 1999 annual meeting in a discussion led by the AS NR and supported by two discussion papers provided by AS. The discussion noted the current space-technology work of C3I and SEN Groups, and the recent efforts of AER to examine future investment by the Group in space platform technologies. It was highlighted, however, that this work is not coordinated and is relatively modest. It was recognized that cooperative research in the area is much more active through various bilateral channels.

The JSA Exec Chair tabled the issue at the 2000 Executive Chairs' Workshop. Consensus was achieved that while space is an increasingly important environment for defence, a significant expansion in TTCP cooperation specifically targeted to space, or a restructuring of TTCP space cooperation, was not appropriate at this time. However, space technology and space as it affects systems-of-systems would continue to be addressed within on-going TTCP activities.

***Issue Ref No**: JSA-ML-9701 (Issue Closed)*

***Issue**: Simulation-Based Acquisition Processes*

***Date Entered**: June 1997*

***Champion**: JSA-AG-5 Simulation-Based Acquisition Processes (UK Chair)*

***Status**: Issue closed. JSA-AG-5 was formed in June 1997 to develop recommendations. Its final report was reviewed by JSA at its July 1999 annual meeting. JSA has agreed to pursue further SBA work under its new JSA-TP-4 (see JSA-ML-9903).*

***Context**: JSA-AG-5 Simulation-Based Acquisition (SBA) Processes was established in order to advise the NAMRAD Principals and the TTCP national authorities on the full breadth of issues arising from the potential use of modern simulation technology throughout the equipment life-cycle. It is widely recognized that such technologies have the potential to revolutionize the overall product introduction process. Experience in civil aerospace suggest that the biggest potential impact comes from radical reductions in development times and costs, with additional benefits in terms of procurement flexibility at 'right first time systems'. There are, however, a number of broader technical issues which have to be addressed before SBA can be successfully integrated with and interfaced to existing processes within the defence environment of the TTCP nations. These include, but are not confined to:*

- ?? *the use of simulation at different parts of the life-cycle, e.g. concept formulation, requirements elicitation, design, test & evaluation, and during operations and maintenance;*
- ?? *the management of information relating to the product definition, including the inputs and outputs from simulation activities and the necessary review processes*
- ?? *the role for a standard underlying systems engineering life-cycle, such as ISO 15288;*
- ?? *links to analysis and trade off studies;*
- ?? *the role of simulation in whole life cost reduction;*
- ?? *linkage to operational systems, e.g. to manage repair and maintenance and to support progressive update;*
- ?? *the handling of COTS items within the Modeling environment;*
- ?? *model V&V, especially in a contractual environment;*
- ?? *interactions between customer and contractor-owned models, and associated technical issues, e.g. maintaining confidentiality and security;;*
- ?? *simulation and reference models to support systems of systems.*

The AG tabled its final report at the July 1999 annual meeting of the JSA. The report is available to TTCP members through national channels. The report summarizes national SBA activities, the proposed system engineering framework in which SBA would reside, the characteristics of the SBA information management environment, and the challenges in forming effective teams of subject-matter experts in order to effectively resolve system challenges during the system life cycle. The AG has

recommended that a new JSA Technical Panel for SBA be formed to include the following Focus Areas:

- ?? *increasing awareness of SBA benefits;*
- ?? *participating in production of SBA architectures;*
- ?? *facilitating practical experiments with SBA concepts; and*
- ?? *facilitating improvements in SBA methods and tools.*

At its 1999 annual meeting, the JSA agreed to form the new JSA-TP-4 on System Engineering for Defence Modernization. The TP is mandated to address system engineering technologies and practices to improve defence management processes, including Simulation Based Acquisition. The latter issue is pursued further at JSA-ML-9903.

***Issue Ref No**: JSA-ML-9702 (Issue Closed)*

***Issue**: Wide-Area Surveillance/Recognized Picture for Coalition Operations*

***Date Entered**: June 1997*

***Champion**: JSA-AG-6 Wide Area Surveillance/Recognized Picture (CA Chair)*

***Status**: Issue Closed. JSA-AG-6 was formed in June 1997 to develop recommendations. Its final report was reviewed by JSA at its July 1999 annual meeting. The strategy to implement the AG recommendations was addressed by JSA, C3I and SEN in Sep-Oct 1999. The TTCP Exec Chairs agreed at the 2000 Exec Chairs Workshop that C3I Group would lead a pan-TTCP activity to progress the AG recommendations.*

***Context**: JSA-AG-6 was tasked to study and comment on the architecture and components required for a theater-level surveillance system aimed at the production of a Coalition Recognized Picture (CRP) among coalition forces across a spectrum of conflict scenarios, specifically identifying how national strategic and tactical (surveillance) assets could contribute to the common picture. Issues of technological compatibility and information flow for tactical and strategic operations among coalition partners were to be addressed.*

As defined by the AG, the Coalition Recognized Picture (CRP) is the common picture necessary to support coalition operations: it provides shared situation awareness over the area of interest assigned to the coalition force commander. The CRP represents an architecture to collect, fuse and correlate information to form, share and maintain the situation awareness picture for unified action. Because it depends on the scenario and on the levels of command, it is a tailored image of the battlespace, based on information identical to all levels.

Wide area surveillance (WAS) is the systematic observation of the area of interest to provide the input necessary to build the CRP: it is therefore surveillance for a purpose. Compared to the CRP, the structure for WAS is more fuzzy because surveillance systems and collection assets tend to be stove-piped, especially in coalition operations where each member of the coalition is expected to contribute surveillance resources.

The AG tabled its final report at the July 1999 JSA annual meeting. The report is available to TTCP members via national channels.

The final report contains 18 issue papers that discuss in some detail the key technical challenges that need to be addressed. These are summarized in the following table.

The final recommendations of the AG regarding follow-on TTCP activities were as follows:

- ?? *create or task a technical panel to act as the integrator of all issues relating to the CRP;*
- ?? *research the application of network-centric concepts and capabilities for the creation of a CRP;*

- ?? *research the development of information management technologies specific to the generation of the CRP.*
- ?? *conduct research into the development of an architecture planning and analysis tool set for use by commanders and planners; and*
- ?? *conduct experiments that test the coalition's ability to create the CRP.*

As a next step in advancing the AG recommendations, the Exec Chairs of JSA, C3I and SEN Groups, with the US Deputy, will meet with AG-6 representatives in Sep-Oct 1999 to discuss the appropriate structure and sharing of effort among the Groups.

Category	***Issue***
Collection	*C1 - Coalition wide area surveillance collection management*
	C2 - Coalition essential elements of information (EEIs)
	C3 - Standardized or compatible precision location information systems (blue forces)
Information Processing	*P1 - Automatic correlation, association, fusion and accountability*
	P2 - Data set visualization
	P3 - Node loading (saturation and internal transformation)
	P4/D1 - Potential value of "network centric" solutions for CRP dissemination requirements
	P5 - Data and information sharing
	P6 - Processing shared data
Dissemination	*D1/P4 - Potential value of "network centric" solutions for CRP dissemination requirements*
	D2 - Interoperability with legacy systems and "low tech" partners
	D3 - Automated dissemination and management processes
	D4 - Compatible automated multi-level security and information assurance capabilities
System of systems enablers	*E1 - National and coalition architecture products*
	E2 - Information architecture planning, analysis and management tools
	E3 - WAS / CRP taxonomy
	E4 - Requirements analysis
	E5 - Performance measurement

***Issue Ref No**: JSA-ML-9703 (Issue Closed)*

***Issue**: Planning/Analysis for Coalition Operations*

***Date Entered**: June 1997*

***Champion**: JSA-TP-3 Joint Concepts and Analysis (UK Chair)*

***Status**: JSA-TP-3 was requested in June 1998 to consider cooperative development of the appropriate OA tools to improve decision-making in coalition capability planning. strategies for realizing these tools were discussed during a workshop held in conjunction with the TP-3 May 2000 annual meeting. Future work in the area has been integrated into the TP-3 program of work.*

***Context**: The effective planning and execution of coalition operations across the spectrum of conflict will be dependent on the ability of the coalition partners to plan for, then exploit, the individual capabilities of the participants. For example, effective Command and Control of the coalition force will be directly influenced by the level of interoperability available among the operational-, system- and technical architectures of the individual participants. Further, the assignment and successful execution of specific missions by the coalition partners will depend on the operational, equipment and technological capabilities each partner is able to bring to theatre, the ability to optimally plan the operation and then configure the force by taking these individual capabilities into account.*

Currently, there are activities underway at various levels of maturity and resourcing within the OA communities of the TTCP nations to develop tools and methodologies that will improve the quality of planning for coalition operations in the above environment. There is clearly benefit to be derived from sharing information and/or jointly collaborating in these developments.

The approach adopted to address the issue was to conduct a workshop to explore the problem of capability planning for coalition operations as part of the May 2000 TP-3 Annual Meeting. This workshop was strongly supported with a range of background papers from Australia, the meeting host nation, and explored thoroughly through syndicate sessions represented by all nations and service representation from Australia. The outcomes led to plans to incorporate the problem domain in the TP-3 program of work.

***Issue Ref No**: JSA-ML-9704 (Issue Closed)*

***Issue**: Vulnerability of Information Operations across Joint/Combined Operations*

***Date Entered**: June 1997*

***Champion**: CA National Representative*

***Status**: Issue closed. To be subsumed by the TTCP Information Warfare way ahead to be discussed at NAMRAD 98.*

***Context**: The combat capability referred to as "information operations" - to suitably protect own-force information and related processes, or to disrupt the enemy's information and processes - is viewed to be critical to success on the modern battlefield. The armed forces of the TTCP nations are either planning for or introducing the digitization attributes necessary to enable information superiority. As complex a task that digitization is proving to be, the task is even more complex when considering operations involving multiple services and/or allied nations. In the case of joint or common operations, it is essential that sufficient levels of interoperability exist among the command and control information systems of the partners for effective C2 to be executed. However, in the search for interoperability, it may be that vulnerabilities to attack of the joint/common C2 information systems are inadvertently introduced. Therefore, it is critical that these vulnerabilities be identified, eliminated and/or managed through appropriate technological and/or procedural means.*

TTCP has assessed how best to address collaboration in the area of Information Warfare. A pan-TTCP Workshop on Information Warfare lead by the C3I Group, held in the US on 8-10 July 1998, considered how best to proceed with TTCP collaboration in this area. Recommendations were presented at NAMRAD'98 and a way ahead accepted.

This issue will be addressed in the future as part of the broader TTCP IW initiative.

***Issue Ref No**: JSA-ML-9705 (Issue Closed)*

***Issue**: Unmanned Aerial Vehicles*

***Date Entered**: October 1997*

***Champion**: JSA-AG-8 Unmanned Aerial Vehicle Concepts (CA Chair)*

***Status**: Pan-TTCP workshop was held 2-5 June 1998. JSA-AG-8 was formed in June 1998 to consider future UAV concepts, including possible TTCP-led technology demonstration. The AG has presented its findings and final recommendations to JSA at its 2001 Annual Meeting. Follow-on work in UAVs has been transitioned into AER-TP-6.*

***Context**: Unmanned Aerial Vehicles (UAVs) offer the potential to provide cost-effective solutions to a wide variety of missions on the modern battlefield, in particular where unmanned solutions are desirable or essential. On-going advances in platform and payload technologies that increase UAV endurance, survivability, reliability and cost are making UAVs increasingly attractive in operations heretofore considered inappropriate. That said, it is recognized that one of the greatest challenges to the introduction of UAVs into service lies with the cultural change and change to Concepts of Operations required to appropriately exploit their potential.*

At NAMRAD'97, the Principals noted the growing interest among the nations for UAV solutions and for collaborative research in UAV technologies. In fact, JSA, AER, C3I, EWS, SEN and MAR Groups all expressed interest in such research. In light of this interest, the Principals directed the JSA Group to sponsor a pan-TTCP workshop on national experts in UAVs. The Workshop was conducted 2-5 June 1998 at the Applied Physics Laboratory of John Hopkins University, MD, US. Some 66 national experts representing all five TTCP nations participated. The Workshop considered the potential missions and CONOPs for UAVs in the 2015 timeframe, and the advances in platform and payload technologies that will be required. It identified opportunities and interest among the nations for collaborative research to advance these technologies. The Workshop Proceedings and final report have been published on CD-ROM.

Based on the findings and recommendations of the Workshop, the JSA Group created JSA-AG-8 on Unmanned Aerial Vehicle Concepts. The Action Group had a mandate through July 2001 to champion pan-TTCP consideration of future UAV CONOPS and the concomitant technology implications. Its specific deliverables included:

- ?? *A methodology to identify critical capability needs/gaps and assess critical technology areas (completed)*
- ?? *The definition of a representative future coalition UAV mission (completed)*
- ?? *For this selected mission, identification of issues and capability gaps (completed)*
- ?? *For selected issues and capability gaps, identification and assessment of critical technologies (completed)*
- ?? *After-action report for a US-CA HAE UAV (Global Hawk) cross-border overflight exercise planned for in 2000 (the flight was cancelled on the eve of*

the event due to unresolved technical problems; however, many important lessons were learned in the course of the flight preparations and planning - these have been reported by AG-8. A subsequent overflight of CA is now scheduled for Sep 2001, and will be progressed under AER-TP-6).

?? *After-action report for a US-AS HAE exercise scheduled for 2001.*

?? *Identification of other future collaborative exercise opportunities. (completed)*

?? *An examination of the scope and feasibility of a TTCP-led modeling & simulation-based joint warfare exercise. (completed – recommendation to proceed with further Concept-of-Use/Technology Assessment workshops)*

?? *Draft Terms of Reference for an associated TTCP Project Arrangement covering a follow-on activity. (not required).*

At the NAMRAD 2000 meeting, it was agreed that with the completion of the JSA-AG-8 mandate in 2001, the responsibility for championing pan-TTCP activities in UAV technologies and concepts would transition to the AER Group under the auspices of its AER-TP-6. In the course of its activities for 2001, the AG therefore engaged the AER-TP-6 in order to ensure an effective transition of its work and outputs into AER.

***Issue Ref No**: JSA-ML-9706 (Issue Closed)*

***Issue**: Defence Technology Management Practices*

***Date Entered**: October 1997*

***Champion**: JSA-AG-9 Defence Science and Technology Management (CA Chair)*

***Status**: A mini-conference was held in conjunction with the June 1998 JSA annual meeting, comparing UK and CA experiences. JSA-AG-9 was formed in June 1998 with 3-year mandate to progress collaboration in the area of defence science and technology management practices with a particular focus on knowledge management. The AG completed its work with its final report presented to JSA at its 2001 Annual meeting.*

***Context**: TTCP has historically conducted collaborative activities in the context of specific defence research and technology objectives. However, the nations also recognize the benefit of sharing ideas and experiences on the practices that each employs to manage its defence technology and defence technology base. Further, given the common interest in emerging concepts such as knowledge management and measures of effectiveness as applied to defence technology management, there may also be opportunity for collaboration through TTCP in order to help develop and apply these concepts within the nations.*

Within this context, the JSA Group conducted a mini-conference on Defence Technology Management Practices in conjunction with its June 1998 Annual Meeting. The conference, lead by the UK and CA, compared experiences and practices of the UK DERA and CA DRDB in managing their respective defence technology bases. The findings of the Workshop demonstrated there are many common issues each nation is facing, and definite benefit in sharing the views and lessons learned from the respective strategies and approaches.

Based on the interest generated by the mini-conference, the JSA created JSA-AG-9 on Defence Science and Technology Management. The AG had a mandate through June 2001 to accomplish the following tasks that build on the work previously completed in support of the June 1998 mini-conference:

- ?? *produce a compendium comparing approaches to key issues in defence S&T management across the TTCP nations (completed);*
- ?? *identify opportunities for collaborative development of new methodologies and tools to address issues of common interest (progress made); and*
- ?? *progress collaborative development in at least one area of common interest, with particular consideration given to the area of knowledge management (progress made).*

The AG has held four Knowledge Management Workshops; given the Principals' interest in examining knowledge management practices, the TTCP Deputies were invited to participate so as to leverage on the Workshop findings. As a result, it was agreed that the AG will serve as the TTCP Technical Advisor to the US Deputy, who

contract the effort to develop an Electronic Library and Technology Watch function for TTCP, exploiting state-of-the-art Knowledge Management techniques. The US TTCP Deputy and JSA-AG-9 presented this KM way-ahead for TTCP at NAMRAD 2000.

The AG present recommendations for further TTCP collaboration in the areas of S&T management and knowledge management at the JSA 2001 Annual Meeting. JSA accepted the recommendation that the compendium on S&T management best practices will be updated on a 2-3 year cycle. CA agreed to lead this activity that will report directly to the Group. Given the diversity and complexity of issues surrounding the emerging field of Knowledge Management, the AG could not develop a consensus view on where collaboration should proceed. JSA agreed to track national developments for the coming year, with the issue to be revisited at the JSA 2002 Annual Meeting (see JSA-ML-0104).