

Annex G – UNDERSTANDING FACTORS THAT INFLUENCE COALITION TEAMWORK

Paper presented at the Symposium SAS-081/RSY on “Analytical Support to Defence Transformation” in Sofia, Bulgaria, 26-28 April 2010

Yantsislav Yanakiev

Defence Advanced Research Institute (DARI)
G.S. Rakovski National Defence Academy
82 Evlogi and Hristo Georgievi Blvd.
1504 Sofia
BULGARIA

yanakiev@md.government.bg

Arwen E. Hunter

U.S. Army Research Institute for the
Behavioural and Social Sciences
ATTN: DAPE-ARI-OP
Building 459, Room 117
Aberdeen Proving Ground
MD 21005-5425
UNITED STATES

Arwen.Hunter@us.army.mil

Janet L. Sutton

U.S. Air Force Research Laboratory
AFMC 711 HPW/RHXB
Wright-Patterson AFB, OH 45433
UNITED STATES

Janet.Sutton@wpafb.af.mil

ABSTRACT

Supporting the SAS-081/RSY focus on cognitive and human aspects of defence transformation and the HFM RTG-163 focus on improving organizational effectiveness in coalition operations, this paper presents results from research aimed at identifying factors that are critical for effective cooperation between coalition partners. Past research on teams and organizations is utilized to propose a framework for studying and enhancing collaboration between coalition partners. The sample used was Bulgarian and U.S. military personnel engaged in a tactical-level, joint military training exercise (n = 145) held at the Novo Selo Army Training Range, Sliven, Bulgaria. In the framework of the NATO Research and Technology Organization (RTO), this research was implemented by the U.S. Army Research Institute for the Behavioural and Social Sciences (ARI), the U.S. Air Force Research Laboratory (AFRL: 711th Human Performance Wing), and the Bulgarian Defence Advanced Research Institute (DARI) at G.S. Rakovski National Defence Academy. Financial support was provided, in part, by the NATO Research and Technology Agency (RTA). Implications for multi-cultural collaboration are discussed.

G.1 INTRODUCTION

G.1.1 NATO Current Operations

As NATO continues to expand its presence across the full spectrum of crisis management operations, coalition partnerships are becoming increasingly more widespread and collaboration between coalition partners is held to higher and higher standards of performance by the global military community. Representative of this transformation are NATO operations and coalition of willing in Afghanistan, Kosovo, Iraq, Somalia, the Mediterranean, off the Horn of Africa, which include increased NATO and coalition presence. With a growing need to collaborate with coalition partners in support of full spectrum

operations, research in the cognitive and social science domains is important to help advance the understanding of human factors that facilitate collaboration in multi-cultural coalitions.

G.1.2 Goals of Paper

In response to the operational needs described above, the goal of this research is to identify factors that are critical for effective collaboration between coalition partners during joint exercises and operations. The latest research results of U.S. and Bulgarian teams engaged in a tactical-level bilateral training exercise are shared in support of transformation and management in the new security environment with a focus on cognitive and human aspects of defence transformation. Since 2006, an agreement has been in place between the U.S. and Bulgarian governments to enhance defence cooperation through security cooperation exercises, joint/combined training activities, humanitarian and disaster relief activities, contingency operations, etc. (see <http://bulgaria.usembassy.gov/odc.html> for official document). Among other purposes, these exercises are used to develop skills necessary for task executions during NATO operations and to improve interoperability between Bulgarian and U.S. military. The current research explores the human and organizational factors that affect coalition teamwork, including information sharing, collaboration, and coalition team effectiveness, by studying U.S. and Bulgarian military personnel engaged in combined training.

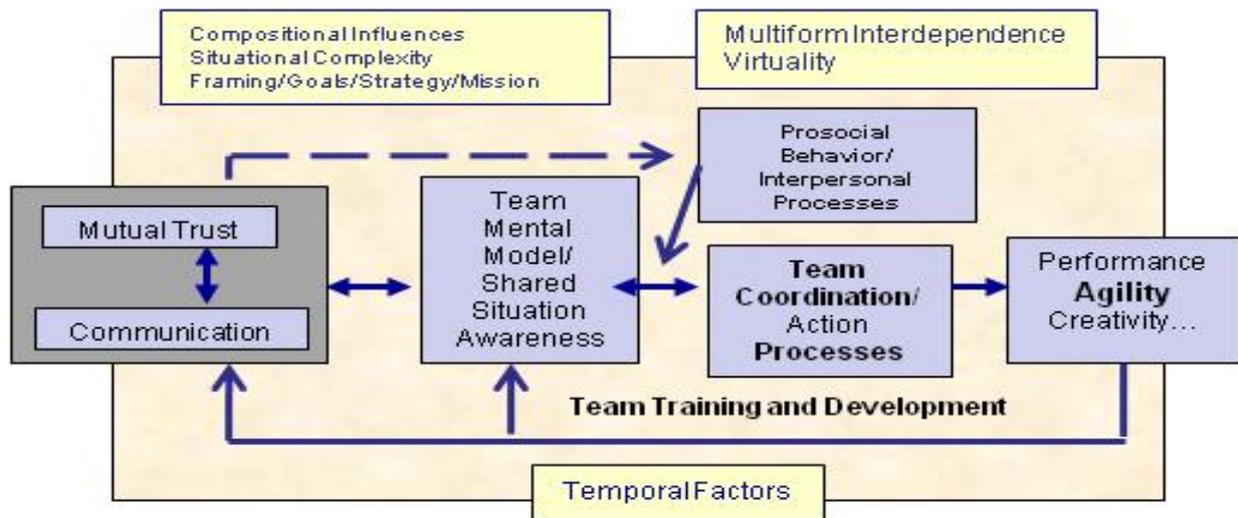
G.1.3 Model of Organizational Effectiveness for Coalition Teamwork

Multi-national operations require collaboration and information sharing between many different teams of individuals that extend from diverse cultural backgrounds (organizational and national) [6]. In this paper, a targeted approach to understanding and enhancing coalition team effectiveness is taken, with a focus on the factors that influence basic team collaboration through information sharing. Others have taken a similar approach, suggesting that effectiveness is tied to the ability to acquire lacking information and to manage the information possessed [9]. Correspondingly, Galbraith [10] supports the assumption that information sharing, quick and timely decision making, and developing shared awareness are needed to meet organizational goals effectively.

Many models of inputs, processes, and outcomes within multi-national teams exist. This research combines critical factors of those models that relate to information sharing, collaboration, and ultimately, effectiveness. More specifically, focus is placed on team inputs and processes related to information sharing between coalition partners coming from diverse organizational and cultural backgrounds, that are expected to affect the collaborative capacity of the coalition. While many existing models focus on various aspects of teamwork, our model focuses on individual and organizational factors influencing coalition team effectiveness through team information sharing and collaborative processes.

G.1.3.1 Performance, Role Interdependence, Information Sharing Model (PRISM)

A model of effectiveness within complex teams was adapted from existing team models [15],[18],[19] by researchers at the U.S. Army Research Institute to represent a sub-set of team inputs and processes affecting the relationship between information sharing (i.e., communication) and performance (see Figure G-1) [12]. The PRISM model can be applied at a team, multi-team, and organizational level, depending on complexity of the distributed operations. Multiple studies are being conducted to examine different aspects of the model. Past research has demonstrated support for some of these relationships (e.g., interdependence moderates the relationship between trust and information sharing), but more research is needed to better understand the multiple factors that influence performance in complex, distributed operations [19].



**Figure G-1: The Performance, Role Interdependence, Information Sharing Model (PRISM).
The PRISM was Adapted from Several Existing Team Models [15],[18],[19].**

This model was adopted for use in the current study to help identify some of the critical factors influencing information sharing, collaboration, and ultimately coalition team effectiveness within a multi-national coalition context. The model suggests that individual attitudes, cultural influences, and trustworthiness are key influencers of information sharing and collaboration between coalition partners. In turn, information sharing affects team states and processes such as trust and cohesion, which ultimately impact effectiveness. Additionally, the actual and perceived interdependence among the coalition partners is likely to change the nature and importance of some of these relationships, modifying the criticality of information sharing and collaboration for individual members of the coalition. The propositions of this model led to the selection of scales that attempted to measure the key constructs inherent in the reciprocal process described above, with the goal of better understanding the critical aspects of coalition teamwork that lead to organizational effectiveness.

G.1.3.2 Inter-Organisational Collaborative Capacity

The PRISM model identifies many constructs affecting coalition team effectiveness through information sharing and collaboration within coalition teams, but focuses on what unfolds when a team is formed. Identifying the factors that individuals and organizations bring to the team that influence information sharing and collaboration is also important to this research. Recently, a model of Inter-organisational Collaborative Capacity (ICC) was proposed by researchers at the Naval Postgraduate School [13] which provides a framework for understanding the individual and organizational factors that are brought to a newly formed team, which are likely to influence team collaboration.

As defined in the initial research, ICC is the capability of organizations (or a set of organizations) to enter into, develop, and sustain inter-organisational systems in pursuit of collective outcomes. The model of ICC was generated through theoretical and empirical research aimed at linking factors inhibiting and promoting collaboration to each of [10] organizational sub-system domains. This approach is similar to other NATO research on organizational effectiveness, which also uses the Galbraith model of organizational design to organize elements of the organization that may impact effectiveness [3]. From this model, a questionnaire was developed to systematically assess an organization (or organizational set's) collaborative capacity. This questionnaire was used in the current study to examine individual and organizational factors existing prior to the multi-national training exercise that are likely to affect collaboration.

G.1.4 Summary

The goal of this research is to identify factors important for enhancing coalition team effectiveness in joint exercises and operations with a focus on individual and organizational factors influencing collaboration. Some factors identified by the PRISM model are assessed to examine attitudes and behaviours that unfold as the team is formed. Additional factors (both individual and organizational) existing prior to the multi-national training exercise are also examined and expected to influence coalition team effectiveness. These individual and organizational factors are explored in terms of their relationship with perceived coalition team effectiveness within both U.S. and Bulgarian samples.

G.2 METHODS

G.2.1 Participants

The data was collected in September 2009 at the end of a joint U.S. – Bulgarian tactical-level training exercise on “Novo Selo” Army training range in Bulgaria. A total of 145 military personnel from both U.S. ($n = 81$) and Bulgaria ($n = 64$) provided responses to the questionnaire assessing factors expected to influence coalition teamwork. U.S. respondents were 94% male, with a mean age of 28. Bulgarian respondents were 100% male, with a mean age of 29. Thirty-four percent of U.S. Soldiers obtained a degree higher than a high school diploma, while 20% of Bulgarian Soldiers held degrees at the undergraduate level or above. In both the U.S. and Bulgarian samples, approximately 50% of respondents reported that they had previous experience being deployed in a multi-national headquarters.

G.2.2 Measures

Questionnaires, consisting of 77 self-report items, were administered to participants in their native language. For small groups ranging in size from 6 – 20 persons, two native-English speaking researchers monitored native-English speaking participants and one bilingual (Bulgarian/English) Bulgarian researcher monitored native-Bulgarian speaking participants while they completed their questionnaires. Questions from participants were answered immediately and privately. All items on the questionnaire were rated on a 7-point Likert-type scale ranging from -3 to +3 as follows: -3 (Strongly Disagree), -2 (Disagree), -1 (Moderately Disagree), 0 (Neither Agree nor Disagree), +1 (Moderately Agree), +2 (Agree), and +3 (Strongly Agree).

The constructs assessed were identified through the theoretical models described above as critical factors influencing collaboration between coalition partners. The first 12 scales were modified from the Inter-organisational Collaborative Capacity questionnaire [13]. These scales assess constructs identified as critical for the capability of organizations (or a set of organizations) to enter into, develop, and sustain inter-organisational systems in pursuit of collective outcomes. The 12 scales are described below:

- *Need to Collaborate* – A felt need for or motivational energy and effort directed toward collaboration with other coalition members.
- *Strategic Collaboration* – Emphasizes establishing and addressing goals for collaboration and considering the interest of other coalition members in planning. Focus is placed on the role of leadership in addressing inter-organisational coalition goals and conferring with leaders of other organizations.
- *Resource Investment in Collaboration* – Investing, committing, or assigning budget, resources, and personnel to coalition collaboration.
- *Structural Flexibility* – The degree to which respondents perceive that their organization is flexible and responsive, quickly forming and modifying policies, processes, procedures, and partnerships.

- *Reward Systems* – Individuals’ perceptions of the consequences of their behaviour in terms of their own personal pay-offs. The items assess the degree to which collaborative work, activities, and talents result in rewards, career advancement, and promotion.
- *Metrics for Collaboration* – The degree to which an organization has identified or established measurement criteria and performance standards to assess coalition collaboration efforts.
- *Information Sharing Norms* – Lateral mechanisms and lateral processes within the organization that provide norms for information sharing. Higher scores reflect organizations with stronger norms for greater information sharing.
- *Collaborative Learning* – The degree to which the organization commits resources to training, works with coalition partners to identify lessons learned, and develops strong norms for learning from coalition partners.
- *Social Capital* – The degree to which organizational members take the initiative to build relationships and know who to contact within other coalition partner organizations.
- *Individual Collaborative Capacity* – Skills, capabilities, expertise, understanding, and knowledge of other coalition partners’ work; willingness to engage in shared decision-making and collaboration.
- *Barriers to Collaboration* – Aspects of history, individual collaborative capacity, role conflict, policies, and unique requirements that create barriers to effective coalition collaboration. A high score on this scale indicates more barriers to collaboration.
- *Support to Coalition Team* – Assesses the degree of support and authority given to coalition teams by the higher organization.

The next 8 scales were constructs identified in the PRISM model, as related to performance in complex teams. All variables in the PRISM model were not measured because the survey methodology utilized in the current study was not deemed adequate for assessing these constructs (e.g., shared mental models). However, particular variables from the model were measured where appropriate and validated scales were utilized in the past and shown to relate to team performance as suggested by the PRISM model. These 8 scales are described below:

- *Perceived Interdependence* – Assesses the degree of reciprocal interdependence required to successfully complete tasks, including perceptions of the degree that the responder needs to depend on coalition partners for information and vice versa. Higher scores reflect a greater degree of perceived interdependence between coalition team members [16],[17].
- *Information Sharing* – Self-reported rating of information sharing behaviours occurring between coalition partners throughout the exercise. Higher scores reflect the perceptions that more information sharing occurred between coalition partners [5],[14],[19].
- *Task Cohesion* – Assesses commitment or attraction to the group task or goal. Higher scores reflect greater engagement in and enjoyment of the coalition team tasks [7].
- *Interpersonal Cohesion* – Defined as attraction to or liking of the group. Scores reflect how much the respondent likes or gets along with coalition team members, with higher scores reflecting greater liking of and similarity to coalition team members [7].
- *Trustworthiness*: Assesses a quality of the trustee as perceived by the trust or relating to one of the four dimensions of trust as defined by Adams and colleagues [1],[2] and Blais [4].
 - *Benevolence* – Judgment that the trustee has a genuine concern for the welfare of others.
 - *Integrity* – Judgment of the trustee’s morale and ethics, credible communications, and a strong sense of justice.

- *Predictability* – Judgment of the trustee’s consistency of work and action.
- *Competence* – Judgment of the trustee’s competence in performing their job.

Finally, two additional scales were included to assess satisfaction of coalition team members and perceived coalition effectiveness [8]. The purpose of including these measures was to examine outcomes associated with coalition team collaboration. The two scales are described below:

- *Job Satisfaction* – Indicates the degree of satisfaction the respondent has with his or her current job. Higher scores reflect more satisfaction.
- *Coalition Team Effectiveness* – Reflects the degree to which the coalition team is perceived to be productive and effective in accomplishing its mission. Higher scores reflect perceptions that the coalition team is performing well.

G.3 RESULTS

The methodology applied was aimed at assessing organizational factors related to collaboration between coalition partners. Results are presented separately for the U.S. and Bulgarian samples and compared to examine differences in means between Nations on the factors assessed, as well as differences in patterns of correlations between critical relationships suggested by past research (e.g., PRISM, ICC).

G.3.1 Reliability

The analysis of the data presented in Table G-1 shows high to very high reliability of the 12 scales assessing inter-organisational collaborative capacity. The Cronbach’s alpha coefficients for the data collected from U.S. military vary between 0.67 and 0.92. For the data collected from the Bulgarian military on the same scales, the Cronbach’s coefficients vary between 0.56 and 0.87, also demonstrating high reliability. On the whole, the reliability coefficients for the Bulgarian sample are lower in comparison to the alpha coefficients for the U.S. sample, which might result from the translation of the questionnaire in the Bulgarian language and probable influence of the cultural differences on understanding of the different constructs. Despite this, the alpha coefficients are satisfactory and the scales can be used as a reliable basis for analysis. We should mention that the reliability coefficients in this survey are close to the coefficients reported by the authors of the original questionnaire, which vary between 0.75 and 0.88.

Table G-1: Means, Standard Deviations, and Coefficient Alpha for the Scales.

Scale	Nation	Mean	Standard Deviation	t-Value	# Items	Coefficient Alpha
Need to Collaborate	USA	2.07	1.06	1.98*	3	.89
	BGR	1.72	1.03			.71
Strategic Collaboration	USA	1.62	1.14	.34	5	.92
	BGR	1.56	.86			.83
Resource Investment in Collaboration	USA	1.31	1.53	2.98*	3	.87
	BGR	.57	1.42			.76
Structural Flexibility	USA	1.51	1.10	3.28*	4	.82
	BGR	.89	1.18			.77
Reward Systems	USA	.29	1.51	-1.77	4	.89
	BGR	.71	1.37			.81
Metrics for Collaboration	USA	.52	1.46	-1.13	2	.79
	BGR	.80	1.42			.87
Information Sharing Norms	USA	.91	1.45	-1.37	3	.88
	BGR	1.21	1.00			.56
Collaborative Learning	USA	1.25	1.39	2.70*	3	.84
	BGR	.61	1.46			.81
Social Capital	USA	1.24	1.32	-.64	2	.67
	BGR	1.38	1.16			.66
Individual Collaborative Capacity	USA	1.33	1.11	-1.57	7	.92
	BGR	1.59	.84			.87
Barriers to Collaboration	USA	.08	1.19	1.72	5	.78
	BGR	-.25	1.09			.69
Support to Coalition Team	USA	.70	1.24	-.35	2	.70
	BGR	.77	1.22			.74
Perceived Interdependence	USA	.72	1.68	-3.79*	3	.86
	BGR	1.65	1.14			.86
Information Sharing Behaviour	USA	.78	1.46	-2.04*	2	.68
	BGR	1.21	.92			.70
Task Cohesion	USA	1.37	1.12	-2.51*	5	.87
	BGR	1.77	.71			.79
Interpersonal Cohesion	USA	1.50	.97	-1.02	5	.83
	BGR	1.65	.72			.78
Trustworthiness – Benevolence	USA	1.09	1.28	-1.85	3	.90
	BGR	1.44	.94			.83
Trustworthiness – Integrity	USA	1.01	1.28	-1.56	3	.93
	BGR	1.30	.92			.73
Trustworthiness – Predictability	USA	.92	1.45	-.24	3	.96
	BGR	.97	1.07			.89
Trustworthiness – Competence	USA	1.13	1.18	-1.48	3	.94
	BGR	1.39	.89			.75
Job Satisfaction	USA	1.36	1.40	-3.22*	3	.65
	BGR	1.92	.82			.72
Coalition Effectiveness	USA	1.00	1.40	-1.83	3	.85
	BGR	1.37	.82			.73

Note: * indicates that t-value is significant at $p < .05$.

For the 8 scales assessing constructs identified in the PRISM model, the alpha coefficients demonstrate high reliability for both the U.S. and the Bulgarian samples. They vary from 0.68 to 0.94 for the data on US sample and 0.70 to 0.89 for the data on Bulgarian sample.

Finally, the 2 scales from DEOMI questionnaire “Job satisfaction” and “Perceived coalition effectiveness” also demonstrate high to very high reliability. Indicative in this regard are alpha coefficients 0.65 and 0.85 for US data and 0.72 and 0.73 for the Bulgarian data.

G.3.2 Differences in Means

The comparison of the arithmetic mean scores on the scales over the U.S. and the Bulgarian samples (Table G-1) shows significant differences on several dimensions. The U.S. respondents score higher than the Bulgarians on the scales “Need to collaborate” (p = 0.050), “Resource investment in collaboration” (p = 0.003), “Structural flexibility” (p = 0.001) and “Collaborative learning” (p = 0.008). The Bulgarian respondents score higher in comparison to the US military on the scales “Perceived interdependence” (p = 0.000), “Information sharing behaviour” (p = 0.043), “Task cohesion” (p = 0.013) and “Job satisfaction” (p = 0.002). There are no significant differences in the arithmetic mean scores on the rest of the scales used in the survey. Figure G-2 shows the distribution of means for both U.S. and Bulgarian samples on each scale.

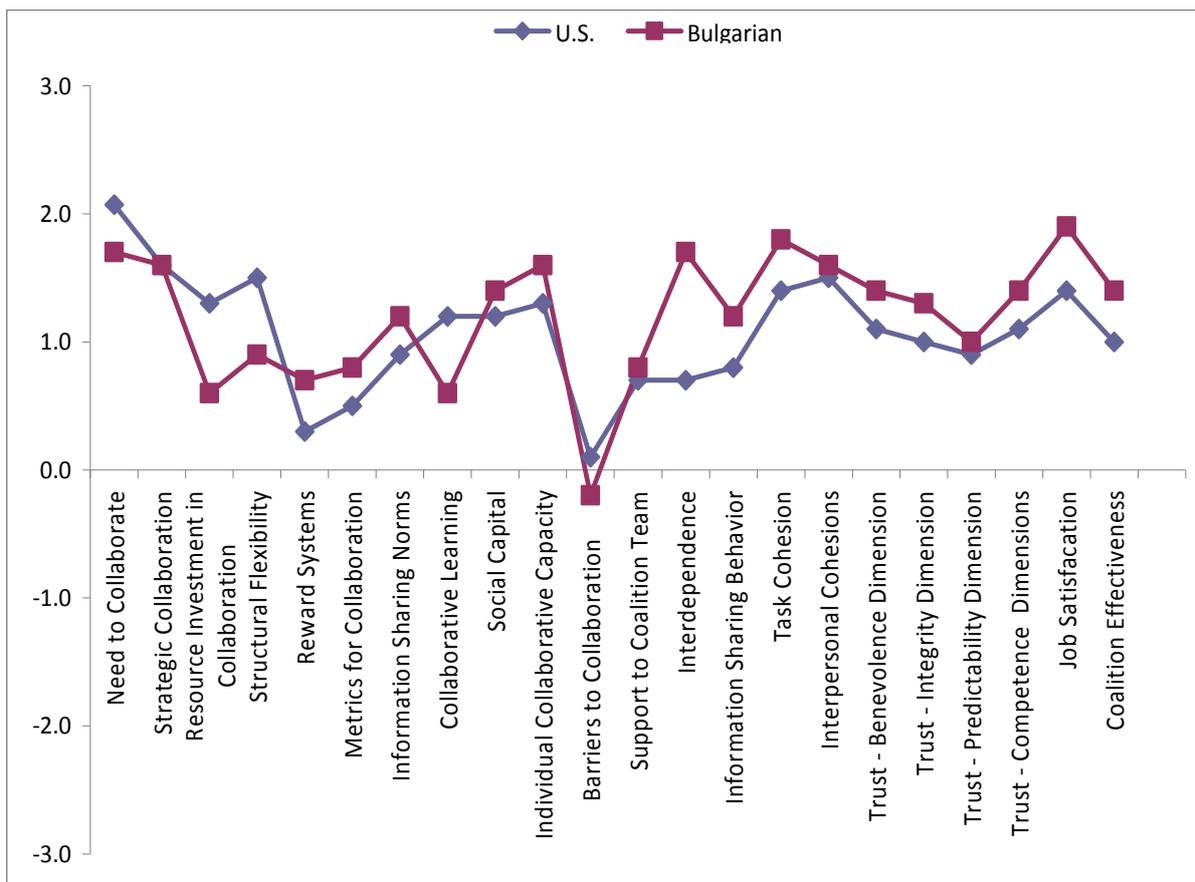


Figure G-2: Differences in Means Between U.S. and Bulgarian Samples.

G.3.3 Correlations

As mentioned above, it is important to identify factors that individuals and organizations bring to the coalition team that are related and influence information sharing and collaboration in multi-national/bilateral coalitions. Therefore, we focused our attention on the relationships between the ICC scales that measure the capacity for inter-organizational collaboration as a prerequisite for achieving the tasks of the coalition and processes/outcomes of this cooperation such as information sharing, trust, perceived task cohesion and perceived coalition effectiveness. In addition, we focus on differences between the two samples of U.S. and Bulgarian military, participating in the research.

The first correlation analysis presented in Table G-2 examines the relationship between the individual and organizational factors present prior to the coalition team formation (ICC scales) and self-reported information sharing behaviour between coalition partners. The analysis of the data shows that all of the correlation coefficients between the ICC scales and the information sharing scale are significant at level 0.05 for both samples. With respect of the U.S. sample, the strongest relationships with information sharing include the Individual Collaborative Capacity scale ($r = 0.663$), Social Capital scale ($r = 0.606$), Collaborative Learning scale ($r = 0.564$), Information Sharing Norms scale ($r = 0.553$), and Reward Systems scale ($r = 0.503$). Generally, the pattern of relationships with respect to the Bulgarian sample is close to the U.S. sample. The strongest relationships with information sharing include the Individual Collaborative Capacity scale ($r = 0.705$), Information Sharing Norms scale ($r = 0.650$), Social Capital scale ($r = 0.564$), Strategic collaboration scale ($r = 0.525$), Metrics of collaboration scale ($r = 0.506$), and Collaborative Learning scale ($r = 0.550$).

Table G-2: Correlations Between the ICC Scales and the Information Sharing Scale.

Information Sharing Behaviour Scale by ICC Scales	Significant Correlations, n = 81, p < 0.05 U.S. Data	Significant Correlations, N = 64, p < 0.05 BGR Data
Need to Collaborate	0.283	0.326
Strategic Collaboration	0.359	0.525
Resource Investment	0.314	0.314
Structural Flexibility	0.380	0.419
Reward Systems	0.503	0.345
Metrics for Collaboration	0.491	0.506
Information Sharing Norms	0.553	0.650
Collaborative Learning	0.564	0.500
Social Capital	0.606	0.564
Individual Collaborative Capacity	0.662	0.705
Barriers to Collaboration	-0.314	-0.315
Support to Coalition Team	0.512	0.455

The only difference between the two samples is with respect to the U.S. military, the analysis suggested the existence of strong correlation between Reward Systems scale and information sharing behaviour, while with respect to the Bulgarian sample this correlation is low. Conversely, in the Bulgarian sample a

strong correlation was found between the strategic collaboration and information sharing behaviour, while in the U.S. sample this correlation was low.

Next, we examine the relationship between each of the dimensions of trustworthiness and information sharing behaviour. The PRISM model suggests that a reciprocal relationship will exist between information sharing and trust, such that perceptions of trustworthiness will lead to more information sharing; and in turn, information sharing is likely to affect perceptions of the trustee in terms of benevolence, integrity, predictability, and competence. The analysis of the data revealed moderate correlations between the information sharing behaviour scale and the trustworthiness scales (Table G-3). There are no significant differences in the pattern of relationships between the information sharing behaviour scale and the four scales measuring different dimensions of trustworthiness between the U.S. and the Bulgarian samples.

Table G-3: Correlations Between the Information Sharing and Trustworthiness.

Information Sharing Behaviour Scale by Trustworthiness Scales	Significant Correlations, n = 81, p < 0.05 U.S. Data	Significant Correlations, n = 64, p < 0.05 BGR Data
Benevolence	0.543	0.450
Integrity	0.417	0.458
Predictability	0.425	0.451
Competence	0.459	0.425

The PRISM model suggests that the reciprocal relationship between trust (operationalised here as perceptions of trustworthiness) and information sharing behaviour will affect team cohesion. Table G-4 presents correlations including each of the dimensions of trustworthiness and information sharing behaviour with task and interpersonal cohesion for both the U.S. and Bulgarian samples. The results demonstrate that all dimensions of trustworthiness are related to both task and interpersonal cohesion for both the U.S. and Bulgarian samples. Additionally, information sharing is significantly related to task and interpersonal cohesion in both samples. For both samples, benevolence had the strongest relationship with task cohesion.

Table G-4: Correlating Cohesion with Trustworthiness and Information Sharing.

Cohesion Scale by Trustworthiness and Information Sharing	Task Cohesion		Interpersonal Cohesion	
	Significant Correlations, n = 81, p < 0.05 U.S. Data	Significant Correlations, n = 64, p < 0.05 BGR Data	Significant Correlations, n = 81, p < 0.05 U.S. Data	Significant Correlations, n = 64, p < 0.05 BGR Data
Benevolence	0.716	0.742	0.738	0.622
Integrity	0.608	0.563	0.595	0.637
Predictability	0.578	0.458	0.495	0.564
Competence	0.655	0.567	0.563	0.533
Information Sharing	0.620	0.598	0.501	0.514

While the PRISM model suggests that cohesion will be influenced by trust and information sharing, the model also suggests that other individual, team, and organizational factors may also influence these relationships. Because the ICC scales were developed to predict collaborative capacity, they are likely to relate to other variables in the PRISM model that lead to enhanced collaboration, including task cohesion. The data, presented at Table G-5 suggests the existence of a strong relationship between the perceived task cohesion scale and the ICC scales. As far as the U.S. sample is concerned, the strongest relationships are between task cohesion scale and correspondingly Support to Coalition Team scale ($r = 0.657$), Individual Collaborative Capacity scale ($r = 0.662$), Social Capital scale ($r = 0.632$), Information Sharing Norms scale ($r = 0.622$), Collaborative Learning scale ($r = 0.620$), and Structural Flexibility scale ($r = 0.526$). With respect to the Bulgarian sample the strongest relationships are between task cohesion scale and correspondingly, Strategic collaboration scale ($r = 0.591$), Individual Collaborative Capacity scale ($r = 0.552$), Information Sharing Norms scale ($r = 0.522$) and Social Capital scale ($r = 0.477$).

Table G-5: Correlations Between the ICC Scales and Task Cohesion Scale.

Task Cohesion Scale by ICC Scales	Significant Correlations, n = 81, p < 0.05 U.S. Data	Significant Correlations, n = 64, p < 0.05 BGR Data
Need to Collaborate	0.411	0.423
Strategic Collaboration	0.427	0.591
Resource Investment	0.347	0.268
Structural Flexibility	0.526	0.338
Reward Systems	0.497	0.401
Metrics for Collaboration	0.437	0.289
Information Sharing Norms	0.622	0.522
Collaborative Learning	0.620	0.414
Social Capital	0.632	0.477
Individual Collaborative Capacity	0.662	0.552
Barriers to Collaboration	-0.309	-0.269
Support to Coalition Team	0.657	0.382

Finally, critical to this research is the idea that the factors examined will ultimately relate to coalition team effectiveness. To begin to examine whether this variables do, indeed, relate to coalition team effectiveness, self-reported ratings of respondents' perceptions of effectiveness are examined in relation to the other research variables. Results of this analysis are presented in Table G-6.

Table G-6: Correlations Between the ICC Scales and Perceived Coalition Effectiveness Scale.

Perceived Coalition Effectiveness Scale by ICC Scales	Significant Correlations, n = 81, p < 0.05 U.S. Data	Significant Correlations, n = 64, p < 0.05 BGR Data
Need to Collaborate	0.346	–
Strategic Collaboration	0.416	0.466
Resource Investment	0.333	–
Structural Flexibility	0.458	0.292
Reward Systems	0.463	0.260
Metrics for Collaboration	0.414	–
Information Sharing Norms	0.449	0.312
Collaborative Learning	0.505	0.311
Social Capital	0.426	0.430
Individual Collaborative Capacity	0.558	0.495
Barriers to Collaboration	–	–
Support to Coalition Team	0.555	0.501
Perceived Interdependence	0.251	0.377
Information Sharing	0.488	0.430
Task Cohesion	0.677	0.613
Interpersonal Cohesion	0.660	0.514
Benevolence	0.630	0.664
Integrity	0.499	0.457
Predictability	0.458	0.344
Competence	0.512	0.653

In regards to the ICC scales, strong to moderate correlations are found between perceived coalition effectiveness among the U.S. personnel participating in the research and the scales Individual Collaborative Capacity ($r = 0.558$), Support to Coalition Team ($r = 0.555$), Information Sharing Norms ($r = 0.449$), Reward Systems ($r = 0.463$), and Structural Flexibility ($r = 0.458$). With respect to the Bulgarian sample the strongest correlation was found between perceived coalition effectiveness and the scales Support to Coalition Team ($r = 0.501$), Individual Collaborative Capacity ($r = 0.495$), Strategic collaboration scale ($r = 0.466$) and Social capital scale ($r = 0.430$).

Significant differences exist in the patterns of the correlations between perceived coalition effectiveness scale and the ICC scales between the U.S. and the Bulgarian samples. This result might be indicative of different understanding and different perception of the coalition effectiveness among the Bulgarian and the U.S. military personnel, participating in the exercise. The existing data does not give enough ground to identify the factors that probably shape these differing perceptions, an important topic for further collaborative research efforts.

In regards to the factors identified in the PRISM model, all variables were significantly related to perceived coalition effectiveness in both the U.S. and Bulgarian samples. Overall, the correlations between the PRISM variables and perceived coalition effectiveness were slightly stronger than the ICC scales. This pattern of relationships makes sense, as the PRISM model suggests relationships that are more directly related to collaboration and coalition team effectiveness than the ICC scales.

G.4 DISCUSSION

The research presented takes an initial look at factors likely to influence coalition team effectiveness. Focus was placed on reliability of the scales, mean differences between U.S. and Bulgarian samples, and correlations between the research variables. More directed analyses of these relationships are needed in future research, but this preliminary exploration into these factors begins to suggest future research topics for parties interested in enhancing coalition team effectiveness.

Differences in means were found on some of the research variables between U.S. and Bulgarian samples. Moreover, these mean differences seemed to follow a pattern, where U.S. generally scored higher on the ICC scales, which assessed individual and organizational factors existing prior to the multi-national training exercise that were likely to affect collaboration. A higher score on the need to collaborate scale shows that the US military perceive their organization as one for which coalition collaboration is a priority, it understands the importance to collaborate with coalition partners to achieve its mission and value the benefits of coalition cooperation. In comparison to the Bulgarian respondents, U.S. respondents seem to perceive the U.S. military as an organization that invests more resources to achieve successful coalition cooperation and is more flexible to adapt procedures and make cooperation successful. U.S. respondents also indicated perceiving the U.S. military as more of a learning organization that highly values lessons learned process and considers each coalition cooperation as a contribution to mutual learning.

Conversely, the Bulgarian means were generally higher for the scales assessing constructs from the PRISM model, which focus on what unfolds once the coalition team is formed in terms of factors affecting coalition team effectiveness through information sharing and collaboration. Bulgarian respondents demonstrate a high level of perceived interdependence between coalition partners to achieve the goals of the exercise/operation both with respect to implementation of the tasks and particularly as far as the exchange of information is concerned. Additionally, the Bulgarian military share the perception that the coalition partners understand the role of timely information exchange and do everything possible to keep the partners up to date about their activities; they feel that their organization shares information openly with the coalition partners. Moreover, the Bulgarian respondents perceive the coalition collaboration as meaningful and important for both sides and therefore, consider the cohesion among the coalition team as high; working with coalition partners is enjoyable and rewarding. Finally, the Bulgarians demonstrate high level of job satisfaction particularly working with U.S. partners in this exercise.

These findings provide insight into problems that need to be addressed within organizations in order to enhance coalition effectiveness in the future. The U.S. respondents seem to indicate that they have a greater capacity for collaboration in terms of the culture of the U.S. military as an organization and the resources it provides. However, once engaged in the exercise, the U.S. respondents may have benefitted from a greater understanding of the interdependencies inherent in the joint training exercise (e.g., How can the coalition partnership be enhanced in the joint training example through greater information sharing? What information should be shared with whom and for what reason?). Conversely, the results of this research suggest that Bulgarian respondents have a better understanding of the interdependencies, want to share available information, and have more positive attitudes toward the coalition team once engaged, but may benefit from organizational cultural changes such as increased flexibility and resources to collaborate. No definitive conclusions can be drawn from this data, but this research begins to suggest

ways of improving coalition team effectiveness. Future research should also examine generalizability to other types of coalition teamwork to see if similar differences are found between other Nations.

In general, the correlations between the research variables were consistent with expectations. Factors were identified by the PRISM model and research on inter-organisational collaborative capacity that were expected to relate perceived coalition effectiveness. The significant correlations presented in the results section suggest that the constructs identified are indeed likely to predict coalition team effectiveness through their relationships with information sharing and collaboration. Overall, the correlations between the PRISM variables and perceived coalition effectiveness were slightly stronger than the ICC scales. Because the PRISM model suggests relationships that are more directly related to collaboration and coalition team effectiveness than the ICC scales, this pattern of relationships was expected. Plans for future research include approaching this problem with a more sophisticated statistical analysis to examine the fit of a model developed as a combination of PRISM and the ICC variables. This will be useful in better understanding the relationships between these variables and identifying the most useful predictors of coalition team effectiveness. Further refinements to the scales used to measure these constructs, including means of measuring constructs more objectively, as well as more precise outcome measures are important to further validate the model.

G.4.1 Military Benefits

This research utilized past theoretical and empirical research to identify factors considered critical for coalition team effectiveness, including organizational and national cultural differences relating to information sharing and trust, fostering collaboration among coalition partners. The findings from this research could be used to improve military training and the organization of coalition teams. For example, organizational structure may inhibit information sharing in current coalition teamwork. Additionally, individual attitudes toward the need for collaboration and differences in perceived interdependence between coalition partners may be barriers to coalition teamwork. By exploring these critical factors, we can begin to understand areas that should be targeted for improving organizational effectiveness in coalition operations.

Additionally, the identification of these factors influencing collaboration in coalition teams also gives rise to better means of assessing coalition team effectiveness, or likelihood of success in future NATO missions. This research, along with future projects, could be utilized to develop a method of assessing the readiness of coalition team members prior to beginning a mission and training could be targeted to address areas of improvement.

G.5 REFERENCES

- [1] Adams, B.D. and Sartori, J.A. (2006). *Validating the trust in teams and trust in leaders scales*. Contract report for the Department of National Defence; Toronto, Ontario, Canada.
- [2] Adams, B.D. and Webb, R.D.G. (2003). Model of trust development in small teams. *Report to Department of National Defense. DRDC No. CR 2003-016*.
- [3] Bisig, E., Seiler, S. and Szvircev Tresch, T. (2009). *Organizational effectiveness – the construct and its determinants*. Working paper for the HFM-163 meeting at ACT, Norfolk, VA.
- [4] Blais, A.R. (2009). *Trust in Teams Scale*. Personal communications on June 24, 2009.
- [5] Bunderson, J.S. and Sutcliffe, K.M. (2002). Comparing alternative conceptualizations of functional diversity in management teams: Process and performance effects. *Academy of Management Journal*, 45, 875-893.

- [6] Connaughton, S.L. and Shuffler, M.L. (2007). Multinational/multicultural distributed teams: A review and future research agenda. *Small Group Research*, 38(3), 387-412.
- [7] Craig, T.Y. and Kelly, J.R. (1999). Group cohesiveness and creative performance. *Group Dynamics: Theory, Research, and Practice*, 3, 243-256.
- [8] Defense Equal Opportunity Management Institute, Directorate of Research (2008). *DEOMI Organizational Climate Survey (v3.3)*. RCS: DD-P&R (AR) 2338. Patrick Air Force Base, FL.
- [9] Essens, P.J.M.D., Vogelaar, J.J.C., Mylle, C., Blendell, C., Paris, C., Halpin, S.M. and Baranski, J.V. (2005). *Military Command Team Effectiveness: Model and Instrument for Assessment and Improvement*. NATO RTO Technical Report AC/323(HFM-087)TP/59.
- [10] Galbraith, J.R. (2002). *Designing organizations: An executive briefing on strategy, structure, and process*. San Francisco.
- [11] Jossey-Bass, IncMarks, M.A., Mathieu, J., and Zaccaro, S.J. (2001). A temporally based framework and taxonomy of team processes. *Academy of Management Review*, 26, 356-376.
- [12] Hunter, A.E. (2010, January). *Omni Fusion 2009 Survey Data and Observations*. Presented to the Battle Command Science and Technology Operational Working Group, Aberdeen, MD.
- [13] Jansen, E., Hocevar, S.P., Rendon, R.G. and Thomas, G.F. (2008). *Interorganizational collaborative capacity: Development of a database to refine instrumentation and explore patterns*. Monterey, CA: Naval Postgraduate School, Acquisition Research Program.
- [14] Jehn, K.A. and Shah, P.P. (1997). Interpersonal relationships and task performance: Mediating processes in friendship and acquaintance groups. *Journal of Personality and Social Psychology*, 72, 775-790.
- [15] Marks, M.A., Mathieu J. and Zaccaro S.J. (2001). A temporally based framework and taxonomy of team processes. *Academy of Management Review*, 26, 356-376.
- [16] Pearce, J.L. and Gregerson, H.B. (1991). Task interdependence and extra role behavior: A test of the mediating effects of felt responsibility. *Journal of Applied Psychology*, 76, 838-844.
- [17] Rossi, M.E. (2009, April). *The Development and Validation of the Comprehensive Team Interdependence Scale*. Paper presented at the Annual Conference of the Society for Industrial and Organizational Psychology, New Orleans, LA.
- [18] Salas, E., Sims, D.E. and Burke, C.S. (2005). Is there a big five in teamwork? *Small Group Research*, 36, 355-599.
- [19] Staples, D.S. and Webster, J. (2008). Exploring the effects of trust, task interdependence and virtualness on information sharing in teams. *Information Systems Journal*, 18, 617-640.

