Holistan Revisited: Demonstrating Agent- and Knowledge-Based Capabilities for Future Coalition Military Operations

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Abstract—*As a fundamental research program, the International Technology Alliance (ITA) aims to explore innovative solutions to some of the challenges confronting US/UK coalition military forces in an era of network-enabled operations. In order to demonstrate some of the scientific and technical achievements of the ITA research program, we have developed a detailed military scenario that features the involvement of US and UK coalition forces in a large-scale humanitarian-assistance/disaster relief (HA/DR) effort. The scenario is based in a fictitious country called Holistan, and it draws on a number of previous scenario specification efforts that have been undertaken as part of the ITA. In this paper we provide a detailed description of the scenario and review the opportunities for technology demonstration in respect of a number of ITA research focus areas.*

I. INTRODUCTION

The International Technology Alliance[1] (ITA) is a large-scale fundamental research effort that aims to explore innovative solutions to some of the challenges confronting US/UK coalition military forces in an era of network-enabled operations [1]. As with any large-scale research effort involving multiple stakeholder groups, it is often useful to provide a scenario that highlights the contribution of scientific and technical achievements to current and future capabilities. In fact, demonstration scenarios can fulfil a variety of functions in such situations: they can support the validation, testing and evaluation of proposed solutions, and they can establish a supportive framework for knowledge acquisition and knowledge system development (see [2]).

In order to demonstrate[2] some of the scientific and technical achievements of the ITA research program, a detailed military scenario has been developed that features the involvement of US and UK coalition forces in a large-scale humanitarian-assistance/disaster relief (HA/DR) effort (see [3] for more details). The scenario is based in a fictitious country called Holistan, and it draws on a number of previous scenario specification efforts undertaken as part of the ITA (e.g. [4]). The main aim of the scenario is to provide a context for technology demonstration within the ITA. In particular, it aims to highlight the relevance of ITA research to military coalition operations. The narrative structure of the scenario also seeks to highlight the fundamental interdependence of ostensibly disparate areas of ITA research – it features a series of events that necessitate the exploitation of multiple capabilities, each of which is the subject of a different ITA research focus area. Such interdependence is the basis of a number of collaborative opportunities that are currently being pursued as part of the ITA program.

II. SCENARIO BACKGROUND

The scenario is set in a fictitious Middle-Eastern country called Holistan (see [4]). The country borders the land-locked country of Rugistan on the west, the Democratic Republic of Weightan to the east and the People’s Republic of Sugaria in the far northeast (see Fig. 1). Holistan has been

[1] http://www.usukita.org

[2] Note that the scenario does not require the development of an integrated technology demonstrator, or simulation environment; it is the narrative structure of the scenario that provides the basis for integrating ITA research outcomes. The development of separate (and largely independent) technology demonstrators is perfectly compatible with the scenario specification effort described herein, although the scenario does necessitate some degree of inter-operation between the various technology demonstration components.

the focus of violent conflict in recent years, with religious fundamentalist groups mounting an insurgency (backed by the People's Republic of Sugaria) against Holistan government forces. In the face of continued unrest, and with the overthrow of the democratically-elected government looking imminent, US and UK forces are deployed to the country (under a UN mandate) to suppress the insurgency and stabilize the region. At the time of the scenario, coalition forces have been largely successful in their campaign. The majority of insurgent forces have been

Fig. 1. Holistan and neighbouring countries

defeated, but pockets of resistance remain in Mantristan, the northern-most province of Holistan.

On the 18th March 2008 a large earthquake devastates the northern region of Holistan, particularly the northern province of Mantristan. Isolated communities in the mountains are hardest hit with large numbers of civilian causalities and major structural damage to many residential buildings. The region is declared a disaster area, and the international community calls on humanitarian agencies to coordinate a relief effort to resolve the crisis. Unfortunately, because of the recent conflict, many members of the humanitarian community have withdrawn from the region, and the agencies that remain in theatre are 'nervous' about the security situation in Mantristan province. Until the humanitarian community can marshal sufficient resources to cope with the crisis, US and UK coalition forces are called on to assist with emergency relief efforts and to improve the security situation for subsequent humanitarian intervention. The affected area is divided into a number of Areas of Responsibility (AoR), each under the command of a military coalition commander. The AoR that is the focus of the scenario described herein comprises three mountain communities situated approximately 40 miles north of Astana, the provincial capital of Mantristan (see Fig. 2). The region is under the control of a brigade-sized military unit (Astana Brigade) comprising logistical, infantry and aviation elements from the US and UK armed forces (see [3] for more details). During the past few months the force has been undertaking strategic operations against insurgent groups who operate from their hideouts in the mountains.

III. Event Timeline

The scenario begins with a US Geological Survey (USGS) report of an earthquake at 15.10[3] hours on the 18th March. From the perspective of technology demonstration, however, the critical period of the scenario extends from 20.00 hours on the 18th March to 14.00 hours on the 19th March. This is the time period in which initial mission planning, force deployment and initial aid distribution efforts are concentrated. The scenario is decomposed into three distinct phases (see Fig. 3), each offering somewhat different opportunities for technology demonstration (see Section IV). These phases of the scenario are described in subsequent sections.

A. Phase I: Mission Planning

This phase of the scenario witnesses the bulk of coalition planning activities. For the most part, the scenario focuses on the planning activities of Astana brigade; however, other planning activities are undertaken throughout the scenario by other coalition units[4], as well as by members of the humanitarian community[5]. Coalition planning focuses on the resource requirements (both military and civilian) of the mission, the potential threat posed to coalition forces by the security situation, the information and surveillance requirements of the mission, and the need to maintain communications with deployed forces at all times throughout the mission timeline. At 01.00 hours on the 19th March, coalition forces leave Astana *en route* to the mountain settlements. They are expected to arrive at their target locations by daybreak.

B. Phase II: Force Deployment

There are three mountain settlements within the target AoR (see Fig. 2): Surah-Lam, Qash-Nagar and Golab-Kel. For the most part, the action within the scenario focuses on the largest of these three settlements: Surah-Lam (this is the settlement that attracts the greatest interest from both a humanitarian and a security perspective). The coalition forces assigned to Surah-Lam (Alpha Force[6]) approach the

[3] All times are based on local (Holistan) time.

[4] Smaller-scale (re)planning efforts are also seen throughout the scenario. One notable example is the tactical planning associated with the deployment of coalition units into Surah-Lam as part of the Combat Operations phase (see Section III.C).

[5] A number of humanitarian aid organizations are assumed to be operating in the region. These include UNHCR, Oxfam, WFP, MSF, ICRC and CARE International. The Emergency Relief Coordinator (ERC) has appointed the UNHCR to serve as the lead agency in coordinating and overseeing all long-term relief efforts. In order to enable coordination and communication with military forces, military liaison officers (MLOs) are assigned to assist the humanitarian community with the planning of specific sectorial activities, e.g. food distribution. The primary role of the MLOs is to ensure that plans for humanitarian action are fully deconflicted with coalition-led HA/DR operations (as well as with other military operations). The MLOs act through the Coalition Joint Civil-Military Operations Task Force (CJCMOTF), which serves as the strategic command HQ for civil-military coordination on behalf of the US/UK coalition.

[6] Two other forces (Bravo Force and Charlie Force) are assigned to the other two mountain settlements, namely Qash-Nagar and Golab-Kel.

Fig. 2. Map showing settlements and transport routes within the target AoR

town from the south via a mountain pass, called the Khevan Pass (see Fig. 2). *En route* they encounter a delay while repairs to the Jolen Bridge (see Fig. 2) are performed, and they also come under attack from insurgent forces that are hiding in the mountains. The attack serves to heighten concerns that the insurgents will use the earthquake to gain a tactical advantage over coalition forces; reports that insurgent forces have moved into Surah-Lam ahead of the arrival of coalition forces (see Section IV.B) do nothing to allay these concerns.

C. Phase III: Combat Operations

By 10.00 hours on 19th March Alpha Force has reached the outskirts of Surah-Lam. Anticipating an ambush by insurgent forces they do not enter the town immediately. Instead, they dispatch three platoons to assess the security situation and neutralize any threat to coalition forces. In order to monitor the progress of deployed forces, Alpha Force commanders, as well as analysts at brigade HQ, establish situation monitoring capabilities that ensure they have an awareness of the evolving combat picture. As the platoons move into Surah-Lam, they are engaged by insurgent forces and a fire-fight ensues. By 14.00 hours the insurgents have been defeated and coalition forces begin distributing humanitarian aid.

IV. Technology Demonstration Opportunities

The (brief) overview of the scenario presented above highlights the main events and actions associated with a complex coalition military scenario that comprises elements of both conventional warfighting and HA/DR. The scenario provides rich opportunities for technology demonstration, particularly with respect to the scientific focus areas of the ITA program. In subsequent sections we revisit the various phases of the scenario (see Fig. 3), this time highlighting the opportunities for technology demonstration in each of a

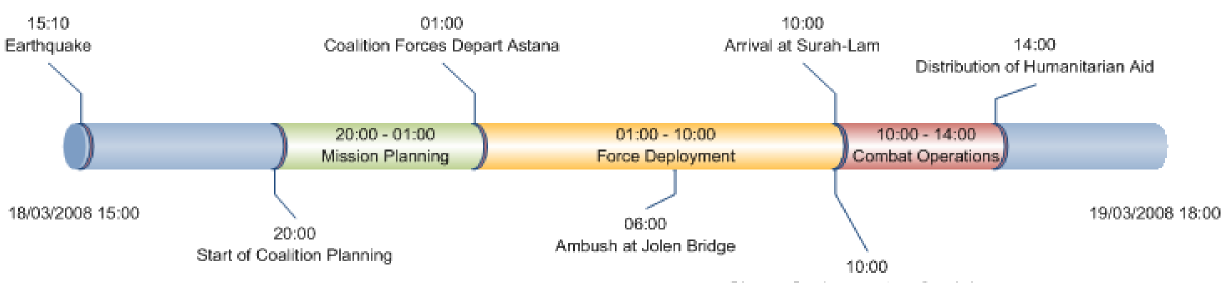

Fig. 3. Scenario timeline

number of research focus areas within the ITA. Following the structure of the ITA program, we review the opportunities for technology demonstration at the project and task level (each ITA project comprises one or more tasks).

A. *Project 8, Task 1 (P8T1)*

P8T1 focuses on the optimal selection of sensor assets based on the fit between specific sensor characteristics and the Intelligence, Surveillance and Reconnaissance (ISR) requirements of specific missions [5]. The process is generally referred to as sensor-mission matchmaking (SMM), and ontologies feature as an essential element of the process – largely because they provide a semantically-enriched characterization of sensor resources that can be exploited by matchmaking algorithms.

The main demonstration opportunity for SMM lies in the Mission Planning phase of the scenario. In this phase, we see a need to marshal sensor assets in support of specific information acquisition, monitoring and surveillance functions. The SMM process is used to ascertain what sensors should (optimally) be assigned to what missions based on the ISR requirements of those missions, and it requires information about what sensor resources are available to coalition forces as part of a sensor deployment plan. In the scenario, we assume that multiple ontologies are being used by US and UK forces to represent their own, nation-specific collection of sensor assets. Clearly, if such assets are to be used in a way that reflects the *joint* nature of the military operations, we need to find a way to execute SMM processes across these multiple ontologies. This is where the use of semantic integration and interoperability capabilities provided by Project 12 (see Section IV.E) comes into play: semantic integration techniques are being used in Project 12 to effect the integration of sensor ontologies, such that sensor selection and deployment can take place irrespective of nation-specific tendencies to represent information in different ways.

B. *Project 9, Task 2 (P9T2)*

P9T2 investigates the use of semantic technologies to support low-level data fusion processes [6]. The aim, in essence, is to explore the opportunities for semantically-mediated data fusion and evaluate these opportunities in an empirical context. For the most part, the research activities of P9T2 focus on the fusion of acoustic datasets (containing the acoustic signatures of multiple vehicle types) using feature selection techniques and semantically-enriched representations of the information acquisition context; for example, road surface type, sensor characteristics, etc.

The main technology demonstration opportunity for P9T2, with respect to the domain scenario, derives from the analysis of acoustic sensor data. As part of their mission preparation activities, the scenario assumes that coalition forces have responded to the potential threat posed by insurgent forces in the Sugarian border region by deploying vibro-acoustic sensors on the road north of Surah-Lam (see Fig. 2). These sensors are intended to detect the transit of vehicles heading to or from Surah-Lam.

At 08.02 hours, the deployed sensors detect the movement of multiple vehicles along the road north of Surah-Lam. The sensor data is analysed by fusion processors located on the acoustic sensor devices, and the results of fusion processing, along with the rationale undergirding fusion-related decision outcomes, is transmitted back to brigade HQ as soon as a communications uplink (provided, in this case, by an Unmanned Aerial Vehicle (UAV) drone with radio transmission relay capabilities) becomes available. When the sensors are deployed, they are furnished with the information sets deemed relevant to the fusion processes they will undertake. For the purposes of the scenario, this includes information about the surrounding terrain, the type of vehicles likely to be encountered (information which influences the confidence limits assigned to fusion outcomes), the characteristics of the road surface along which vehicles are expected to travel and the operating characteristics of the vibro-acoustic sensors from which information will be acquired (e.g. microphone transfer functions). The output of the semantic data fusion process, as part of the scenario, reveals the transit of a number of vehicle types, including Sports Utility Vehicles (SUVs) – the vehicle type most commonly supplied to the insurgents by their allies across the Sugarian border. Further fusion-related analysis indicates that the vehicles are likely to be heavily laden or towing equipment; this heightens suspicions that coalition forces may be engaged by insurgents upon entering Surah-Lam.

C. *Project 10, Task 2 (P10T2)*

One of the key research focus areas for P10T2 concerns the development and utilization of models describing the context of a military mission. The context, in this case, includes multiple types of information, some of which may be readily available from military information systems (e.g., goals, plans, resources, command intent, etc.), and some of which may not be so readily available (e.g., the current state of mission execution, the meaning and importance of unfolding events, the relationships between team members, and so on). Developing a formal model of the mission context is complex, not least because of the difficulty associated with automatically acquiring and representing context-relevant information; nevertheless, mission context models are an important resource in the effort to provide a variety of forms of agent-based support to military teams. Poltrock et al [7], for example, describe context models as “a resource that software agents can employ to anticipate and recognize the team’s need for information or other resources”.

The focus for technology demonstration in respect of P10T2 research concerns the specification of dynamic models of mission context using a simulated combat environment, namely Battlefield 2 (BF2). BF2 is a first-person shooter game in which players fight in a virtual battlespace. The game can be instrumented by means of Python scripts that allow external software components to be (loosely) integrated into the game environment. For example, information about events in the game, such as the death of team members, the destruction of vehicles and entry into a particular area, can be captured and made available to external programs [8]. Poltrock et al [7] rely on precisely this technique to capture information about some aspects of the mission context in an experimental analysis of team-player behaviour (other information being provided by the verbal communication between game players). In terms of the Holistan scenario, the idea is that the BF2 environment will be used as a simulation environment for the close combat operations that ensue when coalition forces enter the town of Surah-Lam (see Section III.C). Recall that, as part of the narrative structure of the scenario, three platoons are dispatched to assess the security situation in Surah-Lam and negate any hostile forces, prior to the entry of the main bulk of Alpha Force units into the town (see Section III.C). The deployment of the platoons is preceded by a brief period of mission planning in which the tactics and rules of engagement (ROE) for the platoon units are decided. This information comprises a partial model of the mission context, which is subsequently enriched by feedback from the BF2 game environment and the communicative dynamics of individuals playing the role of platoon team members.

In order to support the specification of mission context using the BF2 environment, as well as demonstrate the use of knowledge access and situation monitoring capabilities in close combat operational contexts, we propose to extend the technical approach adopted by Poltrock et al [7] with respect to the serialization of BF2 event information. The idea, in essence, is to capture game events using Python scripts and serialize these to a network-accessible RDF stream or RDF-compatible data repository. The use of RDF to represent BF2 information requires the development of an event ontology that is specifically geared to deal with the types of information that can be captured from the BF2 environment[7]. Once developed, such an ontology can support a number of advanced information processing functions. One function is, of course, the retrieval of information to dynamically update elements of the mission context model – this is the primary focus for technology demonstration in respect of P10T2. Other functions include the use of semantic queries to selectively retrieve specific types of information, the specification of knowledge monitors (see [9]) to selectively monitor and report on specific events and contingencies, and the publication of RSS feeds providing information about the state of mission execution. Moreover, because game events are represented in a semantically-enriched format, various forms of semantically-driven analysis or decision support could be implemented using conventional knowledge technologies and knowledge-based services.

[7] see http://bf2tech.org/index.php/Event_Reference.

D. Project 11, Task 1 (P11T1)

The focus for P11T1 research concerns the use of Cultural Network Analysis (CNA) techniques [10] to develop cultural models that are highly sensitive to the cultural differences between elements of a coalition force. An advantage of CNA, relative to other cultural analytic techniques, is that it is often able to detect cultural differences that would otherwise be undetectable because of the subtlety of the differences involved. A case in point is a recent study by Rasmussen et al [11] that examined cultural differences between US and UK military commanders in the planning domain. It might be expected that cultural differences between US and UK military personnel would be small because of the relative similarity of their training experiences and common language; however, CNA was able to reveal differences here. One finding, for example, suggested that UK commanders have expectations about the level of detail used to describe military objectives which differ from those of their US counterparts [11].

One use of the scenario described here is to provide a specific operational context for conducting CNA studies. For example, the scenario provides a common frame of reference for eliciting coalition partners' mental models of the military planning domain. Culturally-shared mental models that result from such studies can also be used in a variety of ways. One ongoing research effort, for example, seeks to apply the results of Rasmussen et al [11] to develop a system for culture-sensitive plan generation that capitalizes on the availability of both coalition planning ontologies [12] and advanced natural language generation (NLG) techniques [13]. It has been shown that ontologies can be used in conjunction with NLG technologies to provide an ontology verbalization capability that serializes the content of an ontology to a human-readable, natural language format [14]. And, in some cases, this ‘report generation process’ can be tailored to meet the specific reporting requirements of different user communities [15]. As such, in cases where we encounter culturally-disparate communities, we can use cultural models to tailor the presentation/visualization of information content to suit the need of specific user communities. In the case of military planning, the requirements for context-sensitive visualization of plan-relevant information are precisely those captured by the culturally-based mental models developed for US and UK commanders (see [11]).

E. Project 12, Task 1 (P12T1)

One of the key research focus areas for P12T1 concerns the use of semantic technologies to facilitate information exchange and interoperability among coalition forces. Specific areas of research include the use of semantic mapping solutions to effect semantic integration, and the use of carefully designed user interfaces to support the exploitation of semantic technologies.

Technology demonstration opportunities for P12T1 emerge throughout all three phases of the Holistan scenario. The Mission Planning phase, in particular, draws on semantic technologies to support the rapid retrieval and integration of multiple types of situation-relevant information. Take, for example, the case of meteorological information. Weather information emerges as an important (if not critical) element of many mission planning activities, and this is because it often shapes and constrains the opportunities for military action (e.g. [16]). In the current scenario, the retrieval of meteorological information is important because it highlights the kinds of resources that may be required in order to counter humanitarian challenges; for example, low temperatures may mandate the need for extra blankets, fuel and power generators, while heavy rainfall may suggest a need for plastic sheeting and tents. Meteorological information therefore impacts on the resource requirements for humanitarian mission planning.

Another information source deemed to be of significance for military planning in the current scenario is mine hazard information. In this case, we assume there is a need to access information about the results of mine hazard impact surveys (maintained by humanitarian demining organizations) and coalesce this with information about recent Improvised Explosive Device (IED) incidents. Ultimately, military planners need to use this information to assess the danger posed to coalition forces both *en route* to the target settlements and also in the vicinity of the settlements themselves. The risk posed by minefields may limit troop deployment activities, or it may necessitate the recruitment of Explosive Ordnance Disposal (EOD) specialists as part of the mission plan[8].

The critical issue, from the perspective of P12T1, is whether coalition military analysts can access these sources of information in a manner that speaks to their immediate task objectives (i.e. the need to develop a mission plan that will coordinate military action in the subsequent deployment and execution phases), and whether they are able to integrate sources of information that perhaps subtend multiple nodes of a distributed information network. The former capability (information retrieval) is the target of technology demonstrations that draw on a number of knowledge access tools, particularly graphical and natural language query designers (see [17]). These tools were designed as part of a joint collaborative effort between the ITA and the Data and Information Fusion Defence Technology Centre (DIFDTC[9]), and they provide analysts with semantic query design and semantic question-answering facilities. The other (and perhaps more important) capability to be targeted by the P12T1 technology demonstration effort is the use of portable ontology alignment solutions to integrate (ostensibly) disparate information repositories providing information about both the meteorological and IED/mine hazard situation. In this case, P12T1 aims to demonstrate its approach to semantic integration using query- and rule-based information transformation solutions, as well as a portable ontology alignment solution developed specifically within the context of the ITA program [18].

Beyond the use of semantic integration technologies to demonstrate the exploitation of multiple sources of scenario-relevant information, P12T1 is also involved in a number of other technology demonstration efforts throughout the scenario. These include the integration of sensor ontologies as part of the SMM process (see Section IV.A), the development of ontology verbalization capabilities to support culture-sensitive plan generation (see Section IV.D), the development of ontology fragments to support semantic data fusion (see Section IV.B) and the development of ontologies to support the monitoring of combat operations using the BF2 simulation environment (see Section IV.C).

F. *Project 12, Task 2 (P12T2)*

One of the aims of P12T2 is to investigate the representation of plan-relevant information, both in terms of the representational formalisms to be used and the type of information to be represented (e.g., tasks, agents, resources, constraints, assumptions, rationale, and so on). Plan representation is important because coalition plans serve as the basis for coordinated military action and, as such, they need to satisfy a number of conditions:

1. they must contain information that is relevant to military decision-making within specific task contexts, operational environments and command echelons;
2. they must present information in a manner that ensures a common understanding of command intent;
3. they must contain information that reflects the current situation, i.e. they must contain up-to-date information; and
4. they must prioritize the presentation of information that is relevant to the specific decision-making context in which the plan is presented. (For example, important information should be highlighted, while irrelevant information should be downplayed or even discarded.)

The representational formalisms (and representational content) of plans needs to be sensitive to these conditions. Ideally, the representational formalisms should be usable (i.e. easy for human end-users to understand and manipulate[10]), expressive (i.e. support the representation of a variety of different types of plan-relevant information) and machine-processable. They should also attempt to make sensible contact with existing techniques and technologies, such as Semantic Web technologies and automated planning tools.

The demonstration of P12T2 research occurs, perhaps unsurprisingly, in the Mission Planning phase of the

[8] EOD specialists are indeed deemed necessary for some components of the missions undertaken by Bravo and Charlie Forces.

[9] see http://difdtc.gdstorm.org.uk

[10] This means that any representational strategy must pay close attention to the cognitive (and in some cases perceptual) biases and limitations of the human end user community.

ITA Task	Demonstration Opportunity	Scenario Phase	Requirements	Collaboration
P8T1	Sensor-mission matchmaking.	Mission Planning	Sensor ontologies; coalition plans.	**P9T2** (representation of sensor characteristics and performance profiles); **P12T1** (application of semantic inter-operability solutions to combine sensor ontologies and sensor asset datasets); **P12T2** (representation of ISR requirements as part of the coalition plan).
P9T2	Semantically-mediated data fusion.	Force Deployment	Sensor ontologies; semantically-enriched descriptions of sensor characteristics, terrain, road surface and expected vehicle types.	**P8T1** (representation of sensor characteristics and performance profiles); **P12T1** (development of semantically-enriched representations – 'micro-ontologies'); **P12T2** (representation of the rationale associated with fusion outcomes).
P10T2	Development and utilization of dynamic models of mission context.	Combat Operations	BF2 event ontology; BF2 event repository.	**P12T1** (development of BF2 event ontology; assistance with semantic retrieval of context-relevant information); **P12T2** (incorporation of coalition plan content into initial context model).
P11T1	Culturally-adaptive plan generation and visualization.	Mission Planning, Force Deployment, Combat Operations.	Coalition plans; cultural models of the military planning process; ontology verbalization and report generation capabilities.	**P12T1** (application of ontology verbalization capabilities to create tailored plan visualizations); **P12T2** (semantically-enriched representations of plan-relevant information content).
P12T1	Knowledge access and retrieval; semantic integration and interoperability.	Mission Planning, Combat Operations	Domain ontologies (meteorology, mine hazards, sensors); instance datasets; knowledge access tools; portable ontology alignment solutions.	**P8T1** (sensor ontology alignment and integration of sensor platform databases); **P9T2** (assistance with the development of micro-ontologies); **P10T2** (ontology for BF2 event streams); **P11T1/P12T2** (culture-sensitive visualization of coalition plan information).
P12T2	Plan representation.	Mission Planning	Coalition planning ontologies.	**P8T1** (representation of ISR requirements); **P9T2** (representation of fusion-related decision rationale); **P11T1** (semantically-enriched representations of plan content); **P12T1** (representation and retrieval of plan-relevant information).

Table 1. Summary of technology demonstration opportunities for ITA research tasks.

scenario. It is at this point in the scenario that military planners endeavour to use the representational elements of the Collaborative Planning Model (CPM) [12] – the planning ontology developed by P12T2 – to express the outcome of their planning activities. To a large extent, the focus for technology demonstration in respect of P12T2 concerns the planning efforts undertaken in respect of the two smaller settlements, namely Qash-Nagar and Golab-Kel (see Fig. 2). It should be clear, however, that the Holistan scenario provides multiple opportunities for the utilization of semantically-enriched planning models. These include the generation of tailored plans for culturally-disparate military commanders (see Section IV.D), the initial specification of mission context models (see Section IV.C) and the specification of ISR requirements as part of mission execution (see Section IV.A).

G. Summary

As should by now be clear, the extended Holistan scenario presented herein provides many opportunities for technology demonstration. The opportunities described here do not necessarily exhaust those that are available (there are many opportunities for the integration of other ITA research focus areas into the scenario), but they do provide a flavour of the way in which multiple scientific and technical outcomes can be showcased within the context of an integrated scenario that features multiple operational foci. Table 1 provides a summary of the technology demonstration opportunities for the ITA research tasks outlined in this paper. It summarizes the demonstration opportunities for each task and highlights the potential collaborative opportunities with other ITA tasks that are (at least in some cases) necessary to realize the opportunity.

V. CONCLUSION

This paper has presented a scenario that features the close inter-operation of US and UK coalition forces in a complex operational context comprising elements of both conventional warfighting and HA/DR operations. The scenario builds on previous scenario development efforts undertaken as part of the ITA initiative, and it supports the demonstration of agent- and knowledge-based capabilities in a number of ITA research focus areas. The main aim of the scenario is to highlight the military relevance of ITA research outcomes, although it also provides a basis for collaboration between ITA research groups – the narrative structure of the scenario is indeed designed to highlight the interdependencies between these groups. The technology demonstration opportunities provided by the scenario are not necessarily limited to those presented here, and further analyses are currently being undertaken to determine whether the scenario could serve as the backdrop for a larger technology demonstration effort that subsumes most, if not all, of the research focus areas currently being explored as part of the ITA program.

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