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Contingency Contractor Optimization
Phase 2, Architecture Document

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Abstract

This report provides documentation of the overarching architecture for the Strategic Contractor Planning Tool and framework. The report describes the system organization, high-level system structure, and interfaces. Various architectural views provide descriptions of the planning tool architecture, information flow, and functionality. The information flow serves to tie together the architecture, analytic framework and existing capabilities. This report highlights the potential integration points for the planning tool within the existing OSD and DoD strategic planning activities. Many existing tools, policies, and information can be leveraged as inputs to this planning tool, including strategic planning information, personnel, and cost resources. These resources are listed and discussed. A high-level description of the planning tool functionality and usage are also described.

ACKNOWLEDGMENTS

J8 Force Development
J4 LOG
J4 Analysis and Resource Division (ARD)
CENTCOM
OSD CAPE Joint Data Support
OSD Policy
OSD Personnel & Readiness
OSD DASD Plans
SOUTHCOM
PACOM
CENTCOM
NORTHCOM
OSD Acquisition Test, & Logistics (ATL)

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NOMENCLATURE

APEX	Adaptive Planning and Execution System
ATL	Acquisition, Technology and Logistics
CAAF	Contractors Authorized to Accompany the Force
CAPE	Cost Assessment and Program Evaluation
CET	Contractor Estimator Tool
CFIT	Capabilities Force to Integration Tool
CFORM	Capabilities Force Management Tool
CME	Contractor Manpower Equivalents
COCOM	Combatant Command
CONOPS	Concept of Operations
DMDC	Defense Manpower Data Center
DoD	Department of Defense
DOE	Department of Energy
FE	Force Element
FTE	Full time equivalents
ISC	Integrated Security Construct
JCA	Joint Capability Area
JCCS	Joint Contingency Contracting System
JDS	Joint Data Support
JOPES	Joint Planning and Execution System
MOST	Mitigation Option Selection Tool
MSFD	Multi-Service Force Deployment
OCS	Operational Contract Support
OUSD	Office of the Under Secretary of Defense
OSD	Office of the Secretary of Defense
P&R	Personnel and Readiness
PARS	Personnel Accountability Rep System
PUTN	Primary Unit Type Name
SME	Subject Matter Expert
SNL	Sandia National Laboratories
SPOT	Synchronized Pre-deployment Operational Tracker
SSA	Support for Strategic Analysis
TPFDD	Time-Phased Force and Deployment Data
TUCHA	Type Unit Characteristic
UTC	Unit Type Code

1. INTRODUCTION

Existing military contingency planning tools do not support the intent of public law and congressional oversight of contractor operations. As a consequence, the extent, duration, and resourcing needed to satisfy contingency needs for contracted capabilities in support of national military strategy objectives cannot be quantified. The ability to develop and institutionalize processes and related tools that facilitate and strengthen strategic contingency program management and Operational Contract Support (OCS) planning and execution are critical. The Office of the Secretary of Defense (OSD) Acquisition Technology and Logistics (ATL) Contingency Contractor Optimization project was initiated to create optimization and decision support tool for strategic operational contract support (OCS) planning. The planning tool's purpose is to provide a capability that, for a given set of mission scenarios and personnel use rules, determines a workforce mix solution that minimizes overall personnel cost subject to limits on personnel group sizes. This planning tool is intended to assist with strategic planning decisions for contractor and total force mix. As such, this capability can assist in strategic planning conducted by the OSD Joint Services during the Support for Strategic Analysis (SSA) and can also assist the service and Combatant Command (COCOM) planners in accomplishing their planning requirements. In addition, this planning tool could be used to support Whole of Government and inter-agency strategic planning.

During Phase 2, Sandia National Laboratories was tasked with creating a conceptual Strategic Planning Framework ("framework") to illustrate the interaction of existing tools, data stores, and the strategic contractor planning tool, and how strategic contract support requirements are addressed [1]. The purpose of this document is to provide a comprehensive overview of the developed planning tool architecture and the proposed framework, including traceability between requirements, data stores, and the framework. This document provides architectural views and descriptions of various aspects of the framework, including the overall system organization, the system structure, the system interfaces, the software functionality and usage, and the integration of the planning tool within the OSD planning framework.

The information presented in this software architecture document is organized into the following sections:

- Architecture Considerations: Assumptions, Dependencies, and General Constraints
- High-Level Strategic Contractor Planning Tool Architecture
- Strategic Contractor Planning Tool Analytic Framework
- Information Flow
- Functional Architecture (software system functionality, usage, and deployment)

2. Architecture Considerations

This section defines the assumptions and constraints for the framework in which the strategic contractor planning tool being developed interacts with the existing tools, and data stores. In order to develop the planning tool, assumptions had to be made about who the user base would be, how the input data might be acquired, and whether the tool would need to interact with other systems. The sections below describe some of those assumptions, along with some potential limitations and constraints.

2.1. Strategic Contractor Planning Tool User Assumptions

The primary users of the planning tool are assumed to be the strategic planners of the joint services and/or the COCOMs during strategic planning activities. This can include use during Spiral 3, Detailed View development of the SSA process. It is assumed that the planning tool users will be knowledgeable about the SSA process, the content of the mission scenarios, the required tool input information, and resources available. It is assumed that the specific organizations and users for this tool will be identified early in the Phase 3 of the tool's development process.

2.2. Strategic Contractor Planning Tool Input Data Assumptions

It is assumed that the input data required by the planning tool is available and that subject matter experts (SMEs) will be available to define and/or obtain the necessary input information. Input data can be grouped into cost by personnel group, capability availability by personnel group, and mission requirements. More detail about the specific input requirements are detailed in the planning tool requirements document, entitled "Contingency Contractor Optimization, Phase 2, Requirements Document."

2.3. Interoperability

It is assumed that the planning tool will initially be used as a stand-alone capability to assist in the strategic planning process. Information will be input directly into the tool by users as needed and imported from database sources as possible (as they are identified and/or become available). Analysis results will be saved to a database. Further interoperability information is contained in Section 5 Functional Architecture.

2.4. Hardware and Operating system

There are no current assumptions about the hardware or operating system of the planning tool. It is assumed that the specific organizations and users for this tool will be identified early in the Phase 3 of the tool's development process and the requirements will be set by the identified user community.

2.5. General Constraints

Additional global limitations or constraints will be identified during Phase 3 which includes the productization and deployment of the planning tool. These constraints will be dependent on the primary user identified. Constraints in the following areas will be considered (this list is *not* exhaustive):

- Required hardware or software environment
- Availability or volatility of resources, including data sources and SMEs
- End-user availability and accessibility requirements
- Training requirements
- Standards compliance
- Interface/protocol requirements
- Data repository and distribution requirements
- Security requirements to include protection of data from unauthorized access, individuals access to data, and control of remote tool accesses
- Memory and other capacity limitations
- Performance requirements
- Network communications requirements
- Verification and validation requirements

3. HIGH-LEVEL STRATEGIC CONTRACTOR PLANNING TOOL ARCHITECTURE

The high-level architecture of the planning tool consists of an overall view of the analytical framework definition. Figure 1 contains a high-level analytical framework diagram. Included in the view are high-level representations of data sources, tool inputs, and tool outputs.

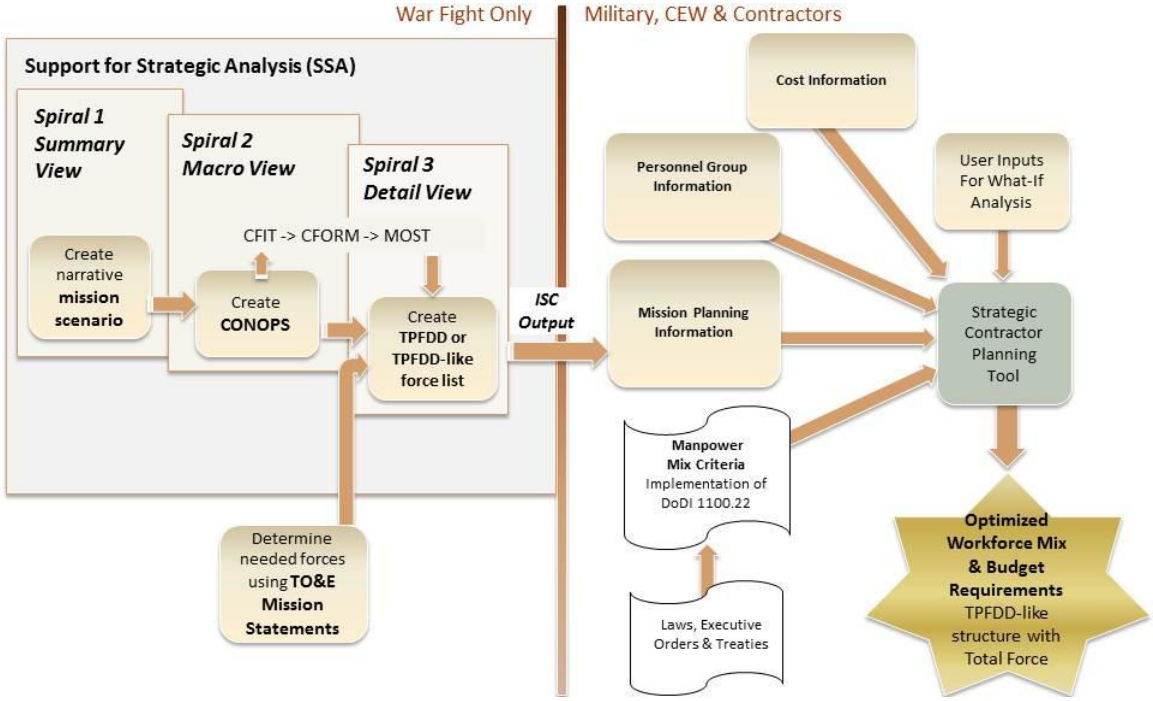

Figure 1. High-Level Strategic Contractor Planning Tool Architecture.

3.1. Description of High-level Architecture

3.1.1. Strategic Contractor Planning Tool Inputs

Support Capability Requirements Information
The SSA process provides an iterative, triple-spiral approach to strategic planning [2] and for the development of concepts of operations (CONOPS) [3]. Each spiral produces increasingly detailed strategic plans, starting with the summary view and moving through to the detailed view. The SSA process produces the Integrated Security Construct (ISC) which consists of a set of mission scenarios and associated military operations arrayed across a multi-year timeline. Within the ISC are specifications of mission overlaps as well as military force elements (FEs) required during each mission phase. FEs are an aggregation of key unit types from each of the services and the COCOMs. As such, at the most detailed level, the ISC output contains fully or partially developed time-phased force and deployment data (TPFDD).

The diagram in Figure 1 indicates an ISC output data translation step. Translation and integration is necessary to make the output from the SSA detail-level strategic planning usable by the

planning tool [3]. The planning tool requires support capability requirements to be specified, in addition to the FEs. This is information that is currently not part of the SSA planning process. These support capability requirements can be communicated through a coding scheme, such as the military Unit Type Code (UTC) or the Joint Capability Area (JCA). Ideally, the coding scheme would be one that is common across the services and across personnel group types (military, contractor and DoD civilian). The developed prototype planning tool supports the Contractor Estimator Tool (CET) approach for translating from UTC to JCA for coding support capability requirements. For Phase 3, the planning tool will accept the coding scheme specified by the planning tool users. If the support and FEs codes available as input are not the same, authoritative data on the capability definitions for each personnel group is required so that capabilities can be consistently mapped across the personnel groups and services. Without this standardized capability mapping, personnel use rules will be impossible to implement. Furthermore, the ISC output may require translation from FE level planning data, for example, to the common support capability requirement level data. The joint service and/or the COCOM planners are the group likely to perform this translation step. Planners at the joint services and the COCOMS use the ISC mission information to further develop the strategic plans to a greater level of detail, often resulting in TPFDD-level information containing UTCs or JCAs.

Cost Information

Because the objective of the planning tool is to find the workforce mix that minimizes the overall personnel cost while meeting all mission requirements and manpower mix constraints, cost information plays a key role in the tool input. The quality of the output will depend on the reliability of the cost information input to the planning tool. There are two types of cost information required by the planning tool: 1) cost by personnel groups including military (active and reserve), DoD civilian and contractors (U.S., local nation, and third-country national), and 2) cost by capability, with common categories across the services and personnel groups.

Personnel Group Information

Information about the availability and a comparison of the efficiency of the different personnel groups is also necessary. The number of full time equivalents (FTEs) available for each capability within the different personnel groups is one tool input providing the available personnel supply for the analysis. In addition, an efficiency factor which compares the different personnel groups to the optimal ability by capability is also needed. In the planning tool, it is assumed that the military always is equivalent to the optimal.

User Inputs

User inputs guide the execution of the “what-if” analyses. The user inputs can be divided into two categories: planning manager and analyst. Planning managers define individual mission scenarios, while analysts perform what-if analysis on combinations of the mission scenarios while varying available parameters. For planning managers, the inputs include required FTEs of each capability by phase and default values for other parameters. For analysts, the inputs include mission scenarios to analyze, start dates, phase durations, operational risk tolerance for each mission scenario, and annual budget. Operational risk assessment guidance is provided in DoDI 1100.22, Enclosure 5 “Guidance for Risk Assessments” [4].

Manpower Mix Criteria and Laws, Executive Orders and Treaties
Workforce mix guidance is an important input to the planning tool. The DoDI 1100.22 defines policy and procedures for determining those positions which are inherently governmental and those that can be performed by the private sector. It also outlines manpower mix criteria and guidance to identify which functions must be performed by government employees and restrictions on their use. Laws, executive orders, and treaties are required by DoDI 1100.22 to detail what work is exempted from the private sector. If there are constraints on personnel usage due to treaty or policy, they can be represented in the tool and will prevent the model from recommending a solution that is not allowable.

3.1.2 Strategic Contractor Planning Tool
The planning tool uses linear programming to determine the lowest cost workforce mix across personnel groups for a given mission set based on budget and personnel availability. Section 5 describes more details of the tool functionality.

3.1.3 Strategic Contractor Planning Tool Outputs
The planning tool outputs the workforce mix including requirement needs by capability for each personnel group by month and the total costs for each mission scenario included in the analysis. These results are provided as graphical output and tabular output and are stored in a database. More details of the planning tool outputs are included in Section 5 and in the user manual, entitled "Contingency Contractor Optimization, Phase 2, User Manual."

3.2. Information Gap Indications

Several information gaps exist in the information required for the planning tool. The gaps are shown in Figure 2. The necessary SMEs and knowledge base to fill these information gaps exist within the joint services and joint planning communities today. A discussion of the known information gaps that exist within the analytical framework follows.

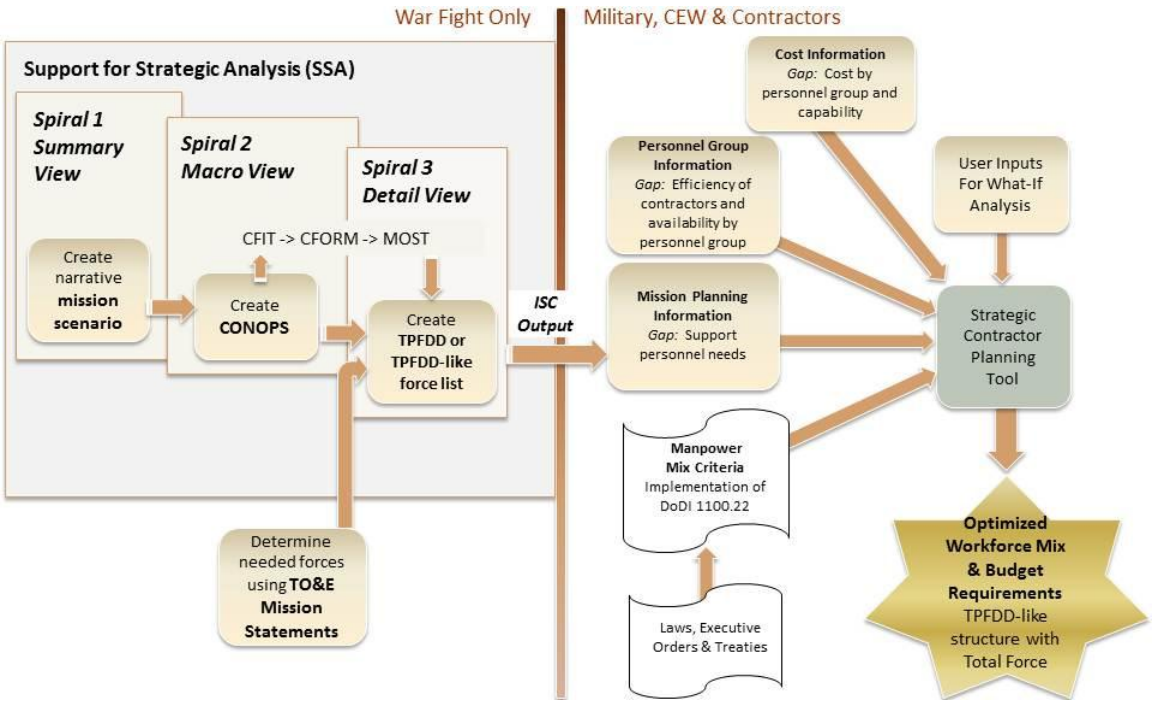

Figure 2. High-Level Architecture with Information Gaps.

3.2.1. Support for Strategic Analysis and Integrated Security Construct

An information gap exists between the translated ISC output and the planning tool. The strategic planning data typically only contains information regarding the military force demands, with no information about support service requirements. This results in an information gap between the planning information that exists today and what is needed by the planning tool [3][5][12]. The support services deal largely with logistics demands required to support the FEs, such as transportation, facilities support (e.g. builders), technology staff (e.g. mechanics), and life support staff (e.g. cooks). Additional support services beyond logistics must also be included in areas such as language translators. Furthermore, there are military UTCs that require additional support services, but the UTCs do not indicate this requirement. Military force requirements and all supporting service requirements must be accounted for in a TPFDD-like input to the planning tool. This is a shift from the current "military only" SSA and planning processes, but without the support service requirements information, the planning tool will be lack a large percentage of the workforce requirements.

The CET developed by OSD provides contractor estimates based on force size, mission phase, and duration. This tool requires users to input contractor ratios which are used to calculate contractor demand levels [13]. Thus, users can directly influence the contractor estimates by varying the contractor ratios. Oftentimes, users do not have the required analytic information or the guidance to provide accurate contractor ratios, resulting in potentially large errors in the contractor estimates. The goal of the planning tool is to provide information about optimal workforce mix for all support services, not just contractor estimates, based on user-defined constraints. Some aspects of the CET have been incorporated into the prototype planning tool, most notably the similarity in treatment of imported TPFDD data and mapping between job codes.

3.2.2. Cost Information

Figure 2 indicates an information gap between available cost information and planning tool input needs. Interviews and research conducted during Phase 2 have shown that there is not a single source of authoritative data on personnel group costs and there is not information about contractor costs at an FTE level [5][6][10]. The planning tool requires cost per FTE by capability and personnel group in order to minimize the cost of the workforce mix. Contractor costs are currently tracked by contract rather than by the number of FTEs required to accomplish the contract. An additional need for personnel costs is the inclusion of undocumented costs involved with contractors, such as contractor oversight, security, transportation, housing, etc. [7]. This requires changes to current reporting requirements to include separating contractor costs (by capability and personnel group) from the overall contract cost and including all costs in an authoritative cost database for all contractors. Improved reporting and standardized data collection will be important for supporting full cost information for support services capabilities.

3.2.3. Personnel Group Information

There are two information gaps in the personnel information area. First, no existing manpower database provides personnel availability information by capability and by group (e.g. military, contractors or DoD civilians). Second, there is a lack of guidance for computing military manpower and contractor manpower equivalents for capabilities that can be accomplished by multiple personnel groups. Authoritative specification of contractor manpower equivalents (CME) is needed in order to convert between personnel group types.

3.2.4. Manpower Mix Criteria

The information gap for this area is authoritative guidance for implementation of the manpower mix rules and criteria outlined within DoDI 1100.22. Currently, manpower mix criteria are performed by tactical level planners based on their knowledge of the instruction. An authoritative translation from this human-based capability to an algorithm is needed.

4. STRATEGIC CONTRACTOR PLANNING TOOL ANALYTIC FRAMEWORK

This section contains a more detailed description of the capabilities that exist within the DoD or Joint Services to support the analytical framework. Figure 3 contains a work flow diagram of this analytical framework. It shows details of the existing strategic planning framework for combat force planning, the data sources, the logistics planning process, and how these activities would integrate with the strategic contractor planning tool.

The work flow diagram in Figure 3 shows how the current combat force and support services planning processes can be used in conjunction with the strategic contractor planning tool. The framework depicts a linear analytical process; however, the proposed solution is intended to become part of the iterative planning process where planning for both combat forces and support services is an integral part of the planning activities, and thus an imbedded component of the manpower mix structure outputs that includes military, contractors, and DoD civilians.

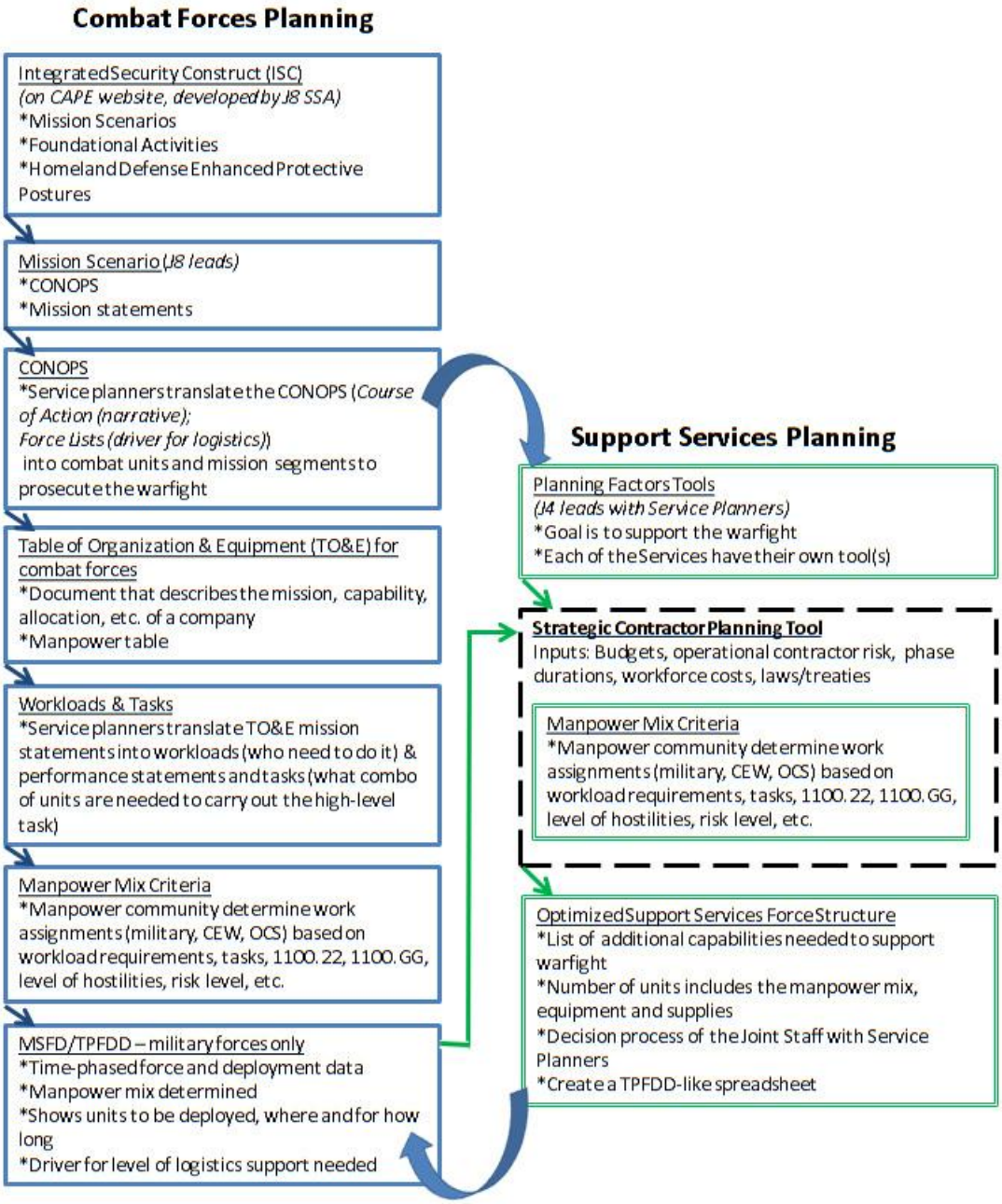

Figure 3. Strategic Contractor Planning Tool Analytical Framework.

4.1. Systems and Tools Applicable to the Strategic Contractor Planning Framework

There are a number of current tools, systems, data stores, guidance documents and capabilities existing within the joint services and OSD of relevance to the strategic contractor planning tool. These capabilities can potentially be leveraged to realize the proposed architecture and analytical framework. These capabilities are listed in Tables 1 and 2. There are many other tools and capabilities applicable to OCS (e.g. Synchronized Pre-deployment and Operational Tracker (SPOT)), that are not included here because they are used in operational or tactical planning or in-field operations. They are not expected to directly relate to, or interface with, the planning tool. Because the planning tool provides a new capability, rather than a replacement capability, information gaps exist in bridging the output from these existing capabilities to the planning tool. Therefore, translation and integration activities would be required to achieve the desired overarching capability.

4.1.1. Support Planning Capabilities

Table 1 lists the strategic planning capabilities that exist today within OSD and the services that directly relate to the planning tool and could potentially be leveraged. A description of the purpose and current outputs is included. The information gaps indicated would be closed through processes involving SMEs within OSD, the services, and the COCOMs in order to accomplish the integration with the planning tool capability.

Table 1. Mission Planning Capabilities that Support the Strategic Contractor Planning Tool

Information Domain	Capability	Purpose	Information Produced	Information Gap
Strategic Mission Planning	Integrated Security Construct (ISC)	Output from the Support for Strategic Analysis (SSA) spiral process that develops strategic missions scenario plans	A set of mission scenarios and associated military operations arrayed across a multi-year timeline with Force Element demand by mission phase with overlaps specified.	The most detailed ISC output contains fully or partially developed TPFDDs, but currently only military force capabilities included
Strategic Mission Planning	Capabilities Force to Integration Tool (CFIT)	Using multiple MSFD data, links military planners' demand request to particular unit type across a timeline by phase. Links CONOPS with force demand for a scenario	Produces a database of level of demand for Primary Unit Type Names (PUTNs) or UTCs. Produces spreadsheet reports with each MSFD and SQL dB on JDS website	Currently used to process military force demand data only, not other personnel groups.
Strategic Mission Planning	Capabilities Force Management Tool (CFORM)	Imports CFIT data, resolves conflicts, rotational restrictions and aggregates to Force Element (FE) level	"Preferred demand" for an ISC expressed by FEs (aggregate of key Unit Types from services). Spreadsheet reports and SQL database	Currently used to processes military force data only. Produces aggregated FE data
Strategic Mission Planning	Mitigation Option Selection Tool (MOST)	Helps develop an ISC (scenario set, military ops and timeline), resolves conflicts, and mitigates excess demands & risks.	"Contingency Demand" for ISC scenarios by FEs. Generates charts/tables to show excess demand and effect of mitigating actions.	Currently processes military force data only. Produces aggregated FE data
Mission Planning	Time Phased Force Deployment Data (TPFDD)	Detailed set of specifications indicating force movement for a set of mission scenarios. Developed by service planners.	Specifies which units (often by UTC and quantity) go where (destination), when and for how long (phase, start date, duration)	Typically includes military force data (not civilians or contractor support). Do not always exist.
Mission Planning	I-Dev	Stores output from CFIT, CFORM and MOST tools	Database containing strategic planning data such as demand requests, preferred and contingency demands.	Currently contains military data but could be expanded to include other personnel groups
Mission Planning/ Output	Annex W	Will contain contractor estimates. Supplement to COCOM OPLANS (guidance provided by CJCSI 3110.03C)	Annex W Tab A will contain estimates of Contractors Authorized to Accompany the Force (CAAF) and non-CAAF by phase.	
Mission Planning	Joint Planning and Execution System (JOPES)	Collection of tools that support development of op plans and TPFDDs. Used in every US military deployment.	Has databases Type Unit Characteristic (TUCHA), Type Unit Equipment Detail (TUDET), cost info, personnel info, …	Primarily used for operational and tactical planning
Mission Planning	Adaptive Planning and Execution System (APEX)	A plan production tool for adaptive planning and execution. Is expected to replace JOPES	Provides net-centric "living plans" developed and maintained within a net-centric collaborative environment	Primarily used for operational and tactical planning

The first six entries are components of the SSA process. The three main tools currently used within the SSA planning process are CFIT, CFORM, and MOST, with all three tools being owned and managed by OSD Cost Assessment and Program Evaluation (CAPE). Each of these tools produces relevant information that could be leveraged within the strategic contractor planning tool, but would require transformation and integration activities.

1. The ISCs provide mission information including phase, duration, and force demand, which are required inputs to the planning tool. Currently, all planning within the ISCs is combat forces only. To close the information gap, planning for demands beyond combat forces is necessary.

2. CFIT links a planner's capability requests to a unit type which meets the capability request requirement [13]. The tool allows multiple, simultaneous capability requests from multiple service planners. CFIT contains forces data for many different Multi-Service Force Deployment (MSFD) scenarios. Planners currently process combat force requests at the primary unit type name (PUTN) level through CFIT, although it is capable of supporting planning at the UTC level.

3. CFORM imports PUTN data from CFIT and provides planners with a mechanism for identifying and resolving duplicate force demand requests, resulting in a Preferred Demand for an ISC timeline [17]. The tool aggregates the PUTNs to FEs to produce an integrated demand table for the specified MSFD scenarios during each phase. It is likely that a combination of output from CFIT and CFORM will be beneficial to users of the planning tool.

4. MOST helps service planners develop the ISC containing force structure demand data, force generation data (e.g. rotation rates), inventory data, excess demand reports, and demand mitigation actions. It also helps service planners identify, assess, and document force management actions that can mitigate excess demand for the identified FEs. In addition, it supports identification of the cumulative effect of rotational and non-rotational demands for FEs by scenario time step. MOST produces the Contingency Demand signal expressed in terms of FEs for each scenario in the ISC, taking into account rotational and non-rotational force demands.

5. The TPFDD is the data type most closely resembling the content and level-of-detail required as input to the planning tool [5]. The planning tool will import TPFDD data to extract the force requests by UTC, along with phase, start time, and destination. If the TPFDD planning data expands to include service support demands and other personnel groups, the plans tool will be capable of processing and utilizing this information.

6. I-Dev is the database used to store output information from the above tools. Its content could potentially be used as inputs for the planning tool. This database could also serve as a common repository point for planning tool outputs if the planning tool were to be used during the SSA process.

7. Annex W (a part of the combatant command operation plan) provides estimates of the numbers and types of contractors to be used to support the operation plan [8]. The strategic contractor planning tool could be beneficial in helping planners develop these estimates.

8. JOPES is both a collection of tools and a set of processes for conducting joint planning [17] [18]. Today the tools are most often used at the operational and tactical level of planning, but they can also potentially provide useful planning at a strategic level. APEX is expected to become the platform for many of the existing JOPES capabilities and to allow net-centric expansion of the capability set [19]. Due to the potential for utilizing these capabilities strategically, JOPES and APEX are included in this table since they could become a valuable resource for guidance, policy, and input information for the planning tool.

Table 2 shows the existing personnel and cost capabilities that either directly relate or have the potential to relate to the planning tool.

Table 2. Personnel and Cost Capabilities to Support Strategic Contractor Planning Tool

Information Domain	Capability	Purpose	Information Produced	Information Gap
Personnel	DoDI 1100.22	Provides guidance on manpower mix rules. Defines policy and procedures for determining workforce mix for personnel groups: military, DoD civilian and contractor	Provides definitions as to which functions different personnel groups can perform	Guidance for implementing 1100.22 is required
Personnel	Contractor Estimator Tool (CET)	Provide contractor estimates based on force size, mission phase and duration. Required input: TPFDD with UTCs, and "contractor ratio"	Estimates of Contractors authorized to accompany forces (CAAF). UTC to JCA mapping	Does not provide optimized workforce mix w/minimal cost
Personnel	Personnel Accountability Rep System (PARS)	Database driven, web-application, serves as the single DoD collection point for personnel accountability information	Provides source for accountability of personnel (military and civilian)	Currently, does not contain contractor data
Personnel, Cost	Defense Manpower Data Center (DMDC)	Maintains the largest archive of personnel, manpower, training, and financial data in the DoD extending back to 1970s	Provides historical repository of personnel, manpower, and cost data	Incomplete historical contractor data due to lack of policies and requirements
Cost	Joint Contingency Contracting System (JCCS)	Financial systems for mission spend analysis, strategic sourcing/staffing. In-theatre contract oversight, cost and performance.	Contract and financial reports to support overall acquisition and forecasting. Storage of contracts, tracks vendor performance	May contain useful cost data for our tool. If so, it would have to be extracted and transformed.

1. DoDI 1100.22 is the primary source for manpower mix guidance.

2. CET is an existing planning tool that provides estimates on contractor usage [11][12]. It relies on TPFDD input as the basis for functionality. It requires the user to enter a "contractor ratio" that directly influences the contractor demand level estimated by the tool [13]. There are several informational processing functions employed by CET that are useful to the strategic contractor planning tool, such as the import format for TPFDD-like data and translation from UTCs to JCAs.

3. PARS is the single DoD collection point for personnel accountability. FTE availability of personnel groups by capability is an important input to the planning tool. There is an information gap in availability of military resources by capability type. Because PARS is the single DoD collection point for personnel information, this is the most likely destination, and/or source, for this type of personnel information and may serve as an important resource for the planning tool.

4. The DMDC is the historical repository for personnel, manpower, and cost data for the DoD since the 1970s. More information and SME guidance is necessary to determine what information within the DMDC data stores could be leveraged, but it is likely to be a useful resource for the planning tool.

5. JCCS is a collection of financial tools primarily at the operational and tactical level. The tools process contract cost information, provide financial forecasting, track vendor performance, and provide other additional capabilities. Cost information is a required input to the planning tool. Currently, there is an information gap on contractor cost by capability. This gap also exists, to some extent, for military capabilities. It is likely that the necessary cost estimates could be extracted from JCCS information, although SME guidance and involvement is necessary to determine the specifics about this.

4.2. Information Flow View

The previous sections summarized the analytical framework and potential information for the strategic contractor planning tool. The diagram in
Figure 4 combines this information into a diagram showing the information flow between processes and how the information flows to the planning tool. The arcs represent the information flow, and the circles represent the processes. The green circles and text indicate information gaps.

On the left, this diagram shows how the planning processes and the information flow between the processes is iterative and cyclical. In order to determine the workforce mix and minimize cost, detailed planning decisions are required. Iterations are necessary to obtain the necessary level of detail. The information gaps are indicated here as “proposed” data. Interview and research results indicate that the information gaps can all be resolved with input from SMEs, service and COCOM planners, and end-user input. Overall, this diagram shows the information and processes that will serve to provide a functional decision support tool.

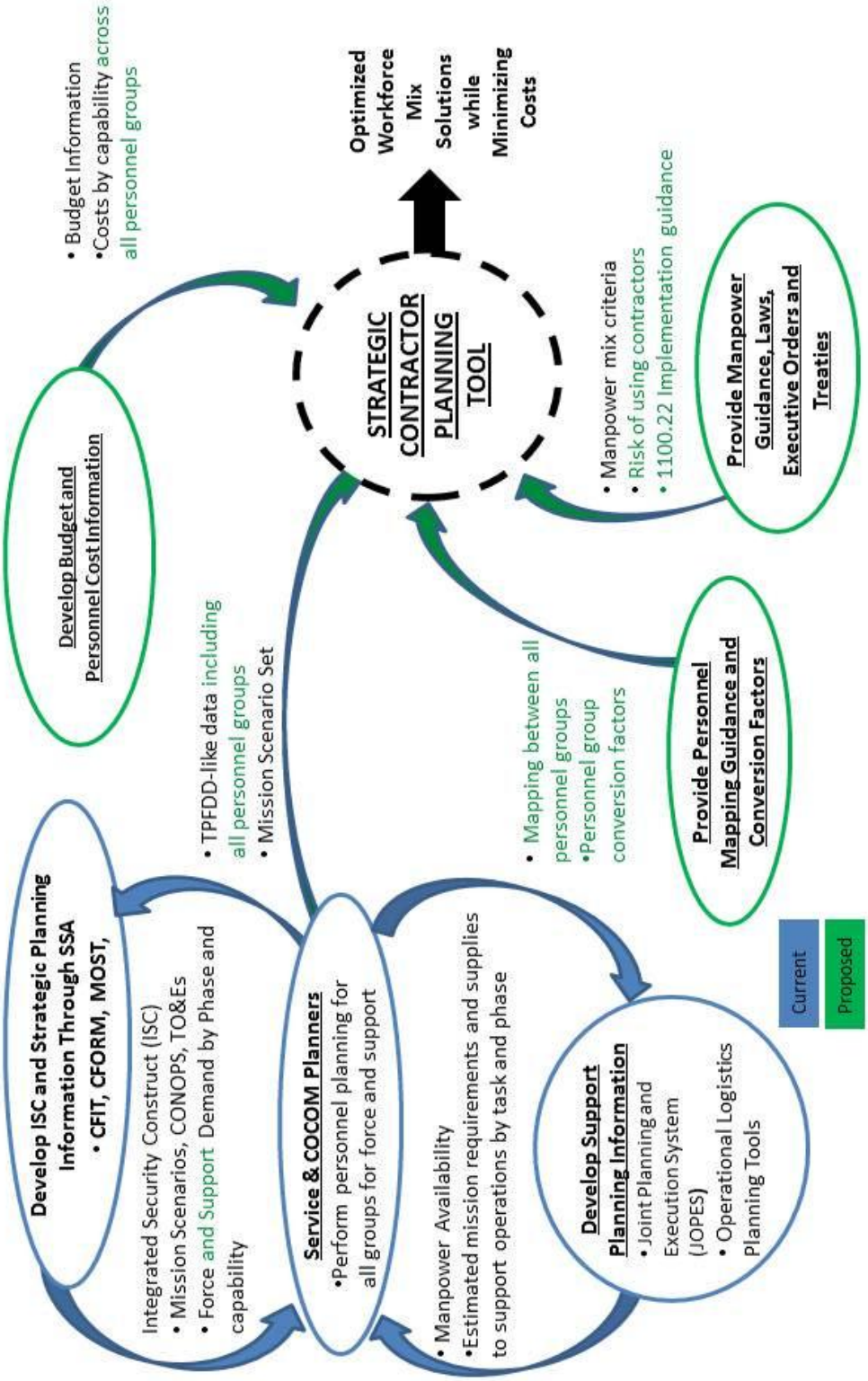

Figure 4. Current and Proposed Information Flow.

5.0. FUNCTIONAL ARCHITECTURE

This section describes the strategic contractor planning tool's functionality from a tool user's perspective. Because this tool is a stand-alone capability, this section focuses on the user inputs to the tool. Figure 5 is a functional view of the tool's architecture.

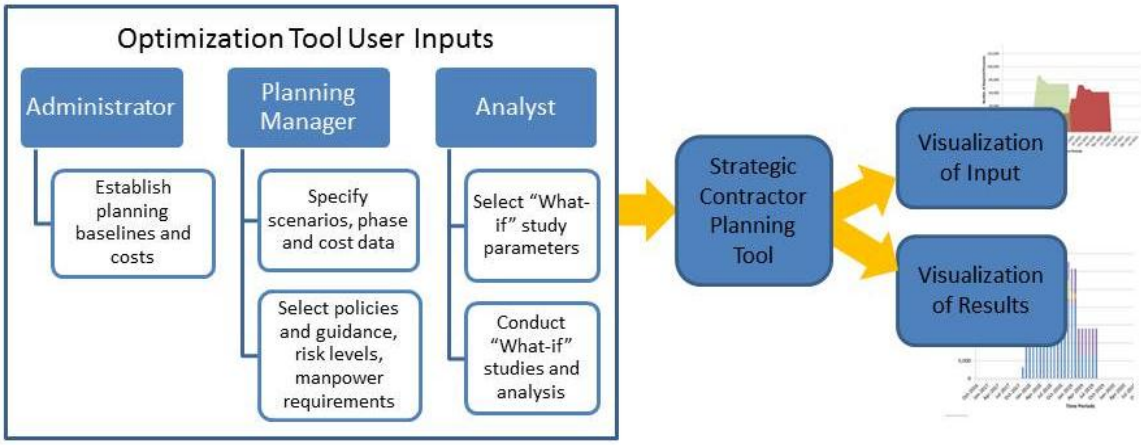

Figure 5. Strategic Contractor Planning Tool Functional Architecture.

5.1. Primary Users

There are three primary users for this tool, each having a different set of privileges and responsibilities: administrator, planning manager, and analyst. A summary of the tasks for each are provided here with further details in the user manual, entitled "Contingency Contractor Optimization, Phase 2, User Manual."

5.1.1. Administrator

The purpose of the administrator's role is to set high level parameter values that are constant across all analyses. These are the high-level, static parameters that should not change across baselines. Parameters that can change between planning baselines are modifiable by the planning manager and/or analyst. The administrator is responsible for establishing the annual cost for active and reserve military, DoD civilians, and U.S. Contractors and the efficiency multipliers (substitution rules) which indicate how well contractors and DoD civilians perform a job compared to the military counterpart.

5.1.2. Planning manager

The planning manager is the mission scenario SME and is responsible for creating new planning baselines and adding and creating the relevant mission scenarios. Planning managers are expected to have enough knowledge about the mission scenarios to be able to set reasonable default values and provide the TPFDD-like data for both warfighters and support. Planners at the service or COCOM level, who are very familiar with mission scenarios, are good candidates for the planning manager role.

Planning managers create a planning baseline which is a collection of scenarios that are available for analysis. All scenarios within a planning baseline have a common set of parameter values set

by the administrator for military, DoD civilian, and U.S. contractor costs and efficiency multipliers. Planning managers can create new scenarios or reuse existing ones. To create a new scenario, the planning managers import a TPFDD, or TPFDD-like data, that specifies the needed capabilities by time and destination. After importing the TPFDD-like data, they can enter planning factors to accommodate additional service support needs. For each scenario, they set the annual cost and efficiency factors (substitution rules) for non-U.S. contractors. They also enter the FTE availability for military and DoD civilians by capability and apply mandatory policies or treaties to the mission scenarios.

5.1.3. Analyst

The analyst is a strategic planner who uses the planning tool to perform what-if analyses. Through these analyses, the analyst will be able to provide estimates on the total workforce needs and costs and when they will be needed. The analyst selects the scenarios to be used and modifies parameters for each scenario chosen to change the problem constraints. Parameters which can be varied are annual budget, annual cost for non-U.S. contractors, mission start dates, duration of mission phases in months, maximum number of FTEs available for military and civilian personnel groups, contractor efficiency, additional policies and treaties, and level of operational risk.

5.2. Strategic Contractor Planning Tool

The tool executes an optimization analysis (which uses a linear programming approach) to solve for a workforce mix constrained by the user inputs while minimizing cost. A detailed planning tool design document provides further details about the model formulation entitled "Contingency Contractor Optimization, Phase 2, Model Description and Formulation" as well as a user manual detailing user interfaces and output visualization, "Contingency Contractor Optimization, Phase 2, User Manual."

The planning tool provides two classes of output: input parameter visualizations and workforce mix results. The input parameter visualizations show workforce requirements on a timeline. This allows analysts to understand how overlapping mission scenarios impact the workforce requirements and can potentially create workforce demands that exceed availability. The input parameter visualizations assist users in confirming their parameter selections and in understanding the impacts of parameter specifications. The model results graphs allow the analyst to view the workforce mix in terms of cost (total cost or cost by personnel group) and workforce allocation (organized by capability or personnel group). These graphs will show the analyst how much money is being spent per personnel group and the number and type of people (workforce mix) that are required to support the selected mission scenarios. The graphs can also show situations where the number of people needed exceed the number of people available.

6. CONCLUSIONS

Overall, this document provides the architecture description for the Strategic Contractor Planning tool. Discussion of assumptions, dependencies, and general architectural constraint considerations are presented. A high-level architecture description provides the framework for the tool usage within the existing OSD and DoD strategic planning activities, with more details provided within an analytic framework. The many existing tools, policies, and data stores that can be leveraged as inputs to this planning tool are listed and discussed. Strategic planning, personnel, and cost resources are listed and discussed. The information flow diagram presented ties the architecture, analytic framework, and existing capabilities together, along with existing information gaps, to pictorially show the integration of information to the planning tool capability. Finally, the functional architecture of the tool as described from the user's perspective is included.

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