

# Collaboration in Different Organizational Structures

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## Abstract

*The structure of organizations must drive the selection of effective collaborative tools. This paper explores the development of two current projects of the Defense Advanced Research Projects Agency, the Joint Forces Air Component Commander (JFACC) and the Genoa programs. While these projects target similar domains and have similar goals, subtle differences in their organizational structures require different collaborative tools. This paper outlines the different organizational factors that affect collaboration and describes the types of tools and technologies that the programs are employing to address these distinctions.*

## 1. Introduction.

Collaborative tools have the potential to both accommodate organizational structures and to overcome the limitations created by these structures. This paper identifies important organizational characteristics which must be considered when determining the appropriate collaborative tools for two large and distinct organizational structures – the client-oriented, often *inter-organizational* structure and the function-oriented, often *intra-organizational* structure.

Functional organizational structures occur most often within an organization. Functional organizational structures foster specialization by placing people of similar interests together. However, such functional organizations also create environments in which people are isolated from seeing different points of view and in which perspectives are narrowed. Functional organizations encourage specialization but, unfortunately, also engender insularism.

Conversely, inter-organizational structures are often separated by client interests. The goal of collaboration for inter-organizational

structures is to create consensus between the constituent members. One shortcoming of consensus-building is that it often requires face-to-face, collocated interactions. The goal of inter-organizational collaboration is to seek consensus, which often requires face-to-face interaction.

## 2. Air Force Planning and Crisis Action Domains.

This paper focuses on two current projects with similar stated goals but with domains that have different organizational structures. For the Defense Advance Research Projects Agency, ISX corporation and other contractors are involved in two large projects aimed at increasing communication and collaboration within their respective domains. Each of these programs, JFACC and Genoa, seek to create advanced technology frameworks to aid decision-makers in responding to world crises.

The goal of the JFACC program is to develop an advanced planning system for the 21<sup>st</sup> century. The JFACC is the Joint Forces Air Component Commander – the commander in charge of all air assets during any military operations. The JFACC reports directly to the theater Commander in Chief (CINC). The JFACC program wants to create a more proactive and opportunistic military planning system. The JFACC program's goals are to create a technical structure and process that promotes "horizontal and vertical collaboration." Vertical collaboration refers to greater cooperation up and down the hierarchical military echelons. Horizontal collaboration, or "cross-functional and cross-component collaboration" refers to greater communication and cooperation between the different functional units and components (e.g., JFACC planners coordinating with transportation planners) that are necessary to put together an operational plan. The JFACC program strives to create better plans by

increasing both vertical and horizontal collaboration.

Similarly, Genoa seeks to create a system for high-level decision-makers in the military and the civil service who are responsible for identifying and responding to major world crises. The Genoa system hopes to create a system that can support collaboration amongst the nation's national security decision makers.

Genoa also seeks to increase communication between intelligence analysts, intelligence community managers, and even academics. The prescribed way for intelligence analysts currently to inform decision makers is to funnel their reports through their respective bureaucracies. It has been noted that the actions of Saddam Hussein in 1990 were predicted by intelligence analysts, but warnings failed to reach decision-makers before the crisis had reached a boiling point.[3] Genoa seeks to identify potential crises before they happen and to facilitate the decision-making process by increasing collaboration between the agencies and between echelons in those agencies.

### 3. Characteristics of Collaborative Organizations.

While both JFACC and Genoa are of a similar scope and have similar goals, the underlying structures of the target domains differ and affect the type of collaborative environments that each of these programs seeks to encourage.

Table 1 provides an overview of the different characteristics within each of these environments that will be explored in this section as they relate to the target domains. To the right of each of the domain structures is a list of the collaborative tools that each of the programs is developing with respect to the characteristics listed in that row – these tools will be further explained in the forthcoming section.

#### 3.1 Organizational Grouping

Organizations can be split into two groups: those that are organized according to function and those that are organized according to client or interest. The JFACC and his staff are largely organized according to function or mission. The Air Force itself is segmented into functions as well as areas of responsibilities. The members of the Genoa domain do not differ as much by function, but by the clients or organizations which they represent – what can be viewed as a “market orientation”. Much of the activities performed by each of the groups within Genoa are similar, but are tailored to their respective organization heads. In many ways, this functional orientation can be seen as *intra*-agency (same organization) collaboration while the client orientation of the Genoa domain can be seen as *inter*-agency collaboration (different organizations).

Whether the organization is divided along functional or market lines often determines the degree of specialization of its constituent members. Organizations that are grouped by function encourage specialization by “allowing specialists to come together under the supervision of one of their own kind.”[2] However, functional groupings also tend to “narrow perspectives” in that specialists often do not interact with people outside of their narrow field. Market grouping, on the other hand, involves many people who can understand the problem as a whole and “can do more tasks and change its tasks more easily to serve the organization's end markets.” [2] A members of a client-oriented grouping is often less able to perform, “a specialized or repetitive task well and is more wasteful, being less able to take advantage of economies of scale and often requiring the duplication of resources.”[2]

#### 3.2 Collaborative Goals

Whether members are specialists or generalists often drives the goals of collaboration. Specialists who collaborate often want to combine their knowledge to get a greater understanding of a complex problem. In the case of JFACC, specialists interact so as to achieve

Table 1 Collaboration in JFACC and Genoa

Characteristics	JFACC Domain Structure	JFACC Collaborative Tool Implementation	Genoa Domain Structure	Genoa Collaborative Tool Implementation
ORGANIZATIONAL GROUPING	function	technologies are divided by task (ISR, logistics,	client	technologies are divided by technological capabilities –

		force application);		providing similar, common tools to all operators
GOAL OF COLLABORATION	coordination	centers around Strategy-to-Task – making sure that every operator understands the goal of the organization and their role and expected contribution to it;	consensus	focuses collaborative technologies on increasing ability to argue and share understanding of different positions
COORDINATION MECHANISMS	standardization of outputs; clearly defined roles; more rules and procedures	standardizing the format of activities; coordination largely occurs through a Common Plan Representation – the physical embodiment of the coordination; uses workflow tools to coordinate among the roles;	mutual adjustment; loosely defined roles	greater emphasis on informal interaction; Genoa relies on individuals to determine roles through face-to-face interaction – informal talks are automatically recorded Genoa has a greater emphasis on ad hoc meetings, and simultaneous face-to-face interactions via VTC etc., direct interaction;

greater coordination amongst their differing activities and to make sure that the overall plan is cohesive.

Generalists, by definition, often understand the problem as a whole. Instead, generalists may represent different interests and have different perspectives on the same problem. For Genoa, high level decision makers (e.g., Secretary of State and the Secretary of Defense) all understand the problem but weigh the priorities and the risks differently based on their different perspectives, personalities, and experience. These perspectives may have been partially formed by the clients or institutions that they are representing. The purpose of these high-level meetings is often to achieve a consensus. It should be noted, however, that consensus does not necessarily imply that each individual will have his interests weighted equally in devising the solution to a problem. An expert on teams explains that consensus, "does not mean unanimous agreement but it does mean that each person can honestly say, 'I have been listened to fairly, and I can live with this decision. While it may not be my first choice, I will support the group's decision.'" [4] The purpose of collaboration amongst generalists is to make sure that every voice is heard, and that the team considers all sides of a problem before taking a position.

### 3.3 Coordination Mechanisms

The types of coordination mechanisms used is often closely associated with the size of the organization. Large organizations often

require standardization to operate effectively. Currently, the JFACC and the military achieve these goals through extensive training and formal rules and procedures. These formal rules and procedures specify clear roles and responsibilities assigned to each position. Such large organizations that rely on standardization for coordination can be seen as "bureaucratic organizations".

The opposite of a bureaucratic organization is an "organic" one, which is completely bereft of standards but which must be small in order to maintain cohesiveness. Coordination that happens in small groups of that of "mutual adjustment" which has been likened to the way in which two rowers on a canoe adjust so that they become in synch.[2] This term explains how members begin to understand each other's viewpoints through direct interaction – the goal of this interaction is to establish a consensus. Most often this adjustment occurs without any verbal communication between the two rowers, but through observation and non-verbal communication. This phenomena also occurs simultaneously – it is difficult to imagine this kind of connection in an asynchronous environment. Finally, the nature of an organization is determined by whether roles are clearly defined or are fluid: one can imagine that even an organization of a few people will not coordinate through "mutual adjustment" if there is a strict understanding of the levels of authority of each of its members.

## 4. Tools and Technologies

The nature of the domains' organizational structures helped to shape the types of collaborative tools that each of these programs are beginning to adopt. Most of the collaborative tools seek to support the types of interactions that were already occurring in these organizations, while some of the collaborative tools sought to use the tools to "overcome" some of the disadvantages that the business structures had wrought on collaborative relationships within these organizations.

#### 4.1 Organizational Grouping

One problem with a functional grouping is that it encourages "a focus on means instead of ends - the way to do the job instead of the reason for doing the job in the first place...It also cuts arbitrarily across workflows, providing no built-in mechanism for that kind of coordination." [2] Perhaps because of this reason and the related problems that have confounded the collaborative planning process in the past, the JFACC program is developing many programs and concepts to counteract these inhibiting forces created by the functional grouping. One of the core components of JFACC is Strategy to Task, which displays the whole plan that starts from the highest-level objectives and is decomposed into lower-level objectives. Every member of the JFACC planning team is, therefore, able to see a direct linkage between what they are doing and how it fits into the larger organization's goals.

The members of Genoa's Crisis Action community suffer from different collaborative problems that stem from its organizational structure – the failure to get important information from specialists and the inefficiency of continual face-to-face meetings. Therefore, the Genoa program seeks to reduce the amount of time it takes for collaborative sessions to occur by creating distributed meetings, that do not require the top decision-makers to be collocated. As well, it includes technologies that allow individuals to "drop out" of the discussion to find out important details and to access specialists information. The Genoa website scenario envisions a situation in which the decision-maker Tom, "drops out of the conference, selects his telephone module, places a call to Julie, his imagery contact, explains the problem and asks her to send him anything she finds to his crisis\_urgent address. He rejoins the conference." [5] Such technologies compress the

amount of times it takes for a collaborative, consensus-oriented group to come to an informed decision.

#### 4.2 Collaborative Goals

Although the JFACC program specifies increased vertical and horizontal collaboration as one of its stated goals, this goal is a means by which the JFACC program can perform its overarching goal: to produce better plans in less time. The goal of the JFACC program is to reduce, "the time required to establish a JFACC planning and execution environment tailored to the specific requirements of a particular theater/contingency in days rather than weeks." [5] One of the problems with the way plans are currently created is that they are dictated from the top-down – the specialists responsible for planning or executing tasks have little understanding of the overall goals of the commanders. Even if they understand the goals, they have very few mechanisms with which to communicate difficulties and possible vulnerabilities.

In many ways, the JFACC program goals are to increase collaboration by introducing a feedback mechanism into the planning process. The kind of communication developed under the JFACC program can be termed *interactive* in that communication constitutes a series of acts wherein a sender transmits a message, the recipient receives the message and formulates a response for transmittal. Much of the collaboration does not need to be performed simultaneously. Instead, it is often preferable that a specialist receive an assignment so that he can prepare a definitive response that the requester can act upon. Therefore, in the JFACC program, operators and agents send out "Requests for Information" – virtual forms which specify the types of information they need and the time by which they need it. Workflow systems channel these requests to the proper authorities. Such interaction is even indirect, but because each role is defined and understood within the JFACC system, and outputs are standardized, the requester can assume that their request will be fulfilled according to its priority. This leads to the greatest efficiency for the JFACC system and the creation of more timely plans.

The Genoa system, on the other hand, still considers consensus-building as one of the preeminent goals of the program. Genoa seeks to

support group interaction by developing, "collaborative argumentation tools for achieving rapid consensus about situations and remedies"[5] Therefore, the Genoa program focuses on incorporating tools that can capture informal meetings. Genoa hopes to develop speech recognition tools that can capture conversations and automatically generate a report. At the end of such sessions, each "participant will be able to edit their portion of the record before it is saved for filing." [5] Much of the Genoa collaborative technologies can be seen as helping to increase *transactional* communication, in which participants are both sending and receiving messages simultaneously. Transactional communication describes face-to-face interactions in which one person may be speaking while another person is sending messages using non-verbal communication. As well, Genoa strives to develop technologies that will help distributed meetings feel more like a brainstorming session held in a single room. Such technologies allow control to flow from one speaker to another, while they collaboratively view documents, and whiteboards. Genoa's attempt to integrate collaborative technology is aimed at increasing the direct, simultaneous, interaction of a small group of participants.

### 4.3 Coordination Mechanisms

As has existed in the air campaign planning domain, roles and formal procedures have become a key part of the coordination mechanism within the JFACC program. Because roles are clearly defined as are the linkages between tasks, it is relatively easy for a robust workflow system to manage the coordination for all the planners. Therefore, while there are no explicit liaisons or managers, a workflow manager can act in this capacity – highlighting, but not arbitrating, inconsistencies or conflicts. Conflicts and high-level decisions will be determined by humans over videoteleconferencing facilities. While the JFACC program is interested in furthering this ability for decision-makers to confer directly, the bulk of the JFACC program is centered around a "Common Plan Representation" (CPR). The CPR is an electronic version of the plan that embodies all aspects of the plan. The JFACC program hopes to create an, "intimate combination of ISR, logistics, and mission planning all tied directly to campaign

objectives," [6] which are embedded in the CPR. During development, careful attention is being devoted to crafting and designing the ways in which planners can produce their outputs. Specific grammar structures are being constructed to provide a more standard structure with which planners should write their objectives, requests for information, and success criteria. By formalizing the outputs of the JFACC planning, the JFACC program hopes to increase collaboration through increased coordination of outputs.

It can be seen that because roles are not clearly derived from position and few rules exist, the Crisis Action domain has a greater emphasis on relationships and creating "ad hoc groupings". [5] Genoa seeks to assist the, "rapid formation of crisis management teams" through "automatic, intelligent notification of team members" [5] such as through automatic alerts to pagers and email addresses. This includes putting an alerting message on the screen "computer generated voice telephone calls to offices or residences." [5]

For the Genoa situation and goals, emerging organizational methods provides clues how to best organize an environment in which, "a diverse group of people must deal with complex, and potentially conflicting material, in innovative and productive ways. It is particularly powerful when nobody knows the answer, and the ongoing participation of a number of people is required to deal with the questions." [7] For physical meetings, Owen recommends an "open space" methodology wherein there is no set agenda. Instead, participants declare a topic in which they are interested and post it on the bulletin board. Other people that are interested in the same topic can join that group and participate. If they do not like the direction in which the group is going or would like to visit other groups, they may do so. In such a way, people in meeting rooms choose to be in a particular place and in which they can make a contribution. Similarly, the Genoa program is exploring creating virtual bulletin boards that will match up people with similar passions. People may be a part of multiple groups and drift from one group to another, thereby acting as informal coordination liaisons between groups.

Owen's open space methodology is particularly adept at addressing problems that are never articulated officially, or put on the "agenda" because it is closely guarded and kept at a minimum to increase efficiency. [7]

However, these issues or problems are precisely the indicators that Genoa seeks to identify early on – to address problems before they become crisis issues worthy of a slot on the agenda.

Much of the collaboration within the Crisis Action domain cannot occur through systems or asynchronous, indirect communication, but must take place simultaneously because of the iterative nature of analysis in the environment. As previously noted, the Genoa program hopes to facilitate trust, as well as accountability, by automatically recording informal sessions between members. In this way, an individual who is new to his position may begin to learn about his colleague's perspectives by reviewing past session notes.

## 5. Conclusion

Although some domains may seem similar, it is essential to analyze the underlying structure of each organization in order to prescribe effective collaborative tools. Organizational structures may be characterized according to their organization grouping, collaborative goals, and coordination mechanisms. Understanding the goals of a program and the strengths and weaknesses of these organizational structures will help drive what tools can best facilitate collaboration within these differing environments.

The JFACC program targets a functionally divided domain and is adopting collaborative technologies that will support the specialized tasks required in the JFACC domain as well as ones that will coordinate between the previously disjointed functions within the domain. JFACC program managers are hoping to increase collaboration between different functions by standardizing outputs and creating sophisticated workflow tools, and implementing a "Strategy-to-Task" objective structure and graphical user interface so that people of all echelons may gain a greater understanding of the organization's goals. Much of the coordination in the JFACC program will take place through machine-to-machine interactions. Only when there are conflicts, or high-level decisions to be made, will "face-to-face" collaborative technologies such as videoteleconferencing be employed. Because the JFACC domain is functionally-segregated, but united toward a common goal dictated from above, the JFACC program managers seeks to improve greater

collaboration through many machine-to-machine mechanisms.

The Genoa domain embodies many different clients and the goal of its collaboration is to achieve consensus. Therefore, the Genoa domain is focusing its efforts on creating better face-to-face collaboration mechanisms such as speech and voice recognition. As with , it is seeking to adopt technologies that will mitigate problems that may affect person-to-person interactions, particularly in distributed environments. Because the goals of the Genoa program is to facilitate consensus-building between different members, the Genoa program's primary collaborative focus is on enhancing person-to-person collaboration.

## 6. References

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