

# Global Transportation Network: An Intermodal Information System

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**T**he global transportation network (GTN) is the information system for the U.S. Transportation Command (USTRANSCOM), and Lockheed-Martin is the prime contractor. As deployed today, GTN is the largest successful implementation of an intermodal transportation supply chain management information system (MIS).

GTN is the primary command and control system, including operations information, and is the primary business management system for USTRANSCOM. As such, its span is very wide, and it interfaces with numerous other systems. It encompasses the information needs of a wide range of intermodal interests—those of carriers, managers, and customers. To provide the required functionality, GTN acquires data from about 23 external systems today. Lockheed-Martin adds about three systems a month and plans to interface with 100 intermodal carriers over the next 24 months through electronic data interchange.

The objectives of GTN have been intermodal from its inception. As an information management system, it has common bonds with numerous systems that are being implemented today. The strategic initiatives are support, both centralized policy planning and guidance, and decentralized execution, so that response to that centralized information can be rapid.

The tactical objective for GTN—to provide a centralized repository and source of intermodal information, planning analysis, execution, and forecasting across the entire intermodal system and worldwide universal communications with all trading partners—has driven its intermodal nature. It has been on a rapid path ever since

Desert Storm and Desert Shield in 1990, when a loss of in-transit visibility resulted in the need for the Joint Forces to open 25,000 of the 40,000 containers shipped to Saudi Arabia to figure out what was in them and where they had to go on the next leg of their journey.

This aggressive development and deployment schedule also infuses the system with functionality in an incremental fashion. Ensuring that users' needs are met in an adaptive and evolutionary fashion is a good way to ensure that what is built is what real users need and want, a system whose users' base is broad, ranging from senior executive generals to personnel supply clerks. Thus, GTN presents special challenges and skill requirements.

The goal for GTN is to provide all the transportation information to support total asset visibility, which is the Department of Defense version of supply chain management. The principal events that are recorded in GTN, relative to movements of people and cargo, relate to lift and shipment of an item and receipt at every node in the transportation pipeline. The system attempts to chronicle every move of an item as it flows through the defense transportation system.

The final segment of total asset visibility is in-transit visibility. Here movement transactions or information about shipments of unit sustainment cargo is captured. If your unit cargo is built to order and sustainment cargo is built to replenish, you can see a correlation with things that the Council for Logistics Management (CLM) talks about in the context of supply chain management. Passengers help to execute and control the transportation process, which requires that extensive amounts of infor-

mation be sent to GTN, which then functions as a transportation central repository and primarily is the command and control information system.

In order to provide the necessary in-transit visibility across all modes of the global transportation system, GTN receives information from air movements, seafair, truck and rail, requisitions or orders, and then unit moves, which are large orders, and basic operations in order to better manage the assets themselves.

To achieve this in a relatively short period of time and meet customers' needs, the major challenge for every information systems provider is figuring out what to build. The development methodology called joint application development (JAD) is utilized, which requires and facilitates close-coupled user involvement. JAD helps ensure that the functionality produced is the functionality desired by the user community. It gets the users involved early in the development process, but even more important, it keeps them involved throughout. The evolutionary, incremental aspect provides users and domain experts with multiple opportunities to view and use the actual product as it is demonstrated, developed, and delivered.

In order to ensure that all issues are considered during this short product life cycle, we have combined JAD with a focus called integrated product teams (IPTs), in which a cross-functional team approach is employed. This is both in response to, and for the satisfaction of, the broad skill and knowledge requirements of an information system with GTN's breadth. The team consists of at least one member with the skills and knowledge required to address a particular product or function area through to completion. The velocity of change in the commercial marketplace, along with the demand to satisfy this need rapidly, has required adoption of the "adapt and reuse" principle as a mantra throughout the life of GTN, that is, from the perspective of both USTRANSCOM—the customer—and Lockheed-Martin. Use of this principle has done a number of things; primarily, it has spread out the development and deployment cycles, and it has reduced the acquisition costs. However, for the technical staff, it has also driven a need for broad knowledge of the workings and technologies available in the commercial marketplace.

Each team member is expected to bring a basic skill set to the team, depending on his or her role. *Domain experts* are knowledge engineers with intermodal operations knowledge in at least one, preferably two, modes, because of the nature of GTN. They are required to have in-depth knowledge of at least one or more of the feeder systems and the data that are available from them. They are required to have basic information systems and information engineering capabilities. Ideally, they have an understanding of relational database techniques and process engineering skills that all the big five consultants have

been talking about for years. Teamwork skills are also essential. I emphasize teamwork again and again because to operate and quickly deploy such a large system, you cannot have your own ideas. You have to work on a team and you have to work in a collaborative environment.

*Systems engineers* then take that knowledge and try to apply functional knowledge and functional requirements and develop a top-level architecture for a solution. They are required to have broad knowledge of commercial information technology, the MIS environment, and a deep-rooted understanding of JAD and rapid application development (RAD) techniques and their limitations. On the technology side, we have talked about JAD/RAD techniques for years as a panacea. The reality is that these techniques solve many, many problems and help deliver the solutions people want, but they have certain limitations and require a certain amount of patience on the part of engineers to listen to users.

Data modeling is the key to this whole centralized repository and requires basic World Wide Web communications architecture skills, operations research, and an understanding that intermodal transportation and supply chain management are control-of-flow operations research problems. A combination of information security skills and business savvy is also important. It is funny to hear people talk about the need to share information when the reality is that most corporations are investing heavily in their technology infrastructure and are looking for ways to reap service discriminators. As for trying to get them to work together and adopt open systems, the transportation side of these companies is behind the technology side. We have been dealing with open standards and trying to figure out what to share and what to hold close to the vest for years on the technology side. Now the business side is getting involved.

*Database engineers and architects* must have superior skills in data modeling. When you look at the functional titles and the relationships between global supply chains, modeling is the key to developing a system quickly without wasting time. If it is done wrong, you end up throwing away half of what you developed in the first 6 months of a project. Deeply rooted software query language skills are necessary, as well as a basic understanding of the transportation domain. If educators could figure out how to infuse some transportation into the engineering side and the operations research side, so that students learn how to apply technology, and then some technology into the business side, so that students are not afraid to wrestle with the technology, that would help greatly. *Software application developers* need technical skills in basically the same areas as the database engineers, along with their own technical knowledge. The *project manager/team leader* is the person we expect to bring the knowledge to bear of what data and information can be shared without losing the service

discriminator advantage and what data and information must be safeguarded.

In this industry, roughly 1,000 technology companies are now involved, so staffing and training of that staff are constant challenges. We have increased our staff in this area by 100 percent in the last 15 months and continue to grow. Training and education then become ongoing requirements and will be through the foreseeable future. One must fuse business and technical skills to create robust and durable representations of real-world objects and how they relate to each other while still maintaining these database and performance ways. None of you like to press a button on a computer and wait 3 min for an answer. This means that in addition to modeling all these complex interactions, the data modeler has to work fast. The global nature of intermodalism complicates that situation. In enterprise modeling, the functional side needs to understand and model processes in a technical way or in a way that can be translated for technical people without loss of the meaning across the enterprise. In addition, they have to foresee the nature of the process changes that the technology will enable when it is brought to bear on the problem.

Teamwork is essential, since no one person can do it all. As much as technicians like to consider themselves experts who should be left to do what they want and functional experts like to just indicate what the system will do, you have to work in the realm of the possible and you have to respect each other and work as a team. When we look at entry-level or even senior candidates (and we are looking for both right now), we put a premium on those who have worked at least at the undergraduate level on collaborative projects for which the actual grades and success of the entire team are influenced by the grades and success of the individual members. This experience brings a lot to bear when they come into a business that functions in that way.

In external alliances with trading partners, teamwork comes into play regarding what data are shared and what data are safeguarded. On the technical side, we have had to wrestle with this with open systems for years. For example, I can get lots of information on DOS and what this operating system does, but I could not pay

\$100 million today and get the proprietary format of a PowerPoint file from Microsoft. Therefore, you have to understand which things are your market discriminators and only safeguard those as opposed to everything else. When we try to share data with some transportation companies for whom USTRANSCOM is a large customer, it is taking us months just to work out confidential disclosure agreements.

What we have come to realize is that we going to have to pay more for higher-level personnel with more experience because it is unlikely that anyone, even a transportation professional, understands multiple modes without at least 5 years of experience. As I mentioned earlier, we are placing a premium on collaborative work projects in undergraduate programs for entry-level and new recent graduates. We have increased our use of technical consultants and subcontractors, not across our whole enterprise, but on focused initiatives. We are going out and buying, at a premium, those skills we need. We are establishing and continue to maintain ongoing in-house training programs, brown-bag sessions where our functional experts talk and educate our technicians on what the domain experts need to know and our technicians educate the functional people as to what technology is and does.

With respect to increased documentation and focus on processes, even as our talent base grows very quickly, there is still a need to cater to the average worker as opposed to the exception. This includes, for example, ISO 9000 and the Software Engineering Institute's capability maturity model (SEI CMM) or initiatives where we are forcing cross-training of best practices. We have explored, and continue to explore, the establishment of an alliance with an institution for transportation domain knowledge. Technicians just do not have that type of exposure. They spend their life in the information technology world and they need to know how to apply that technology to the domain, be it banking, transportation, or elsewhere in the industry.

Increased participation in industry groups and conferences to maintain currency in both transportation and technical domains is important. The velocity of change in knowledge here is also rapid.