Creating Lean Supply Chains

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The Office for Enterprise Innovation and Sustainability (OEIS) has been aggressively working with clients to create lean supply chains. A recent major assignment has been in the aviation industry, specifically in the area of helicopter repair and spare parts. In this program, OEIS has provided direction and support to the U.S. Army Aviation and Missile Command (AMCOM) as it works to improve supply chain performance to better support the war fighter. A team consisting of the Army, UAH and industry took an enterprise wide, systems approach in the following tasks:

i. evaluating the supply chain current state,
ii. designing improved processes, and
iii. implementing strategic and tactical solutions.

The initial step in the overall process was the identification of several critical systems, sub-systems and assemblies to be addressed. These parts were the "problem children" with substantial order backlogs and long delivery delays. In the second step, multi-echelon supply chain maps were developed for each critical part. This mapping process started at the prime contractor and stepped back through the tiers in the supply chain, concluding at the raw material suppliers.

The data gathered allowed the supply chain maps to be populated with information relating to both administrative and manufacturing lead-times, not only at the prime contractor but also at the suppliers. Exhibit 1 is an example of the supply chain details for a critical assembly containing two retainers, two adapters and a spacer represented by the five product flows to the prime. In this example, the first item (Retainer: shown on the top line) requires 158 manufacturing days (in red) to obtain based on the existing procurement system. The purple numbers to the far right of each inflow line indicate the maximum monthly capacity of the product stream without impact to normal throughput. Shown as Prime Administrative (PA) Lead Times (in blue) the analysis

discovered that the prime contractor requires 50 manufacturing days (10 weeks) to submit the order to the supplier and perform administrative functions. The rest of the supply chain analysis for Retainers discovers that suppliers require 50 days to manufacture, 10 days to anodize, 10 days to paint and 10 days to manufacture the raw materials.

Based on the research it takes 130 days to supply the retainer to the prime contractor. This compares reasonably well to the 158 manufacturing days in the prime contractor's procurement system. However, this may not always be the case as can been seen with the second Adapter. This particular part requires 250 manufacturing days for completion according to the prime contractor's procurement system. The research identified 50 manufacturing days at the prime contractor for administrative services, 130 manufacturing days at the tier 1 of which 40 days are for outside processing. The forging company takes 30 manufacturing days and the raw material supplier takes 150 manufacturing days to deliver the raw material. Therefore, based upon the analysis, 360 manufacturing days are required to supply an adapter to the prime contractor, a 110 day discrepancy between what the prime believes the lead time to be and reality.

Critical paths with parts requiring more that 200 manufacturing days were identified and are indicated by red boxes. These critical paths were then further examined to identify specific bottlenecks and constraint points.

By utilizing this supply chain mapping process, the team was able to establish:

1. Details of the multi-echelon supply and value chain supporting this assembly;
2. Detailed lead times required by each supplier;
3. Critical paths and specific bottlenecks; and
4. Actual days required to support the supply chain versus unsupported estimates.

After the development of the supply chain maps, UAH, suppliers and the prime contractor worked together to establish a program of strategic and tactical actions required to improve the function of the supply chain. Strategic initiative examples include value stream mapping and/or kaizen events. Tactical initiative examples include improved lines of communication and supply chain specific conferences.

As the strategic and tactical initiatives were implemented, the team assisted by UAH facilitators utilized enterprise value stream mapping tools to document current and future states. Exhibits 2 and 3 are examples of enterprise value stream maps (EVSM). The current state EVSM (Exhibit 2) provided a snap shot of the "as is" conditions within the supply chain taking into account the time required by the contactor to manufacture the assembly and ship it to the customer along with the information flows. The critical path is highlighted in yellow. This document provided the team with a blueprint with which to identify improvement opportunities to reduce the overall lead time. Seven areas were identified for continuous improvement events (value stream mapping and kaizen activities). The seven areas were:

1. Housing manufacture at Company C;
2. Collar manufacture at Company D;
3. Ring Assembly 1 manufacture at Company D;
4. Ring Assembly 2 manufacture at Company D;

5. Raw material supply to Company G for the -6 bearing ;
6. Assembly, paint and inspection activities at the prime contractor; and
7. Final assembly shipping activities from the prime contractor to the customer

The future state EVSM (Exhibit 3) provides a vision of how the supply chain should function upon completion of the seven continuous improvement events (highlighted in blue) shifting the critical path (yellow) from the -6 bearing to the -1 bearing. Through this exercise a 30% reduction (272 days) in the production lead time is believed to be achievable. The future state EVSM highlights many additional areas of potential improvement.

The enterprise value stream mapping approach provides the following benefits:

1. A concise view of the supply chain noting critical areas;
2. The system understanding needed to focus limited resources at particular companies to provide "best bang for the buck";
3. Communication tool for the customer, prime contractor and suppliers; and
4. A "living" document to monitor and manage improvements in the supply chain.

Improving supply chain performance requires an enterprise view of the value chain. Enterprise value stream mapping through the multi-tier supply chain has proved to be an excellent tool to accomplish this objective. This approach not only focuses on activities within each supplier but more importantly on the interfaces between the suppliers. The Office for Enterprise Innovations and Sustainability has both the expertise and resources to assist organizations in their supply chain improvement endeavors.

For further information, please contact:

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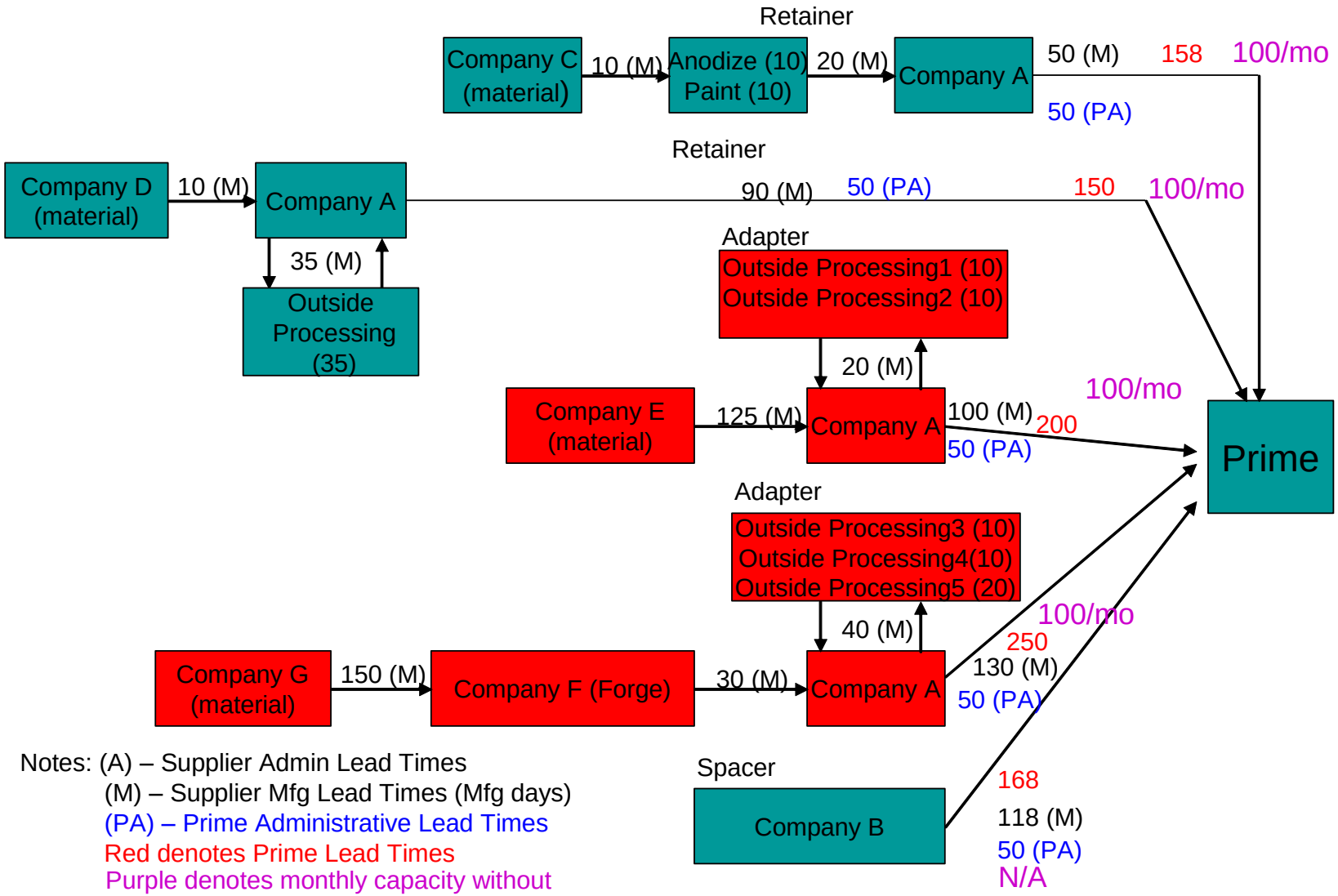
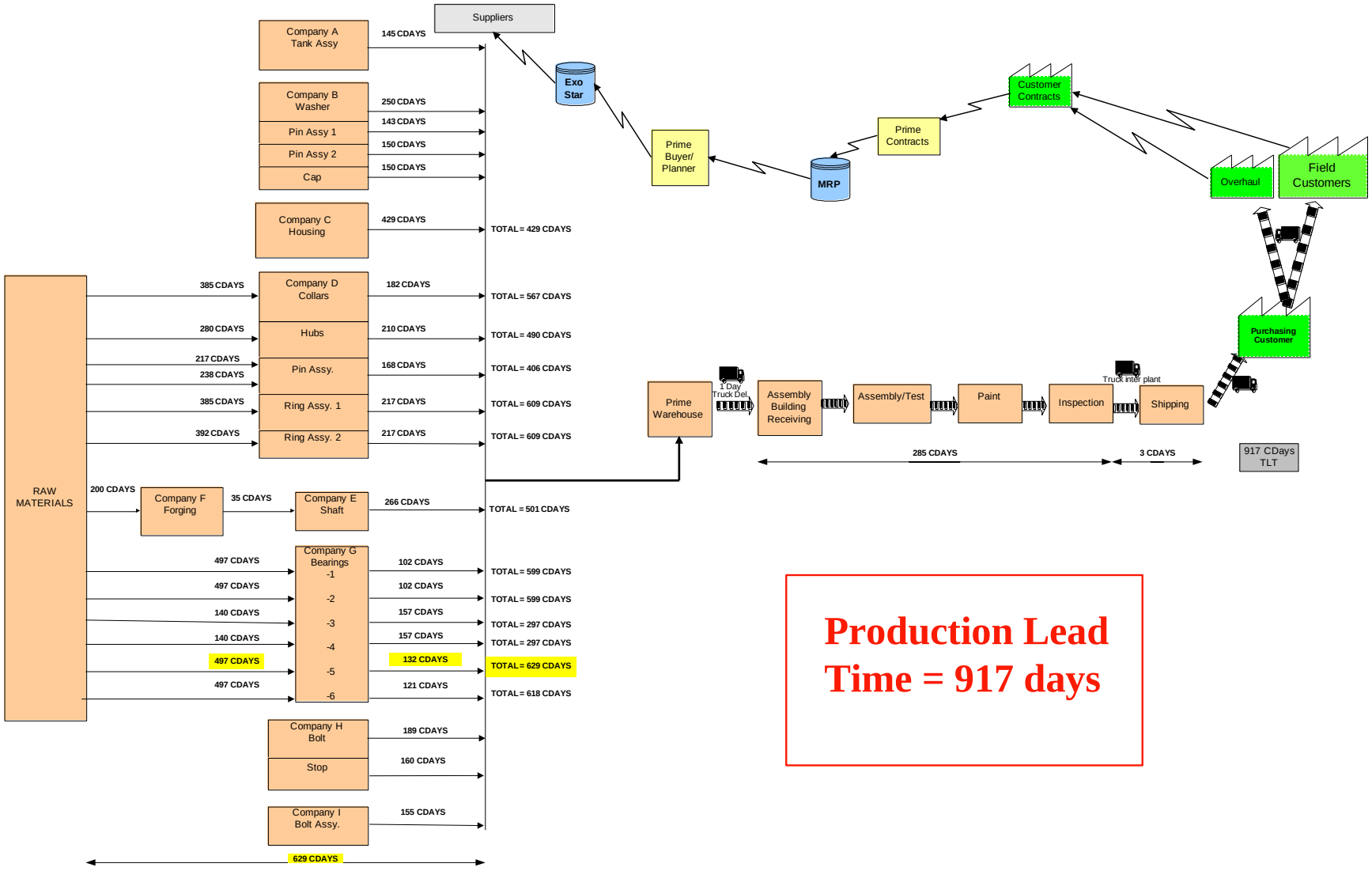
Exhibit 1 - Supply Chain Mapping Example



Notes: (A) – Supplier Admin Lead Times
(M) – Supplier Mfg Lead Times (Mfg days)
(PA) – Prime Administrative Lead Times
Red denotes Prime Lead Times
Purple denotes monthly capacity without impact to normal through put

Exhibit 2 - Current State Enterprise Value Stream Map



Production Lead Time = 917 days

Exhibit 3 - Future State Enterprise Value Stream Map