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SIMULATION OF PROPELLANT CASTING WORKSHOP

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ABSTRACT

Roketsan Inc. is a leading institution in the Turkey for designing, developing and manufacturing rockets, missiles and weapon systems. The production system contains 2 different facilities with 50 workshops and approximately 1200 resources. This case study presents the simulation of propellant casting workshops where the rocket motors are produced. Besides standard simulation functions, our simulation model considers parallel used resources, limited resources, capacity constraints and shift system. The model analyses feasibility of rocket motor production according to annual production calendar. According to these analyses, the model reveals bottleneck resources. By these capabilities it is used as a decision support tool for annual production planning, shift scheduling, resource allocation and investment decisions in the factory.

1 INTRODUCTION

Roketsan Inc. was founded in 1988 and has become a leading institution in the country for designing, developing and manufacturing rockets, missiles and weapon systems. The company has 2 facilities located on 6,000,000 m2 in Ankara, Turkey, with approximately 3000 employees. The mission of the company is to serve in the national defense with rocket and missile systems; and to contribute to the technological defense infrastructure of our country. The vision of our company is to become the leading establishment from the depths of the seas to the heights of the sky; to be placed among the first 50 companies which direct the global market with their sales volumes and missile technologies, by means of our own original products and advanced technologies. Roketsan is a make-to-order company with job shop production type. There are 50 workshops such as plastic, mechanical, composite fuel, avionic, rocket and missile assembly and weapon system lines with approximately 1200 resources. Due to intensive manufacturing calendars, these resources are used in production of products and semi-finished products in more than 60 different projects. These resources are not project specialized; they are used by multiple projects. Therefore, the productions overlap at the most of the machine and worker resources. These conflicts lead to update manufacturing planning for each week.

2 MODEL

The semi-finished products are represented by “Entities” in the model. Propellant casting workshops, machines and other resources are added to simulation model. These resources are represented by “Servers” in the model. The entities are released into the model regarding annual production calendar. And, they are

processed regarding route, servers and shift system relations. The starting and ending times of each entity in the servers, amount and time spent in queues and some state variables are kept by "Tallies". Order numbers and creation time are determined from annual production calendar. The primary and alternative routes, processing time for each entity and required capacities of servers are imported from tables which are taken from ERP, Enterprise Resource Planning.

The constraints of our simulation model can be listed as follows:

- Explosive limits of workshops
- Project based propellant casting tool amounts in workshops
- Resource capacities

The outputs of our simulation model can be listed as follows:

- Server utilization rate
- Production realization rate of each project at any instant
- Bottlenecks
- Order and delivery starting and ending times
- Time spent in critical server's queue
- Average explosive amounts in workshops
- Additional transfer needs of forklifts due to WIP queues

3 CONCLUSION

This study aims to verify the feasibility of annual production plan for rocket motors processed in Propellant Casting Workshops which is the common bottleneck for all projects. The simulation model will ease to observe project conflicts at that job shop and hence, will be used as a decision support system. Monthly production realization rate of projects, server utilization rates and bottlenecks can be observed considering workshop constraints. Thanks to these observations, investment goals, shift arrangements, routine maintenance period decisions and production plan revisions can be determined. Furthermore, at any point of the manufacturing year, there will be decrease in production quantity of the projects or there will be new projects signs. Due to simulation model, scenario analyses can be easily conducted to observe the cases such as new projects' delivery time, or possible bottlenecks.