

The Turbojet Engine Model of R&D Management

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I. Executive Summary

A model for R&D management based on the analogy of a turbojet engine is presented. The goal is to use a system to manage our R&D that is as advanced as the R&D that we do. There are four guiding principles to the design of this system: simplicity, freedom, responsibility, and auditability.

The engine is divided into five stages: the intake, the compressor, the combustion chamber, the nozzle and turbo-charger, and the thruster and feedback controller. The intake, through a managed and coordinated process identifies technologies from internal R&D organization, business units, universities, marketing organizations, competitive intelligence, national laboratories, and project spin-offs. The compressor is a map of business units and business drivers to levers that technology projects can pull. This will allow for flexibility and quality control in determining the business value of technology. The combustion chamber is where technology meets business need creating business value, the ultimate goal. Technology projects are associated with levers, targets for those technology projects are set, costs and timing specified, deliverables stated, probability of success determined, and options for R&D outlined. The nozzle increases the efficiency of the engine by forcing a strict tollgating procedure on the system. The tollgates are reached by meeting the deliverables within the time frame and budget specified. Projects are allowed to continue on to the next tollgate according to a ranking based on an optimization of expected monetary value, EMV, constrained by risk, cash flow and resources. There is also a mechanism via which strategic alignment can also be incorporated in a quantitative way. The final stage is the thruster. Here the technology project will be implemented and/or commercialized – the business value will start to be extracted.

This process will be governed by a Research Committee that will control the process and arbitrate disputes. There will be an alignment of behavior and the process goal (i.e., optimizing EMV with constraints) by a system of incentive compensation.

There are several things that this management model adds. The first is an auditable and refinable valuation of each technology project based on the business technology maps and technology project targets – a valuation that includes realistic financial models and risked option valuation. The second is a quantified way to determine the level of R&D funding under risk, cash flow, and resource constraints. The third is a rational way to allocate R&D funding. The fourth is quantified value to present to host governments to justify the use and funding of technology. The fifth is an alternative method of R&D cost allocation to the business units. The sixth, yet most important, is an improvement in the efficiency of R&D in creating business value and the alignment of R&D with the corporate strategy.

II. Overview of the Turbojet Engine

The analogy that we use to develop the model of R&D management is that of a high-performance turbojet engine (see Fig. 1). The goal is to use a system to manage our R&D that is as advanced as the R&D that we do.

There are several guiding principles to the design of this engine. The first is simplicity. The process should be easy to understand. The simplicity will also prevent manipulation of the process that defeats the goal of maximizing the efficiency of the money spent on R&D. This simplicity should also be manifest in as little process overhead and burden on the researchers as possible.

The second is freedom. Teams and managers should be trusted to make the right decisions. Only at well-defined tollgates will there be an audit. This freedom to operate between tollgates will have an ancillary benefit of allowing a further optimization of the process.

The third is responsibility. Researchers and the people that oversee the process should be held responsible for their actions and decisions. This starts by designing a process where the value added by teams and individuals are quantified. It continues by linking the compensation of the teams and individuals by how