THE SYNAPSE PRODUCT DEVELOPMENT PROCESS

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WELCOME

Synapse's product development and new product introduction expertise provides the collaborative teams needed to accelerate time-to-market through design for excellence, quality, manufacturing, supply chain, and support services with industry leading partnerships.

The foundation for this expertise is the Synapse Product Development Process, which is detailed in this document. It captures all the elements that should be considered when working on a large, complex, multi-stage project; helps manage product development across the lifecycle, from product conception through retirement. The process is intended to help our clients understand the range of our expertise across any product lifecycle.

CASE STUDY
HIGH-FIVE MOOD ALTERING ROBOT COMPANION

Here's how the Synapse Product Development Process works:

Let's pretend a company has the wild idea to create a line of, let's say, High-five Mood Altering Robot Companions, or, H5 Robots for short. The H5s would essentially be small, fully automated and self-aware robots with one giant hand to deliver angst-reducing high-fives on command. Wouldn't that change the world?

So Company X comes to Synapse and tells us they want to create High-five Mood Altering Robot Companions and we immediately jump into the Synapse process.

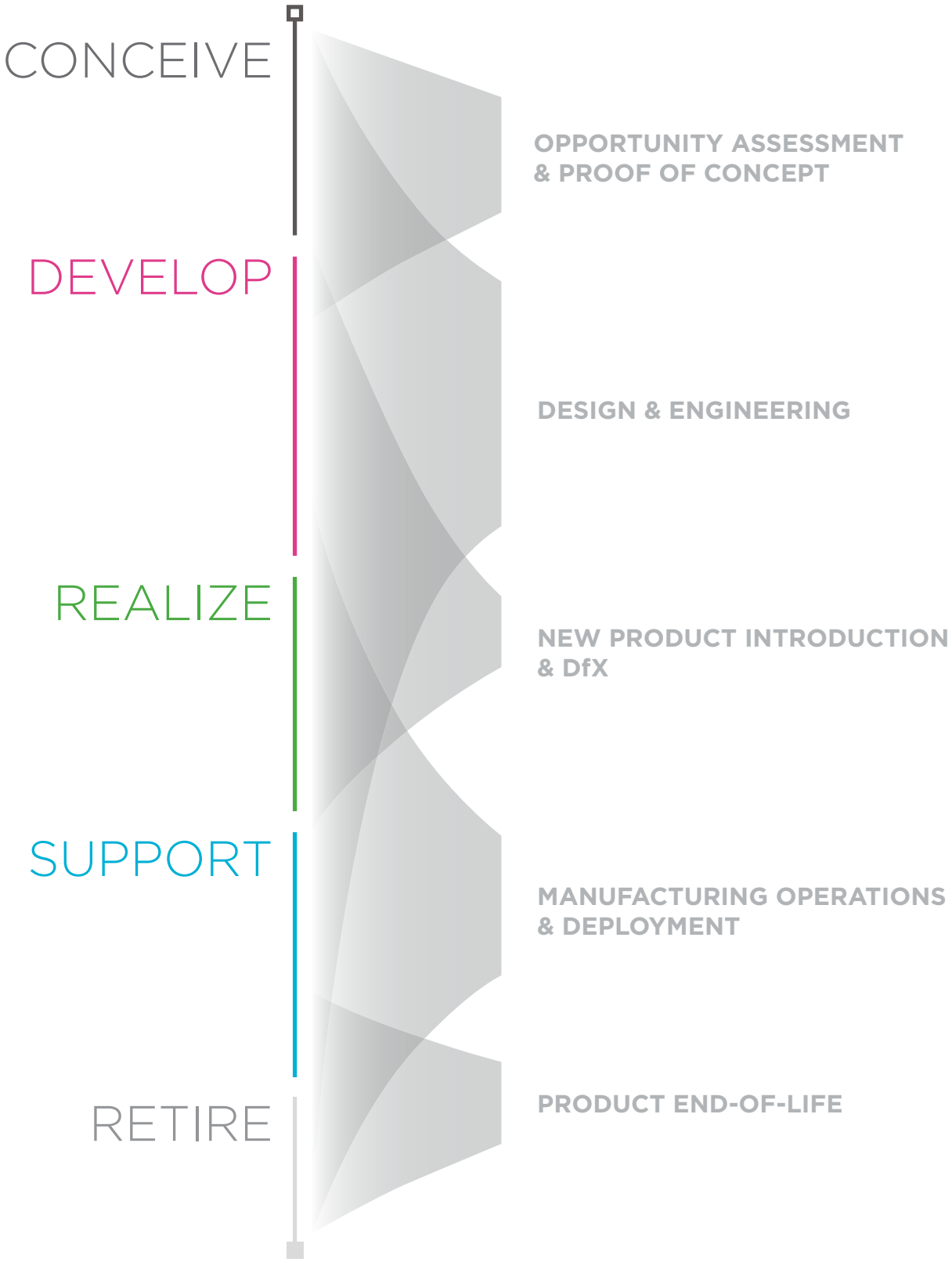
TERMINOLOGY

DfX *Design for "X", which refers to concurrent engineering activities like Design for Manufacturability, Design for Assembly, Design for Test, and Design for Quality*

EOL *End-of-Life, indicates that the product is at the end of its useful lifetime and that the product will no longer be produced, and also may no longer be sold or supported*

Phase *the distinct steps under each product lifecycle Stage. Completion of all of the phases under a Stage results in completion of the overall Stage*

Stage *the high level steps that comprise the overall end-to-end product lifecycle, from product conception, to product retirement*


CONCEIVE
DEVELOP
REALIZE
SUPPORT
RETIRE
OPPORTUNITY ASSESSMENT
& PROOF OF CONCEPT
DESIGN & ENGINEERING
NEW PRODUCT INTRODUCTION
& DfX
MANUFACTURING OPERATIONS
& DEPLOYMENT
PRODUCT END-OF-LIFE

STAGE OVERVIEW

CONCEIVE

PHASES

1 Define the Opportunity

2 Develop Initial Concepts

3 Market Data & Business Plan Approval

DEVELOP

PHASES

1 Alpha

2 RFQ/DfX

3 Engineering Validation (EV)

REALIZE

PHASES

1 Production Validation (PV)

2 Production Ramp & Market Launch

3 Optimize Production

SUPPORT

PHASES

1 Sustaining Production

2 Logistics & Fulfillment Operations

3 Deployments, Installations & Channel Supports

RETIRE

	EXIT CRITERIA	STAGE GATE
4 Architecture Proposals 5 Proof of Concept (POC)	Approved Product Concept	Business Concept Review
4 Design Validation (DV)	Design Validated and Ready for PV	Design Validation Review (DVR)
	Production Capable of Hand-off to Support	Sustaining Readiness Review
4 Service & Support	Product Retirement Decision	Product Retirement Plan Review

ROLES

At Synapse, we bring together high-caliber, multi-disciplinary teams to execute the full end-to-end product lifecycle. Below are definitions of some for the key roles involved in the product development process.

Creative

Industrial Design (ID) combines applied art, and applied science, to define the aesthetics, ergonomics, functionality, and usability of a product.

User Experience (UX) and Human Factors (HF) applies user-centered design practices to generate cohesive, predictive, and desirable designs based on holistic consideration of users' experiences.

Management

Product Management helps a company deal with the planning, forecasting, or marketing of a product, or products, at all stages of the product lifecycle.

Project Management (PM) has overall responsibility for successful planning, execution, monitoring, control, and closure of a project.

Marketing links the business with customer needs and wants in order to get the right product to the right place at the right time.

Business Development (BD) develops and implements growth opportunities for the company.

Engineering

Software Engineering (SW) applies the principles of engineering to the design, development, maintainance, testing, and evaluation of the software and systems that make products work. SW includes: Firmware/ Embedded, Desktop/Mobile, Enterprise, and IT.

Mechanical Engineering (ME) applies the principles of physics and materials science for analysis, design, manufacturing, and maintenance of mechanical systems.

Electrical Engineering (EE) utilizes non-linear and active electrical components to design electronic circuits, devices, and systems. It typically also includes passive electrical components and is based on printed circuit boards.

Systems Engineering manages sub-system hardware and software interfaces and manages requirements and specifications between sub-systems.

Quality and Test

Quality Assurance (QA) utilizes best practices, tools, procedures, and standards to systemically monitor development processes, and prevent defects.

Test applies methods and tools to evaluate an implemented design against specifications.

Reliability demonstrates that a design, system, or product will meet specifications over an extended period of time.

Regulatory and Compliance ensures and demonstrates that a system or product design and the practices used in development comply with applicable industry standards and/or regulations.

Manufacturing

New Product Introduction (NPI) introduces a new product to market, from the idea stage, to mass production sign-off of the final product.

Operations (OPS) provides management of logistics, materials, supply chain, planning, and manufacturing functions. This role also includes Supply Chain, Packaging, and Logistics (forward/reverse).

Support

Deployment provides best-in-class solutions engineering, installation, commissioning, and system acceptance.

Service Engineer provides after-sales service and support, keeps customers satisfied with their product experience.

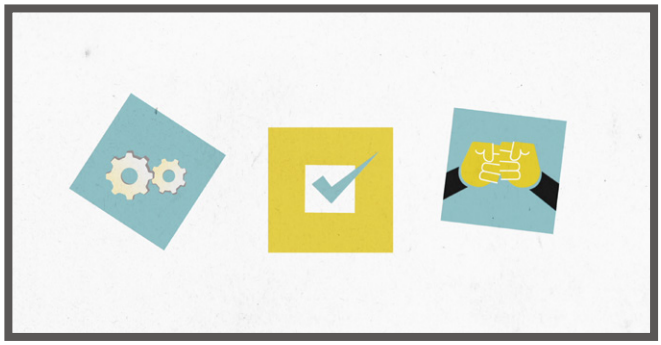
Miscellany

Legal manages and performs many of the day-to-day legal needs associated with developing a product including Intellectual Property (IP), Contracts, Non-disclosure agreements (NDAs) and Statement of Work (SOW).

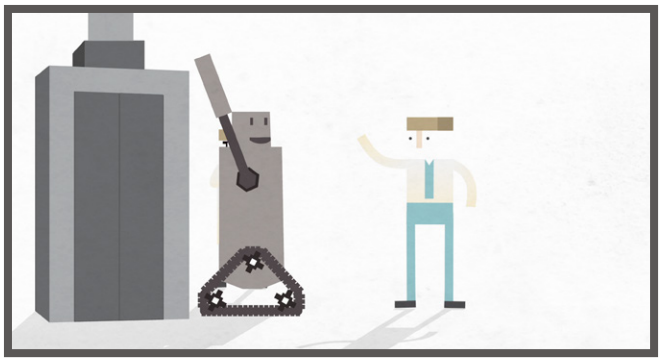
STAGE OVERVIEWS

STAGE 1

CONCEIVE



This phase starts with a series of questions. The first one of course being: “High-fiving robots? What took you so long?” But then we ask, can we build these robots? What’s possible? What are the critical features?



By answering these questions, we go from the How phase into developing a proof of concept. Synapse puts together testing requirements and designs a cosmetic H5 Robot model. Of course, it often takes time to get to the exact model needed.

The Conceive stage is focused on identifying a problem or a need, defining the opportunity around that need, testing that the market is real and achievable, then determining technical feasibility and a design approach for a product concept(s). Upon exiting the Conceive stage, the product idea is a client-approved Proof of Concept that is used to secure funding for form factor design (fit, form, function) in the Alpha phase.

Synapse’s primary areas of engagement in this stage are with Architecture Proposals and Proof of Concept phases. The beginning of this engagement occurs prior to the Architecture Proposals phase as a scoping activity. Synapse works with the client to capture product goals, project exit strategy, and an understanding of the market and potential users. During this period, Synapse is also working to create an End-to-End development plan with ROM costs, and timing for follow on phases, as well a detailed scope (cost, milestones, and deliverables) for the Architecture Proposals phase.

TERMINOLOGY

Alpha *a prototype, works and looks like final product*

E2E *End-to-End*

MRD *Marketing Requirements Document*

NFF *Non-form Factor a functional POC that works like, but doesn’t look like, the final product*

POC *Proof of Concept a non-form factor product intended to communicate or demonstrate the feasibility of a new design that meets the product requirements*

PRD *Product Requirements Document*

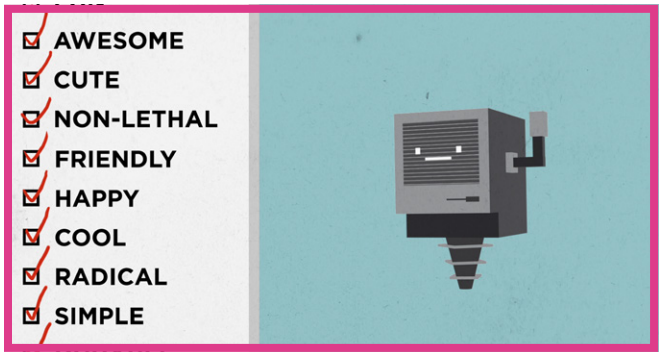
ROM *Rough Order of Magnitude*

PHASE SUMMARIES

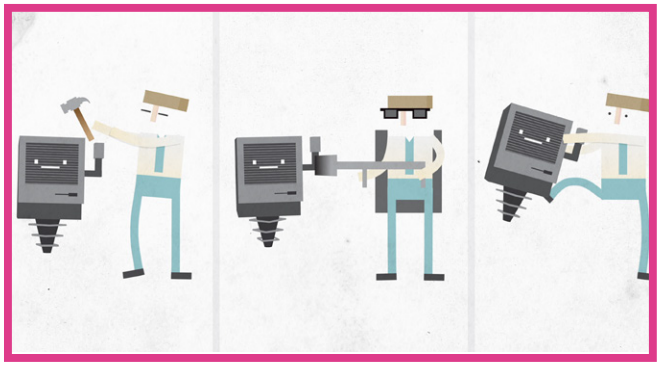
PHASE	MISSION
Define the Opportunity 1	Identify the problem, the market for a solution, and the strategic fit for the business.
Develop Initial Concepts 2	Brainstorm solutions and define initial product concepts: high-level form, features, and scenarios of use.
Market Data & Business Plan Approval 3	Test the product concepts with potential customers. Develop a business plan, and secure funding to proceed with development of product concept(s).
Architecture Proposals 4	Develop one or more system designs and an assess the advantages and risks in realizing each design.
POC 5	Demonstrate that critical features and functions can be realized, and identified risks can be mitigated.

STAGE 2

DEVELOP



We then move into the Alpha phase, or a looks-like, feels-like prototype. In this phase, we test against the product requirements we defined in the first phase.



From there, we begin the engineering and design validation testing. The engineering testing asks whether it meets original requirements, and then puts the concept through regulatory testing. The assembly of the High-fiving Robot itself is then analyzed to ensure the needed number of units can be produced.

The Develop stage takes a proven product concept and achieves initial implementation of the desired form, fit, and function in prototype volumes (Alpha), then prepares the product for volume manufacturing. Synapse refines the initial Alpha design for volume manufacturing by engaging in DfX activities ("X" being Cost, Manufacturability, Assembly, Test, Safety, Quality, etc.). After selecting a Contract Manufacturer (CM) and transitioning this refined design, Synapse enters a cycle of New Product Introduction (NPI) which builds, tests, and reviews with the goal of identifying and addressing design and process issues before increasing to production volumes. Engineering Validation (EV) serves to prove that the design is manufacturable with the chosen CM and supply chain. Design Validation (DV) serves to prove that the design and manufacturing processes result in products that meet specifications with acceptable yield and reliability.

TERMINOLOGY

CM *Contract Manufacturer*

RFQ *Request for Quote*

PHASE SUMMARIES

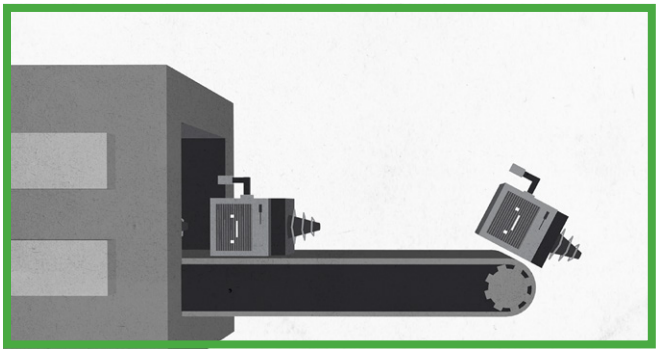
PHASE	MISSION
Alpha 1	Build POC into form-factor (form, fit and function), striving to meet product requirements and mature the design.
RFQ/DfX 2	Refine the Alpha design for volume manufacturing and select manufacturing partner.
Engineering Validation (EV) 3	Build refined form-factor design at chosen factory to validate it can be built with the chosen supply chain and partners,
Design Validation (DV) 4	Demonstrate feature-complete hardware and software, and qualify that the product meets documented requirements and specifications. Achieve readiness for mass production manufacturing and logistics, including validation of processes, tests, packaging, and other aspects of the supply chain.

STAGE 3

REALIZE

During the Realize stage, the product goes through a production ramp up until it reaches stable levels and production plans are realized. In addition to validating the scaling of production volume, this stage emphasizes process consistency in the production, supply chain, planning, and logistics operations areas. Risk mitigation plans are implemented, and continuous improvement initiatives are launched to maintain and improve steady-state performance.

You then work with the manufacturers to simulate mass production of the H5s, measuring target units per hour reached, in hopes of identifying any major yield issues on our ramp up to production quantities.



In this phase, we deliver a full High-fiving Robot production model with packaging at the desired level of awesomeness.

TERMINOLOGY

Supply Chain *the activities required to make and deliver a product - from sourcing raw materials, to converting those materials into finished goods, and then shipping and distributing the goods to customers*

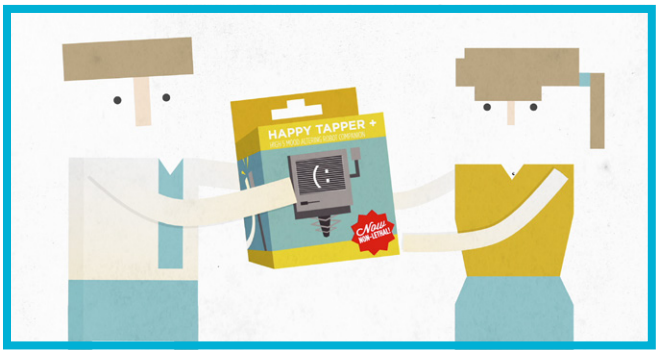
PHASE SUMMARIES

PHASE	MISSION
Production Validation 1	Build validated DV design in sufficient volume to identify and address associated process and capacity issues on the production line.
Production Ramp & Market Launch 2	Ramp up production in controlled manner to meet desired run rates, while maintaining quality and yields. Support product launch into the market (end user/retail).
Optimize Production 3	Optimize production yields, volumes, planning, and materials processes via value engineering, production, and sourcing efficiencies.

STAGE 4

SUPPORT

The final phase is mass production. During this phase, electrical engineering and mechanical engineering pull out over time, while software and firmware stay engaged, depending on client needs.



We also prepare for delivery to the client, stores, and customers.

The Support stage starts once production has reached steady-state levels, and cost, quality, and yield targets have been met. Maintaining production at these levels requires ongoing sustaining engineering, manufacturing, and vendor management. During this stage, the focus also shifts to implementing the full scale of downstream aspects in the supply chain, which encompass the forward logistics aspects, such as inbound shipments to the market, warehousing and distribution, inventory management, order fulfillment, customer deployments, and product support. There is also the reverse logistics aspect, which includes how product returns are managed, and how repair and refurbishment processes are structured.

TERMINOLOGY

Deployment *the transformation of components or a system from a development or packaged form to its operational working state at the customer's location*

Logistics *the management of the flow of resources between a point of origin and the point of destination in order to meet customer requirements*

PHASE SUMMARIES

PHASE	MISSION
Sustaining Production 1	Production has reached steady state. Supply chain, demand management, and sustaining engineering practices are well established.
Logistics & Fulfillment Operations 2	Product is in market, forward and reverse logistics processes are fully operational, and product is being fulfilled and shipped to customers.
Deployments, Installations & Channel Support 3	Product is being deployed at customer locations, customer has accepted product, and retailer/channel support infrastructure is fully implemented.
Service & Support 4	Synapse is providing ongoing hardware and software maintenance and product support services to the customer.

GLOSSARY

Alpha *a prototype, works and looks like final product*

API *Application Programming Interface*

BOM *Bill of Materials*

CAD *Computer-Aided Design*

CAPA *Corrective and Preventive Action*

CBOM *Costed Bill of Materials*

CM *Contract Manufacturer*

CMF *Colors, Materials, Finish*

COGS *Cost of Goods Sold*

Cpk *a measure of process capability*

CSR *Corporate Social Responsibility*

Deployment *the transformation of components or a system from a development or packaged form to its operational working state at the customer's location*

DfX *Design for "X", which refers to concurrent engineering activities like Design for Manufacturability, Design for Assembly, Design for Test, and Design for Quality*

DGR *Daily Going Rate*

DOE *Design of Experiments*

E2E *End-to-End*

EMC *Electromagnetic Compatibility*

EOL *End-of-Life, a term used to indicate that the product is in the end of its useful lifetime and that the product will no longer be produced, and also may no longer be sold or supported*

EWP *Earliy Warning Process*

FAI *First Article Inspection*

FF *Form Factor*

FOB *Freight on Board*

FOT *Field Operational Test*

HALT Highly Accelerated Life Test

IP *Intellectual Property*

KPI *Key Performance Indicator*

Logistics *the management of the flow of resources between a point of origin and the point of destination in order to meet customer requirements*

MFG *Manufacturing*

MFG Report Card Summary *a consolidated list of statistical manufacturing process performance, and status indicators, that designate the health of a manufacturing process*

MP *Mass Production*

MRD *Marketing Requirements Document*

MRP *Materials Requirements Planning*

NFF *Non-form Factor a functional POC, works like but doesn't look like, the final product*

NRE *Non-Recurring Expense*

OIL *Open Issues List*

OOBA Out-of-Box Audit

OOBE *Out-of-Box Experience*

OPS Operations

PCB *Printed Circuit Board*

Phase *the distinct steps under each product lifecycle stage. Completion of all of the phases under a stage results in completion of the overall stage*

POC *Proof of Concept, a test to prove something intended is actually possible, conceptually identical to the intended final product*

POS *Point of Sale*

PRD *Product Requirements Document*

QBR *Quarterly Business Review*

RACI *Responsible, Accountable, Consulted, and Informed*

RET *Reliability Evaluation Testing*

ROB *Rhythm of Business*

ROM *Rough Order of Magnitude*

RFQ *Request for Quote*

R&R *Repeatability and Reproducibility*

SLA *Service Level Agreement*

SMT *Surface Mount Technology*

SPC *Statistical Process Control*

Stage *the high level steps that comprise the overall end-to-end product lifecycle, from product conception to product retirement*

Supply Chain *the activities required to make and deliver a product - from sourcing raw materials, to converting those materials into finished goods, and then shipping and distributing the goods to customers*

SWOT *A structured planning method in business used to evaluate Strengths, Weaknesses, Opportunities, and Threats*

TM *Trademark*

TAKT *from the German word Taktzeit, which translates to cycle time, sets the pace for industrial manufacturing lines*

UPH *Units Per Hour*

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PARTY

FINAL STAGE

Wait. Did we say that was the final phase?

The final phase is actually all of us at Synapse tapping a new keg and racing electric skateboards around our office while shouting “yippie ki-yay!” at the top of our lungs as Ryan, the receptionist, fires off the confetti cannon over and over to celebrate another job well done.

Dream it, and Synapse will make it a reality.

Like a robot that turns frowns upside down with one raise of its hand.