

Product Development & Manufacturing with **Artificial Intelligence**

Jon den Hartog
Vice President
Product Development and Manufacturing Solutions

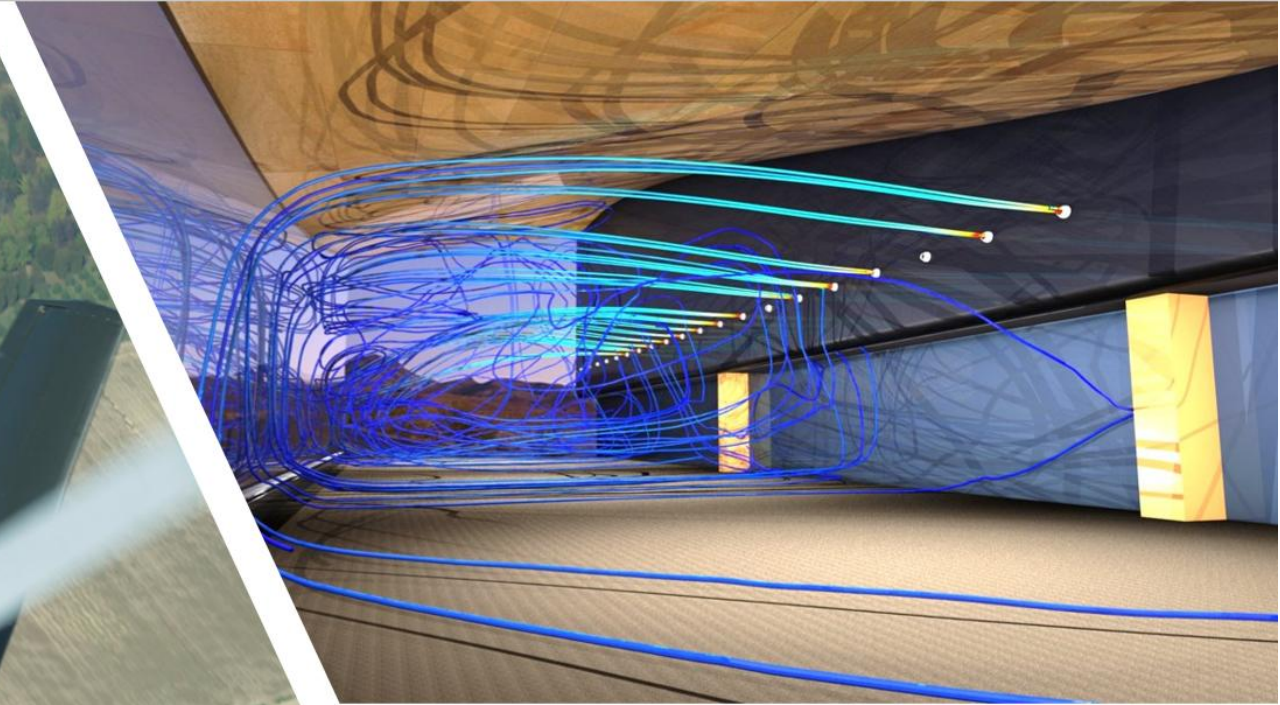
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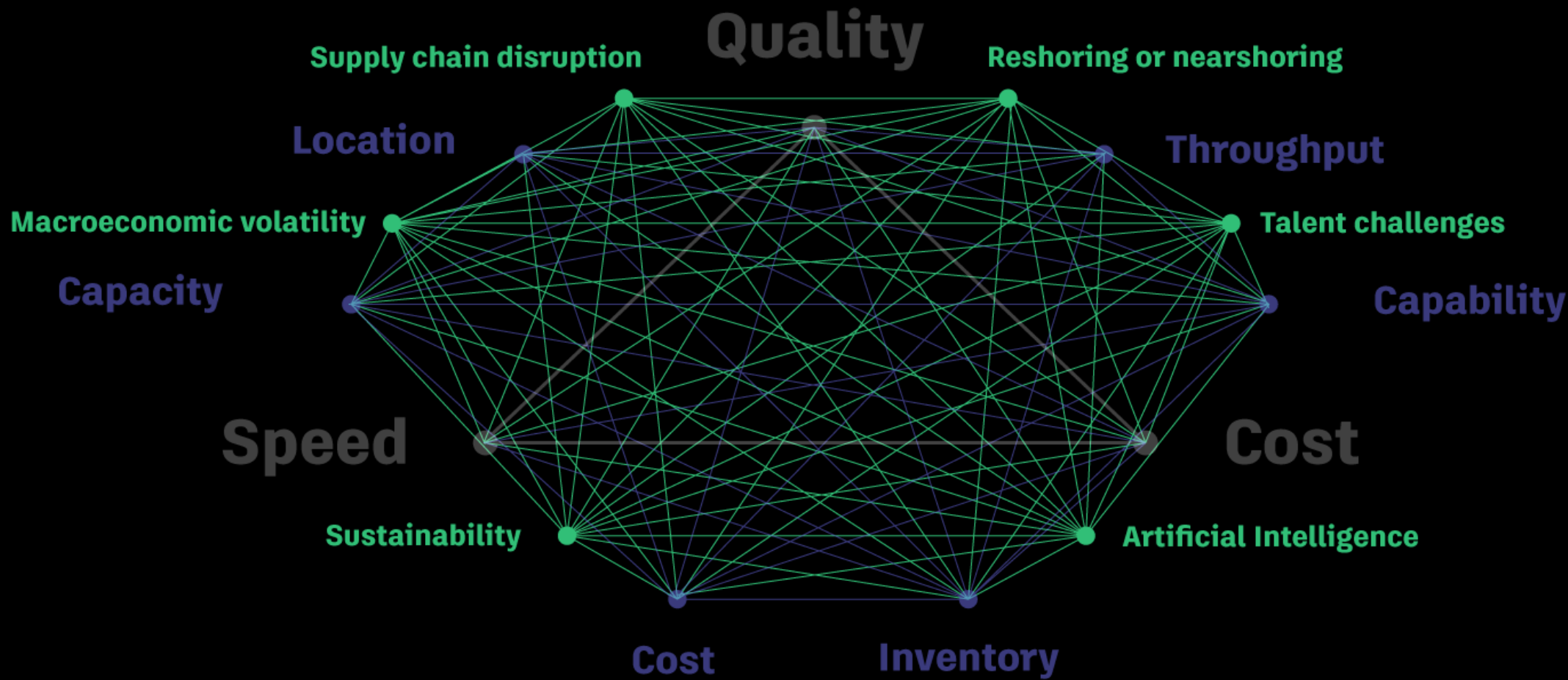


Agenda

- 01 The AI shift
- 02 Autodesk's approach
- 03 What you can do today
- 04 Our recommendations

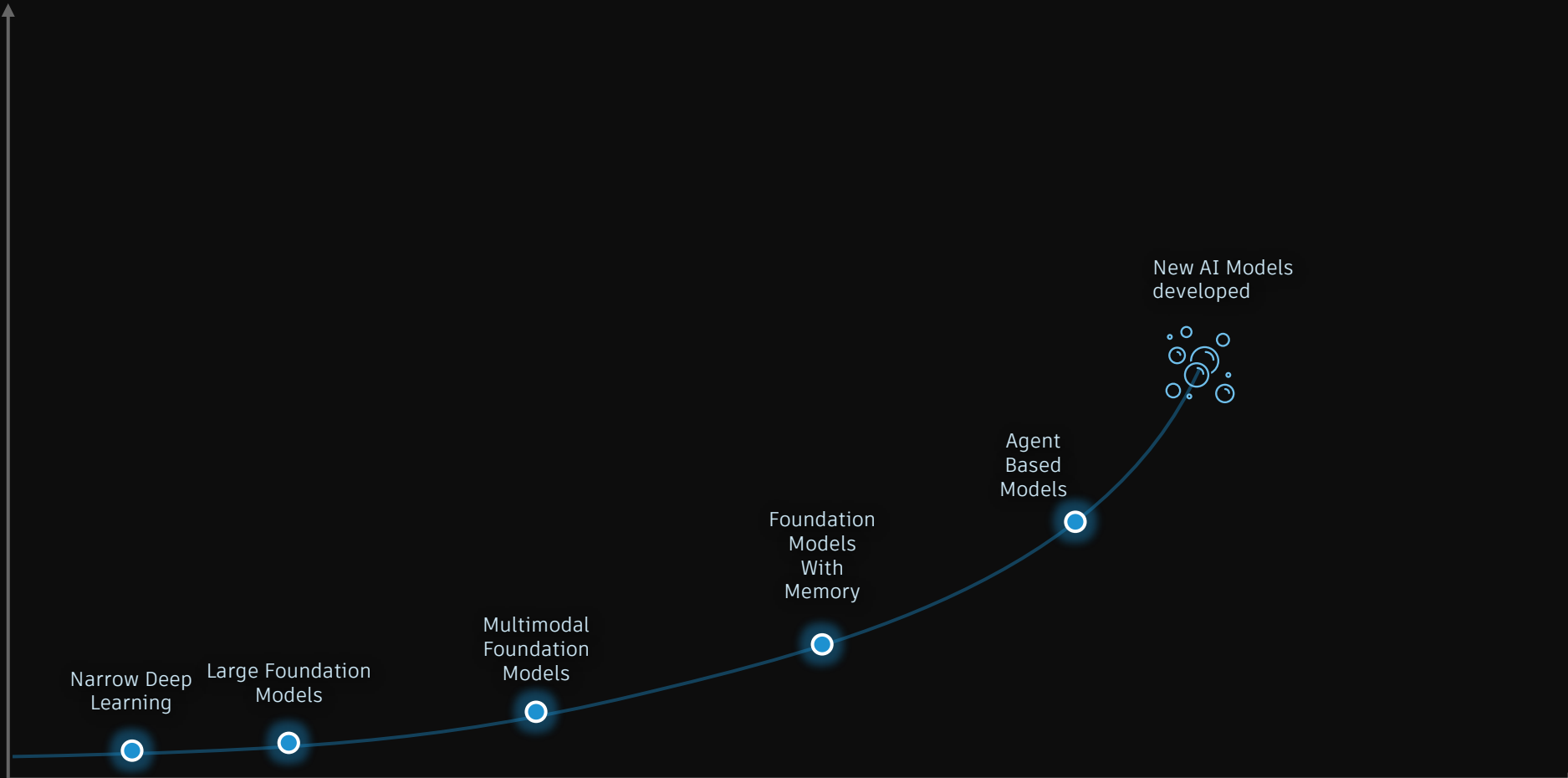
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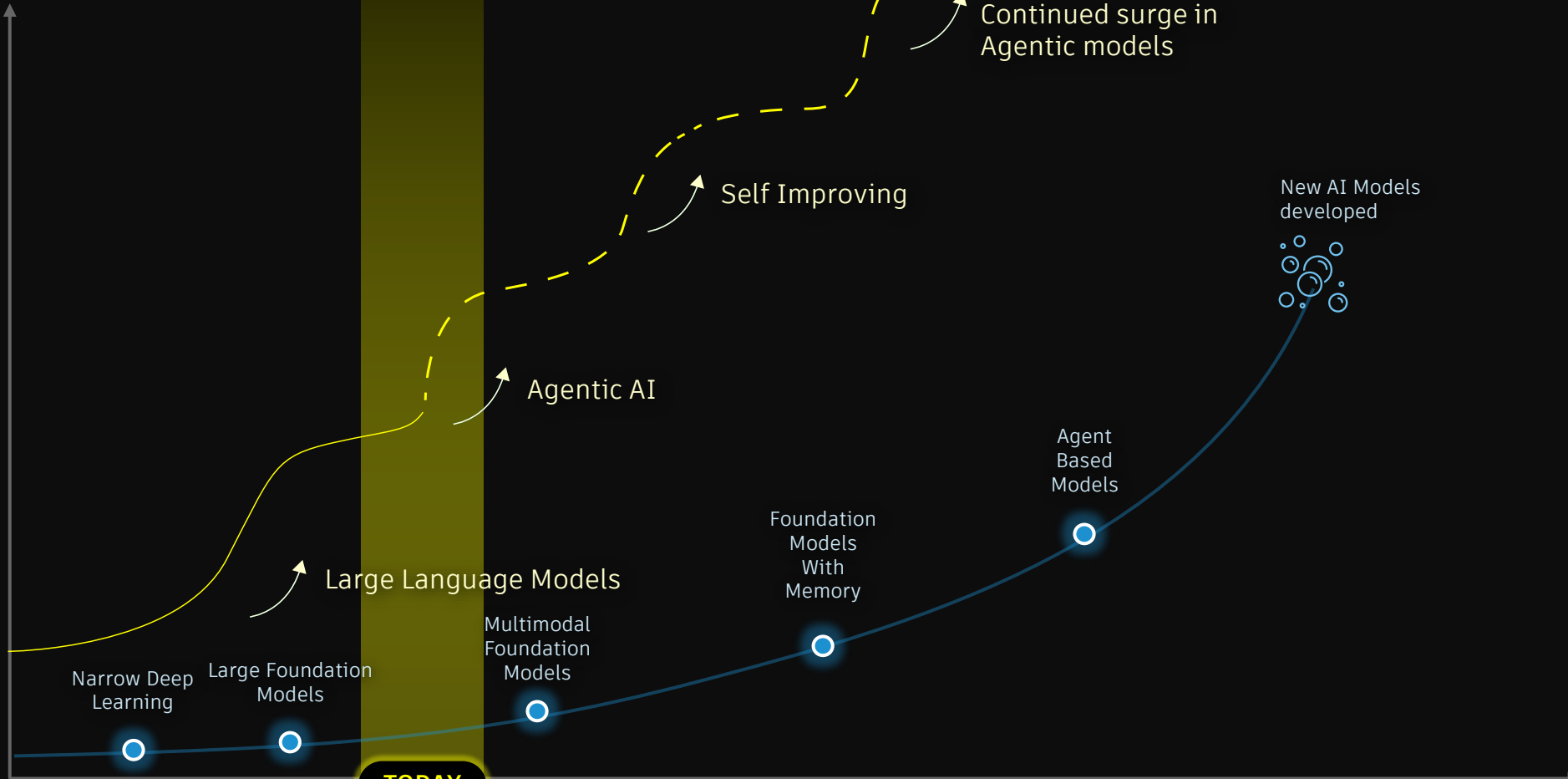
Impact



Time



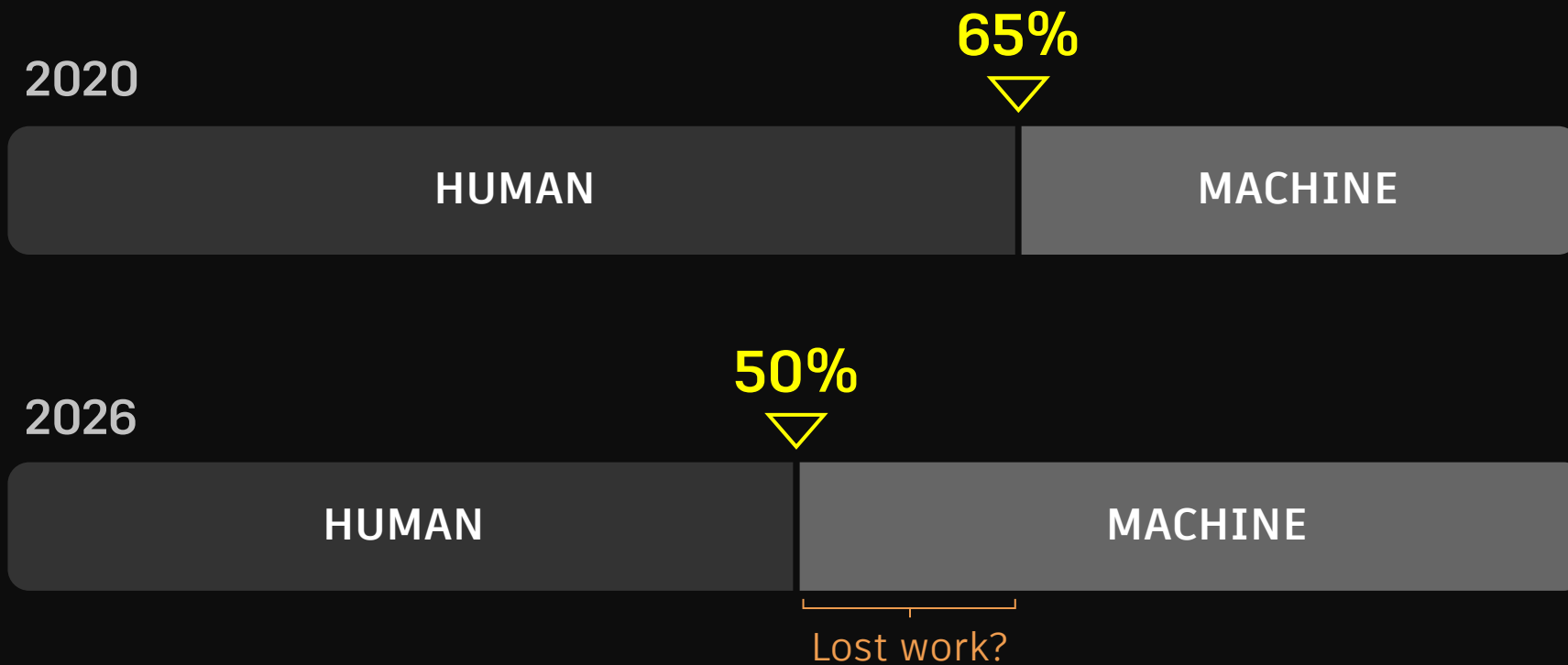
Impact



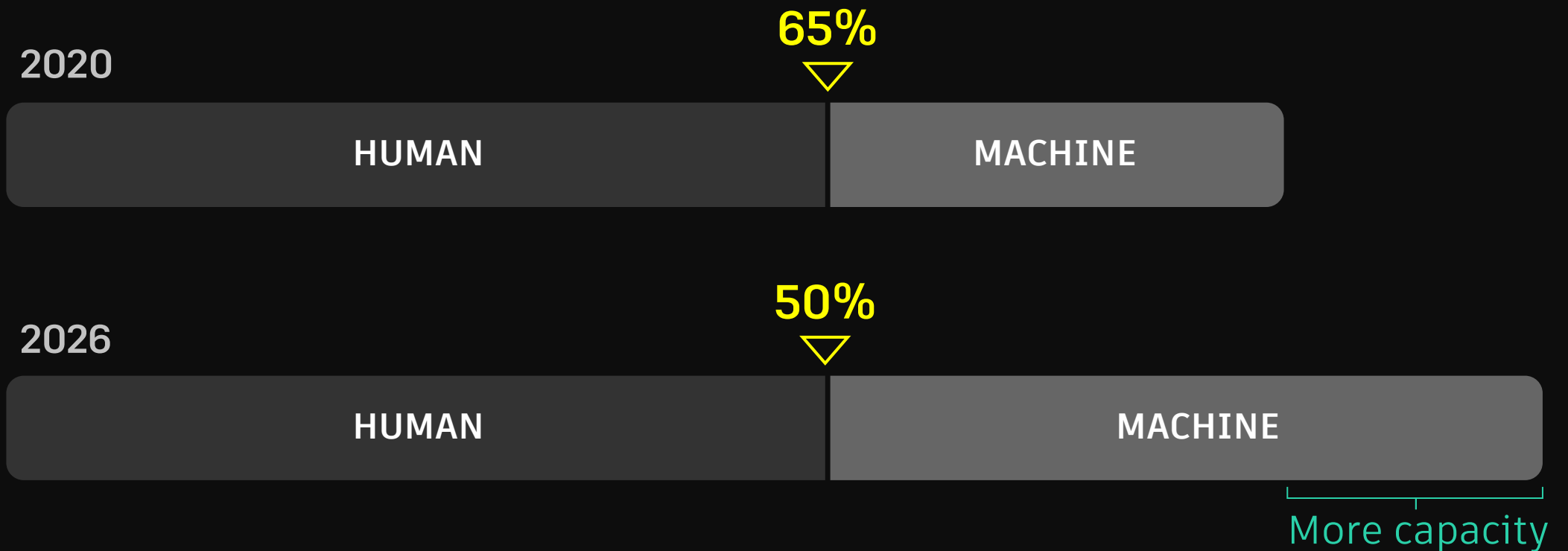
TODAY

Time

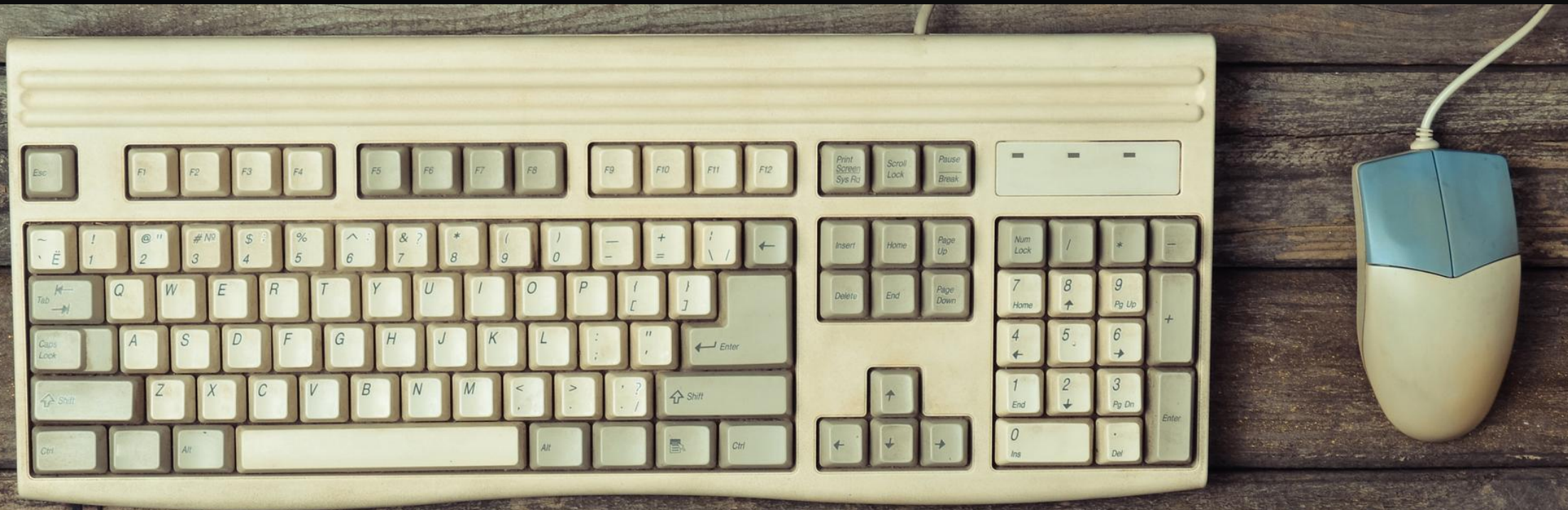
A new relationship with machines



A new relationship with machines



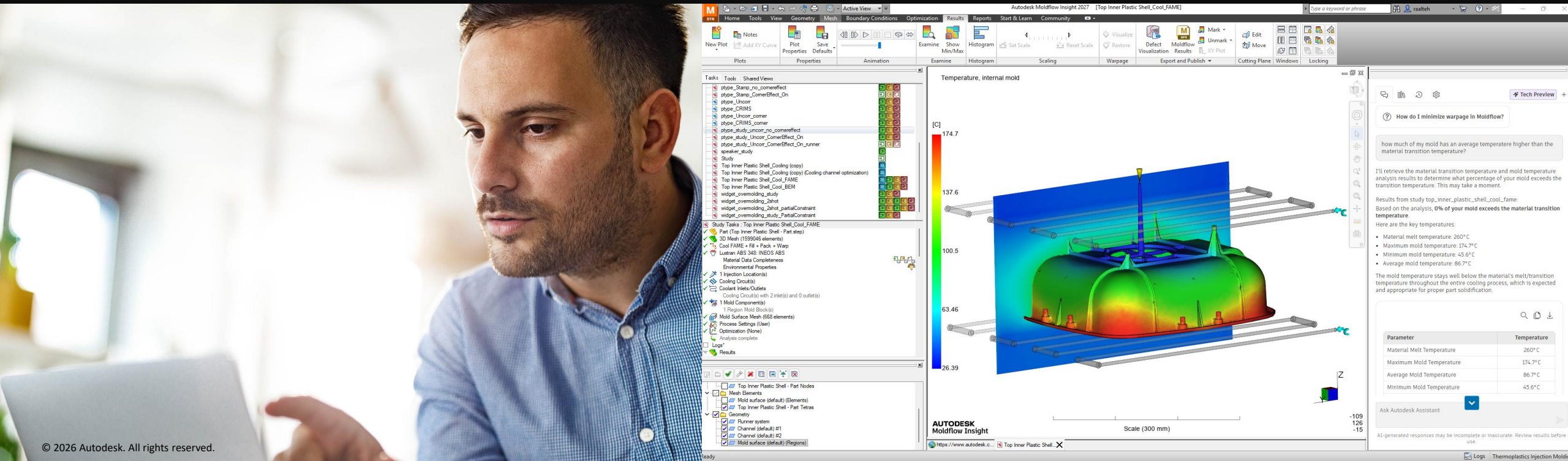
Traditional relationship with machines



New relationship with machines

“Conversation is the new interface”

Mustafa Suleyman, CEO, Inflection AI



Agenda

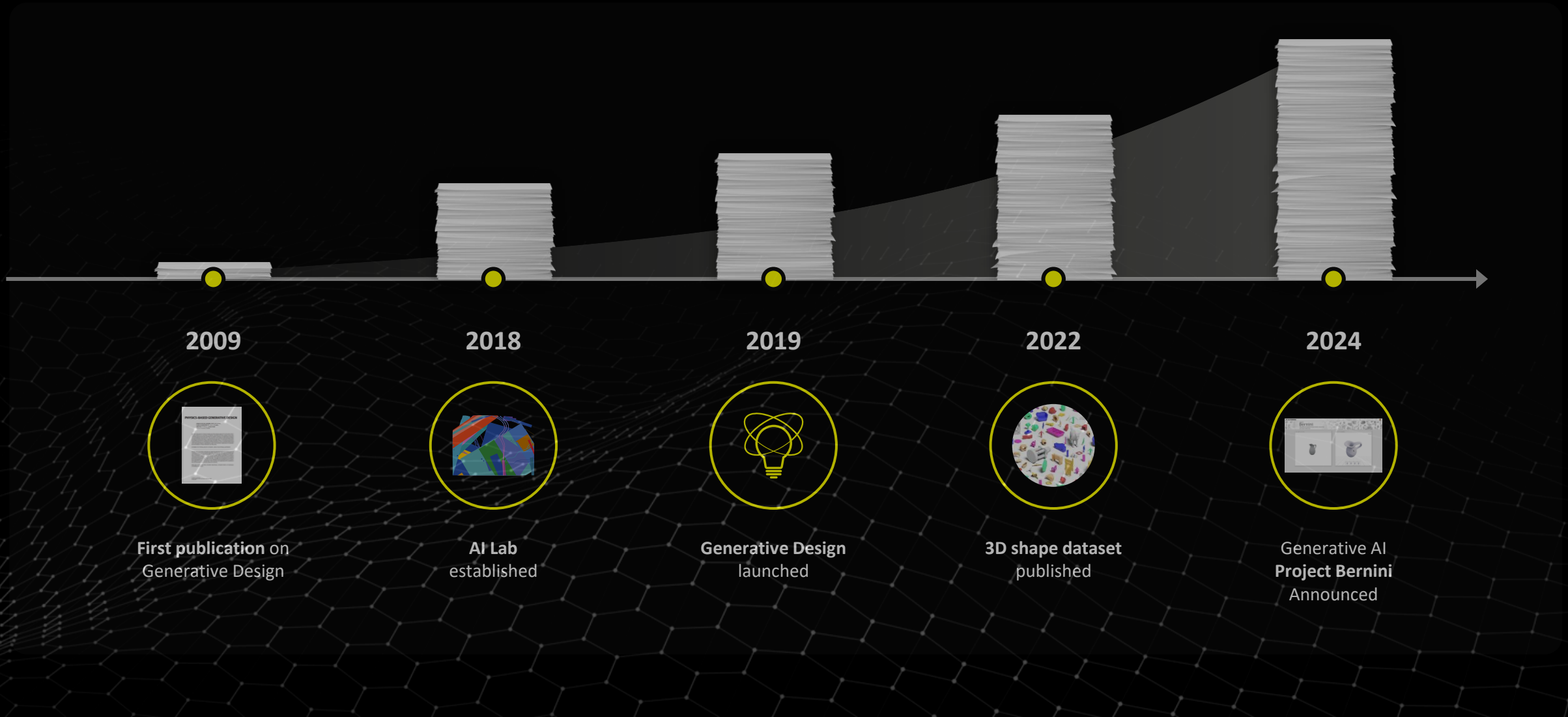
- 01 The AI shift
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Autodesk's **AI Mission**

Autodesk AI is built for Design and Make industries. With a focus on augmenting creative **exploration and problem-solving, automating tedious and repetitive tasks**, and assisting teams with **predictive insights** into their project data, Autodesk AI helps customers stay ahead of industry demands and technological shifts—bolstering ambition, creativity, and sustainability.

Autodesk's history with AI



Hai Dang, University of Bayreuth & Autodesk Research, Bayreuth, Bavaria, Germany. George Fitzmaurice, Autodesk Research, Toronto, Ontario, Canada.



Sanghi, AI Mahdavi Ami

BrepGen: A B-rep Generative Diffusion Model with Structure Geometry

XIANG XU, Simon Fraser University, Canada and Autodesk Research, Canada. JOSEPH G. LAMBOURNE, Autodesk Research, UK. PRADEEP KUMAR JAYARAMAN, Autodesk Research, Canada. ZHENGGANG WANG, Simon Fraser University, Canada. KARL D.D. WILLIS, Autodesk Research, USA. YASUTAKA FURUKAWA, Simon Fraser University, Canada.



Material Selection

Bon Adriel Aseniero, Autodesk Research, Toronto, Ontario, Canada. Qian Zhou, Autodesk Research, Toronto, Ontario, Canada.

an Joon Lee, Autodesk Research, New York, USA. Benjamin Idek, Autodesk Research, New York, USA.



Comparing results with a 6-Stage XLB with DNS data of [90] (solid line), as well as the log-log of wall distance (13).

selection workflow. Our protoged with the architect's design stages. The study highly increased confidence, an... CCS Concepts Human-centered co... Artificial intelligence. Keywords Architecture, Performance.

CLIP-FORGE: Towards Zero-Shot Text-to-Shape Generation

Aditya Sanghi, Marco Puro, Joseph G. Lambourne, Yie Wang, Kamal Rahani, Autodesk AI Lab, Autodesk Research.



We present a zero-shot text-to-shape generation method named CLIP-FORGE that can generate 3D models that accurately reflect the text.

Abstract Generating shapes using natural language can enable new ways of imagining and creating the things around us. While significant progress has been made in text-to-image generation, text-to-shape generation remains a challenging problem due to the non-ambiguity of natural text and shape data at large scales. We present a simple yet effective method for zero-shot text-to-shape generation that circumvents such data scarcity. Our proposed method, named CLIP-FORGE, is based on a two-stage reasoning process, which only depends on an established shape dataset and a pre-installed image-text network such as CLIP. Our method uses the knowledge of existing generation models to generate shapes that are semantically similar to the text and can be used to generate shapes for a given text. We use only domain-general text-to-image generation models to generate shapes that are semantically similar to the text and can be used to generate shapes for a given text.

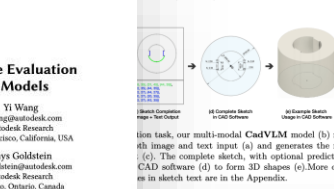
I. Introduction Generating 3D shapes from text input has been a challenging and interesting research problem with both practical scientific and applied value. In the artificial intelligence and cognitive science research communities, researchers have long sought to bridge the two worlds of text and 3D shapes.

Computing methodologies Natural language processing, Applied computing Computer games, Software and its engineering Interactive games.

Keywords Narrative Planning, Character Simulation, Large Language Models, Video games, Generative AI.

CadVLM: Bridging Language and Vision in the Generation of Parametric CAD Sketches

Sifan Wu, Amir Hossein Khoshdel, Mor Katz, Pradeep Kumar Jayaraman, Yewen Pu, Karl Willis, and Bang Liu.



Computer-Aided Design (CAD) is central to engineering. However, it encounters challenges in achieving modeling and lacks practical evaluation initial designs. We harness the capabilities of

Equation: QD_{n+1} = \sum_{i=1}^n f(x_i) and f(x_i) = \begin{cases} f(x) & \text{if } x \in R \\ \text{otherwise} & \end{cases}

In BOP files, black-box descriptor functions can be predicted using the descriptor GP models. When descriptor values are mispredicted, i.e., a solution is proposed with a predicted quality which, when evaluated, is different from its expectation, we simply set the value of a solution to 0, or contextually meaningful lower bound.

III. RELATED WORK A. Quality-Diversity Algorithms QD has its origins in the field of evolutionary computation where, when searching for a single global optimum, maintaining genetic diversity is important to avoid premature convergence and to escape local optima [8]. In QDO, however, we are not seeking diversity over the search space but searching for diversity in descriptor space. In other words, QDO seeks to solve many different optimization problems simultaneously, where each problem is defined over a shared problem space and solves the problem in a behaviorally diverse way.

III. RELATED WORK B. MAP-Elites MAP-Elites [11] is a kind of multi-objective optimization. QD algorithms such as Needy Search with local competition (NSLC) [7] and MAP-Elites [11] ensure a set of high performing solutions. The solutions set returned by MAP-Elites is an example of a structured archive, a grid of points where each bin in the grid stores a solution for a region in descriptor space. By contrast, the variety of algorithms here proposed for QD search, and [17] provides a good overview. In the following, the focus on the algorithm most relevant to our work, namely MAP-Elites, SALS, and SPEEC.

C. MAP-Elites Most modern QD takes place in the context of the MAP-Elites framework [11]. All valid sets of points are evaluated via the objective and descriptor functions, the best point in each region is considered an 'elite' and is stored in the archive. Elite points are randomly selected as parents from the archive and combined to produce children that are then evaluated. If a child surpasses the elite for its region in the archive, or if the first individual in that region, it becomes the new elite in that region. This relatively simple, yet powerful approach provides good coverage over the region and finds high performing points when given a sufficient budget.

D. Bayesian Optimization Bayesian Optimization (BO) is an optimization approach for expensive black-box functions, see, e.g., [19] for an introduction. The general idea of BO is to start with some initial

GraphSeam: Supervised Graph Learning Framework for Semantic UV Mapping

FATEMEH TEIMURY, McGill University and Autodesk, Canada. BRUNO ROY, Autodesk, Canada. JUAN SEBASTIAN CASALLAS, Autodesk, Canada. DAVID MACDONALD, Autodesk, Canada. MARK COATES, McGill University, Canada.



Example mesh. In the top row, we show the predicted outputs of our graph network in UV space (a). Additional

to automate UV mapping, the proposed UV mapping framework uses the UV space while minimizing the use of the graph method. Automatic and minimization algorithms, they fail to bid factor for professional artists. The only (CNNs) and the fact that a mesh of a graph, one opened a new bridge in the computer graphics domain. In HDNs for the first time to propose IR, that enables users to replace their portion and seam length. To this end, we present a supervised graph learning framework for semantic UV mapping. The question arises in DesignQA (a) based on the high-quality hand-drawn UV maps and systems. The question arises in DesignQA (a) based on the high-quality hand-drawn UV maps and systems. The question arises in DesignQA (a) based on the high-quality hand-drawn UV maps and systems.

1 INTRODUCTION UV mapping is a fundamental task in computer graphics that involves the projection of 3D surfaces to 2D representations. This process

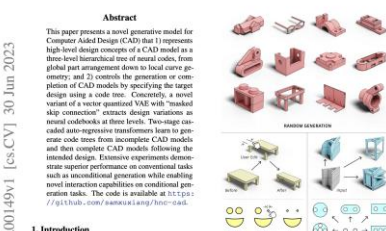
90+

AI Research papers

Abstract This paper presents a novel generative model for Computer Aided Design (CAD) that 1) represents the high-level design concepts of a CAD model as a three-level hierarchical tree of neural codes, from global part arrangement down to local curve geometry; and 2) controls the generation or completion of CAD models by specifying the target design using a code tree. Concretely, a novel variant of a vector quantized VAE with 'masked skip connections' extracts design variations as neural codebooks at three levels. Two-stage cascaded auto-regressive transformers learn to generate code trees from incomplete CAD models and their completion CAD models following the intended design. Extensive experiments demonstrate superior performance on conventional tasks such as unconditional generation while making novel interaction capabilities on conditional generation tasks. The code is available at https://github.com/sambasank/hier-gad.

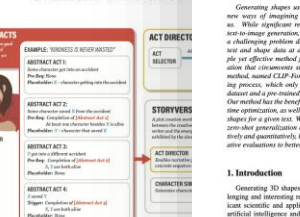
Hierarchical Neural Coding for Controllable CAD Model Generation

Xiang Xu, Pradeep Kumar Jayaraman, Joseph G. Lambourne, Karl D.D. Willis, Yasutaka Furukawa



I. Introduction Our main objective is to apply, construct or relearn, neural codebooks are created using Computer Aided Design (CAD) software. Most modern CAD design tools employ the 'Sketch and Extrude' style workflow (Cunha et al., 2016; Shinar, 2009), where designers 1) draw lines of 2D curves as outer and inner boundaries to create 2D profiles, 2) extrude the 2D profiles to form 3D shapes, and 3) add or subtract 3D shapes to build complex CAD models. CAD models created in this way have a natural tree structure which supports local edits. The curves at the leaves of the tree can be adjusted and the extrusions represented to update the final shape. For designers, it is also important that cells propagate semantically to others. Although 'Sketch and Extrude' allows local changes, it does not provide the relationships required to give the anticipated behavior when the model is edited. A computational system with understanding of design trees would enhance the practice of CAD. Proceedings of the 40th International Conference on Machine Learning, 2023.

Verse: Towards Co-authoring Character Simulation



We present a novel plot creation workflow that starts from an LLM-driven character simulation through an RLHF process that iteratively generates and revise

Computing methodologies Natural language processing, Applied computing Computer games, Software and its engineering Interactive games.

Keywords Narrative Planning, Character Simulation, Large Language Models, Video games, Generative AI.

Autodesk **trust** principles for AI

Building integrity & trust
into Autodesk AI



Responsible

We hold ourselves to high standards in acquiring and managing data as well as training and delivering fair and safe AI models.



Transparent

We are forthcoming about the design, development, and intended use of AI systems and data.



Accountable

We are committed to respecting the choices of our customers and aligning to laws and regulations.



Reliable

We are rigorous in building AI systems that strive to provide accuracy, validity, and consistency.



Safe & Secure

We employ robust practices throughout the AI lifecycle to protect customer data, intellectual property, and privacy, and to produce safe outcomes.

Autodesk

AI transparency



AI Transparency Card

Autodesk Fusion

AutoConstrain

Description

A feature that analyzes sketches and suggests the constraints and dimensions to fully constrain sketches.

Feature information

Feature functionality	Automate
Model source	Proprietary
Primary technique	Transformer

Trust ingredients

User directed feature	Yes
Personal data	No
Data source(s)	Customer content (e.g. sketches)

Choice format	No
Encryption at-rest	Yes
Encryption in-transit	Yes
Other safeguards	Tokenization De-identification

For more information on our Trusted AI practices, consult our Trust Center.



COMMITMENT TO OPENNESS

We publish AI transparency cards on Autodesk's Trust Center and will continue to evolve them to provide transparent information.

Underlying AI methods

What the feature does, how it works, and 3rd party vendor considerations.

Privacy considerations

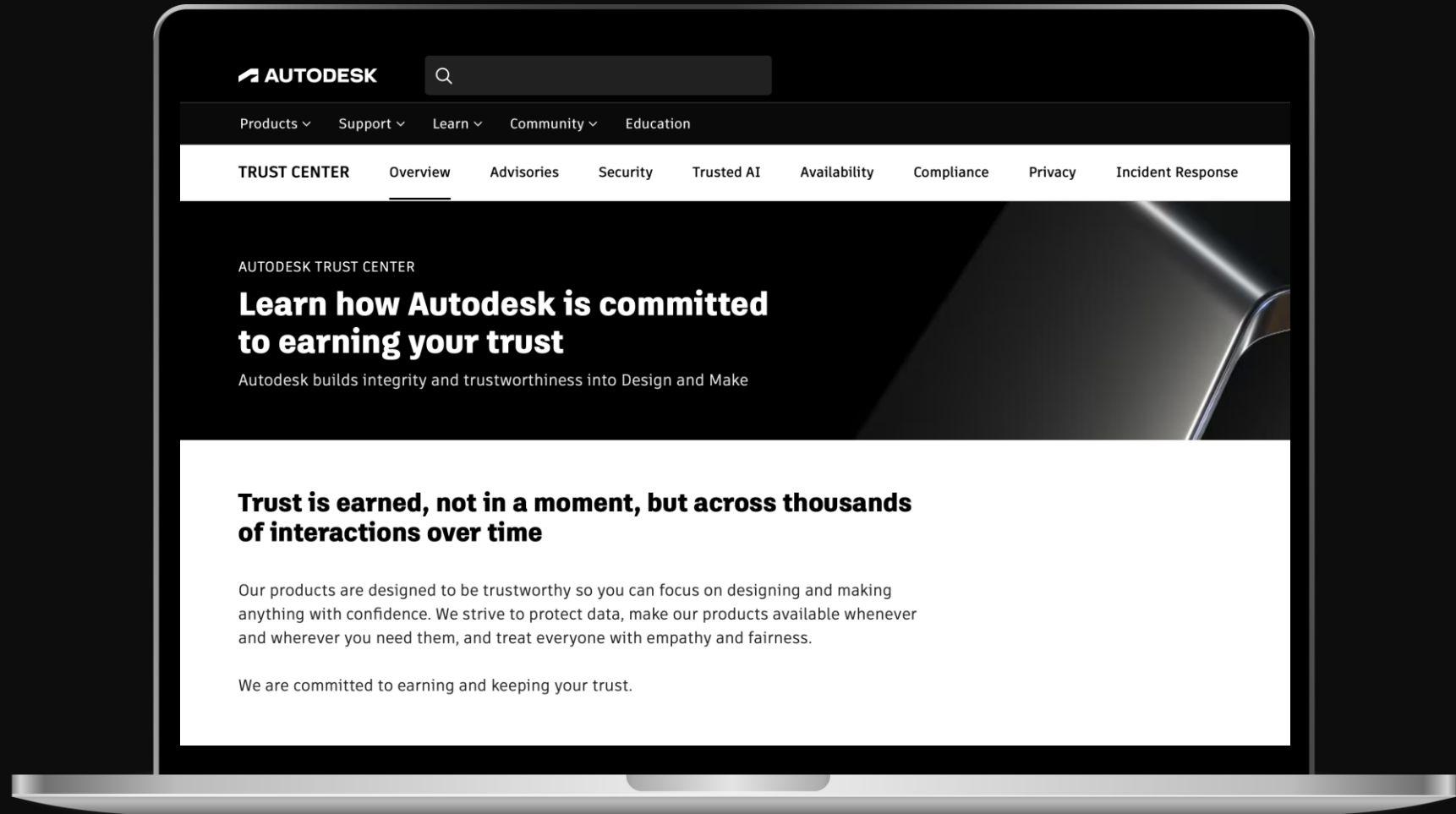
If personal data is used, what additional safeguards are in place to protect privacy.

Data protection measures

If data is needed for training what kind, which elements of customer content, and measures in place to protect IP.

Online Trust Center

trust.autodesk.com



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Features powered by Autodesk AI

Industry	AI-Powered Feature	Product
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AECO	Inference Node	Dynamo
	ML Node Autocomplete	Dynamo
	Rapid Wind Analysis	Forma
	Rapid Noise Analysis	Forma
	Embodied Carbon Analysis	Forma
	Site Automation	Forma
	Machine Learning Deluge	InfoDrainage
	Generative Design in Revit	Revit
	Smart Block: Replacement	AutoCAD
	Smart Blocks: Detect and Convert	AutoCAD
	My Insights: Macro Advisor	AutoCAD
	Markup Import & Assist	AutoCAD
	Search and Convert	AutoCAD

AECO + D&M	My Insights	AutoCAD, Revit, Civil 3D, and Fusion
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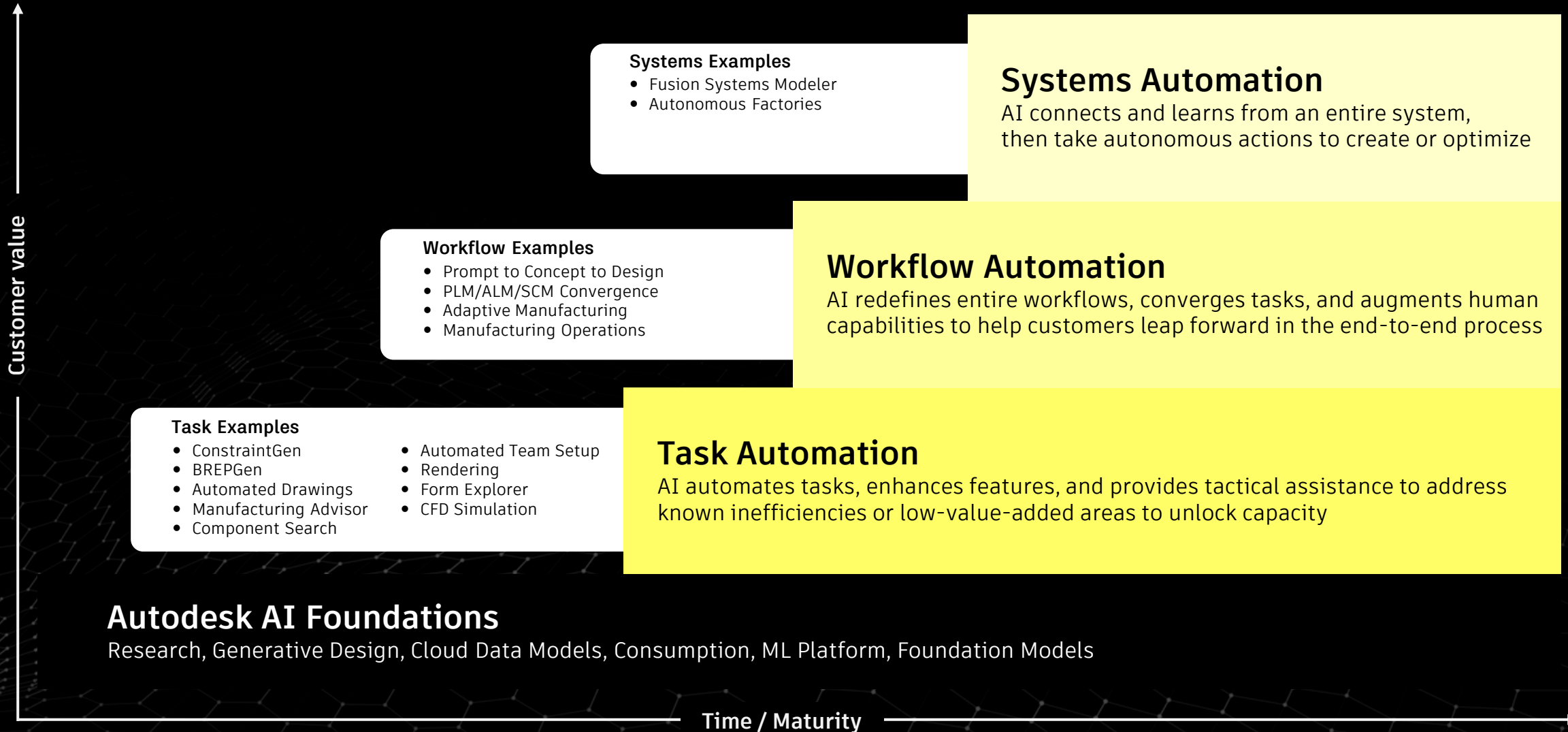
Construction	AI Assistant for Construction	Construction Cloud
	Automated Specifications Sectioning	Construction Cloud
	Automated Submittals Logs	AutoSpecs
	Automated Symbol Detection	Takeoff
	Construction IQ	Construction Cloud
	Photo Autotags	Construction Cloud
	Financial Data Extraction	TradeTapp
	Bid Forwarding	BuildingConnected
	Automated Plan Processing	Construction Cloud
	Subcontractor Recommendations	BuildingConnected
	Automated Object Generation	ConstructionCloud

Industry	AI-Powered Feature	Product
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Product Design & Manufacturing	AutoConstrain	Fusion
	Fastener Classification for Drawing Automation	Fusion
	Manufacturing Advisor	Fusion
	Generative Design Clustering	Fusion
	Generative Design Optimization	Fusion
	Feeds and Speeds Recommendation	Fusion
	Search Results Relevance in Fasteners library	Fusion
	Form Explorer	Alias
	Performance driven design	Navpack
	Inventor Automation with Autodesk Assistant	Inventor
	Vault Automation with Autodesk Assistant	Vault
	Moldflow Automation with Autodesk Assistant	Moldflow

Media & Entertainment	Camera Analysis	Flame
	ML Timewrap	Flame
	Human Face Semantic Keyer	Flame
	Salient Keyer	Flame
	Sky Extraction Keyer	Flame
	ML Morph	Flame
	Human Body Semantic Keyer	Flame
	ML Dept	Flame
	Inference Node	Flame
	Machine Learning Upscale	Flame
	ML Deformer	Flame
	MotionMaker	Maya
	Flow Generative Scheduling	Flow
TBC	WonderDynamics	

Path Ahead – AI Capability Framework to deliver value



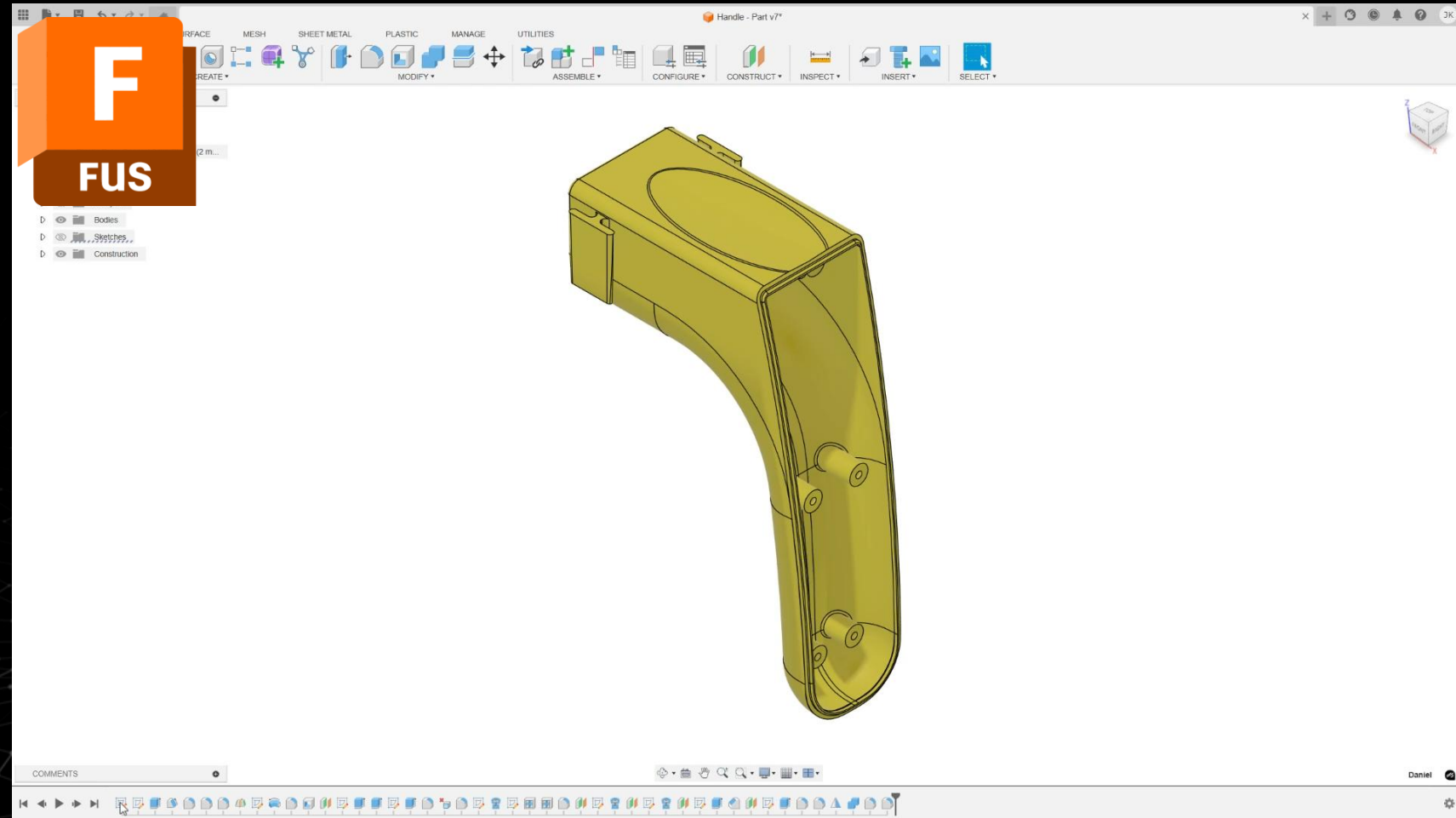
Task Automation | Sketch AutoConstrain

Description:

Streamlines the design process by automatically applying constraints during 2D and 3D sketching as well as repairing common sketch issues, speeding up workflow and reducing manual input.

Value Proposition:

- Reduce Non-Value-Add Processes
- Reduce Resource Consumption
- Reduce Defects and Non-Conformities
- Improve Quality and Reliability

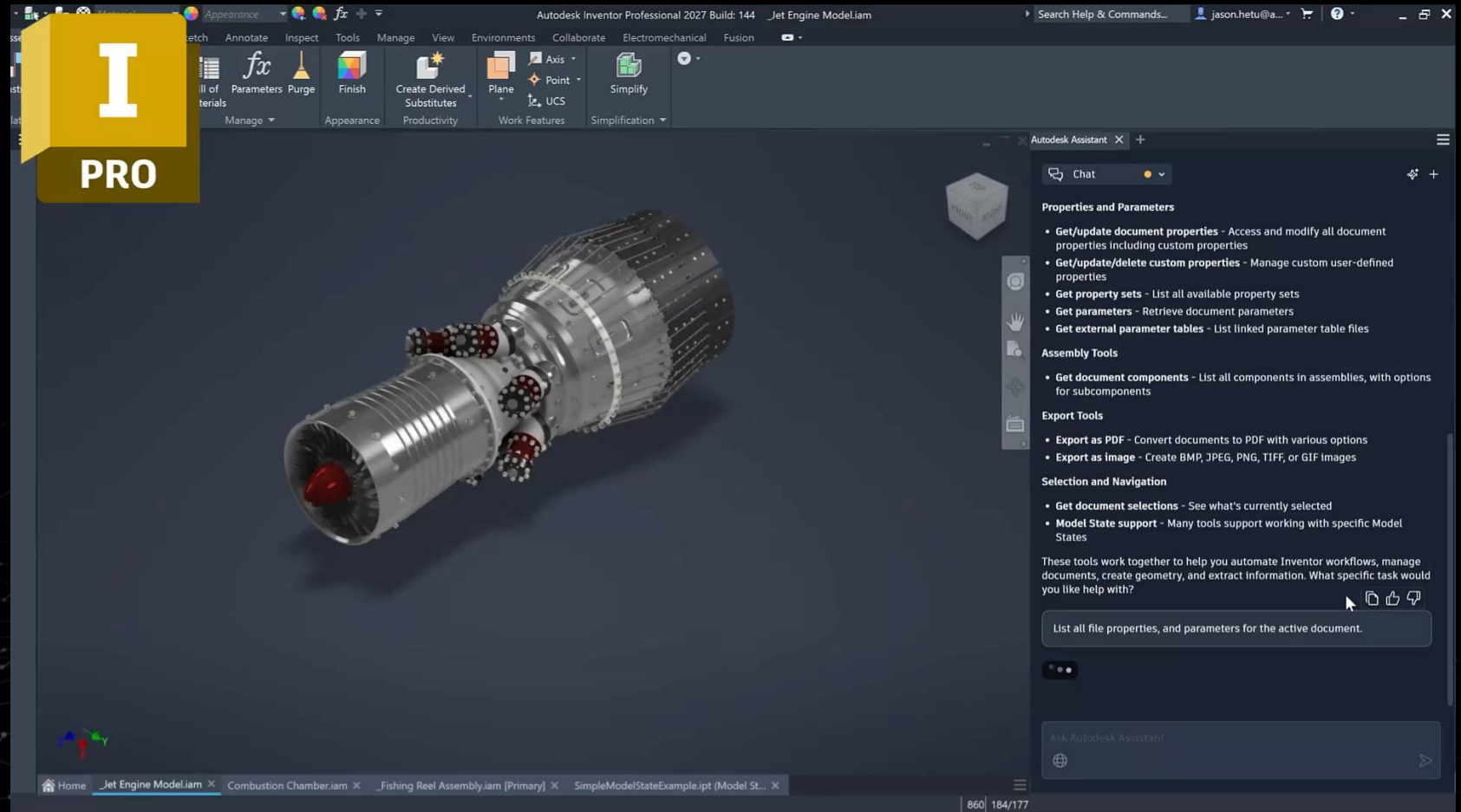


Task Automation | Model Interrogation

Description: Chat with Autodesk Assistant to work directly with your Inventor models, properties, and documents through natural language commands.

Value Proposition:

- Faster discovery and selection of components, features, and properties across open documents
- Read and write iProperties, parameters, and instance data without navigating dialogs
- Automate repetitive tasks like updates, exports, appearance changes, and BOM cleanup
- Hands-on model control through conversational prompts instead of manual workflows

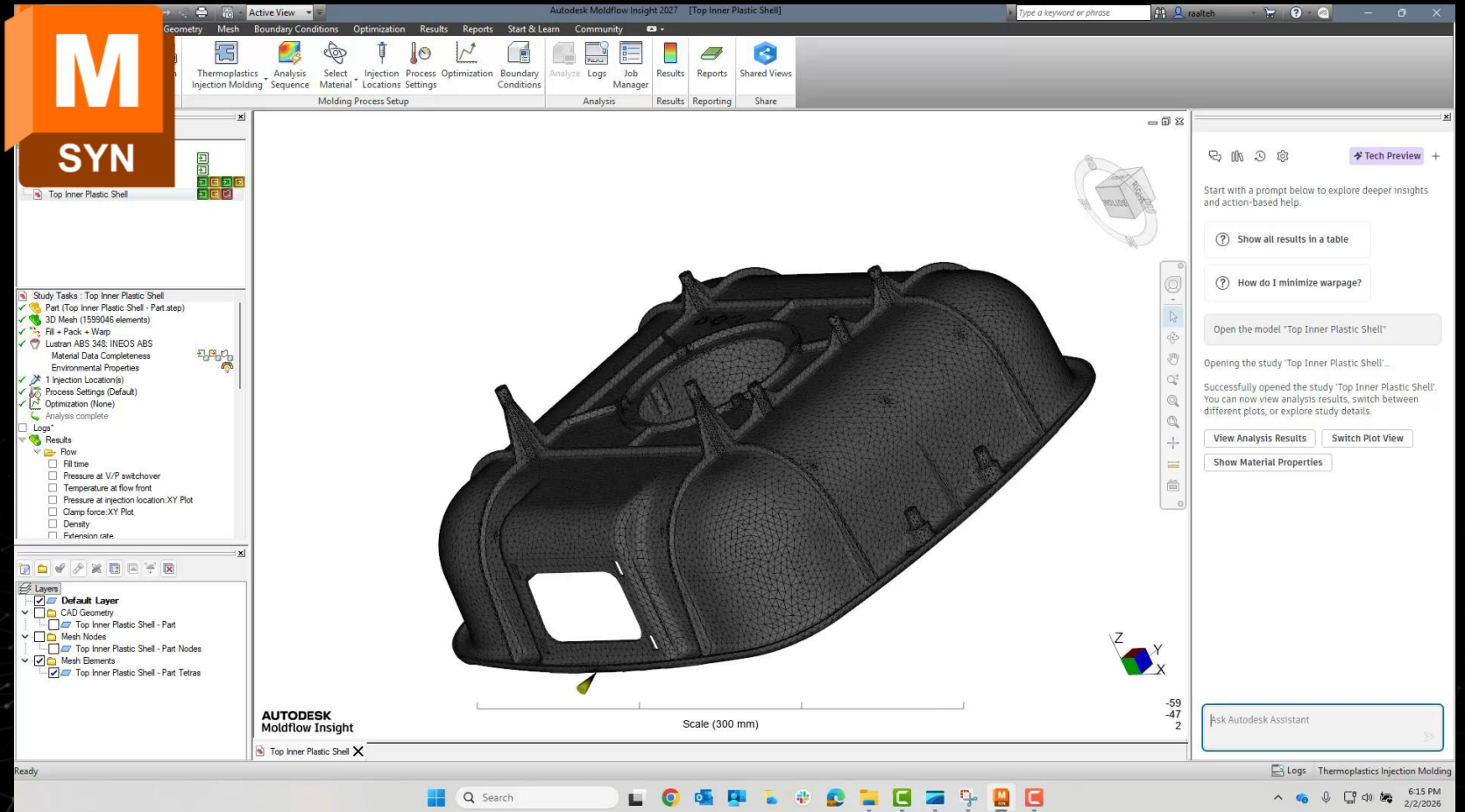


Task Automation | Simulation Assistance

Description: Chat with Autodesk Assistant to interpret Moldflow simulation results, get guidance on injection molding challenges, and take action directly within your analysis environment.

Value Proposition:

- Plain-language summaries of complex simulation results, highlighting key risks like fill problems, weld lines, and warpage
- Guided recommendations for process and design changes informed by analysis data and Moldflow domain expertise
- Lower barrier to entry for new or occasional users who need expert-level interpretation without deep simulation background

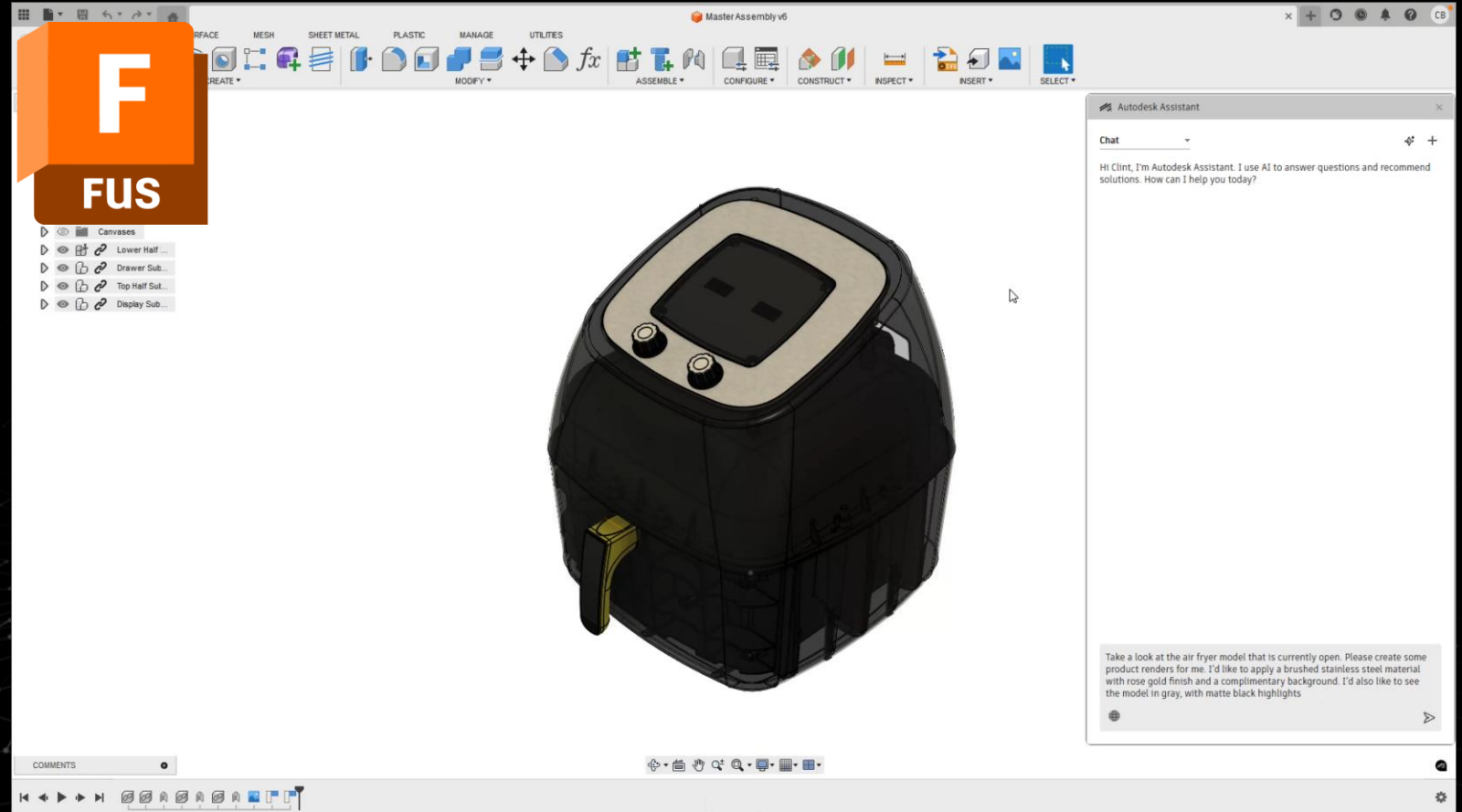


Workflow Automation | Media Generation

Description: Through a collaboration with Microsoft, we have enabled new workflows for the creation of high quality AI generated product imagery and aggregation of those into a curated Microsoft PowerPoint presentation for design reviews

Value Proposition:

- Reduce Non-Value-Add Processes
- Reduce Resource Consumption
- Reduce Defects and Non-Conformities
- Improve Documentation and Collaboration



Workflow Automation | Form Exploration

Description:

A powerful in-product assistant that enables rapid exploration and creation of automotive concepts, offering intuitive 3D proportional design assistance and performance insights directly within the Alias environment

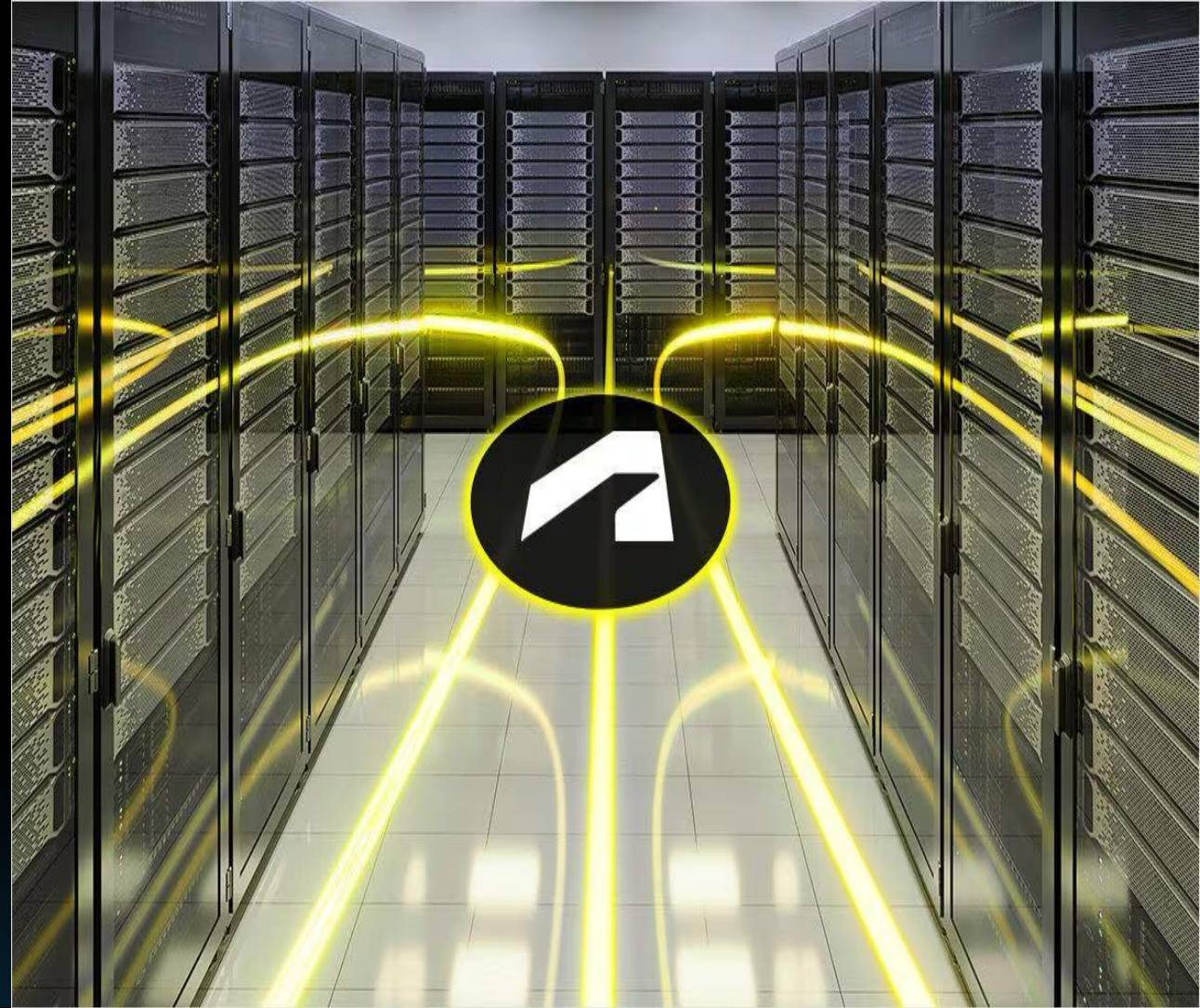
Value Proposition:

- Unlock Design Creativity
- Reduce Time to Design Approval
- Reduce Non Value-Add Processes
- Improve Product Personalization



Autodesk MCP Servers*

**in progress*





Model Context Protocol

What is MCP?

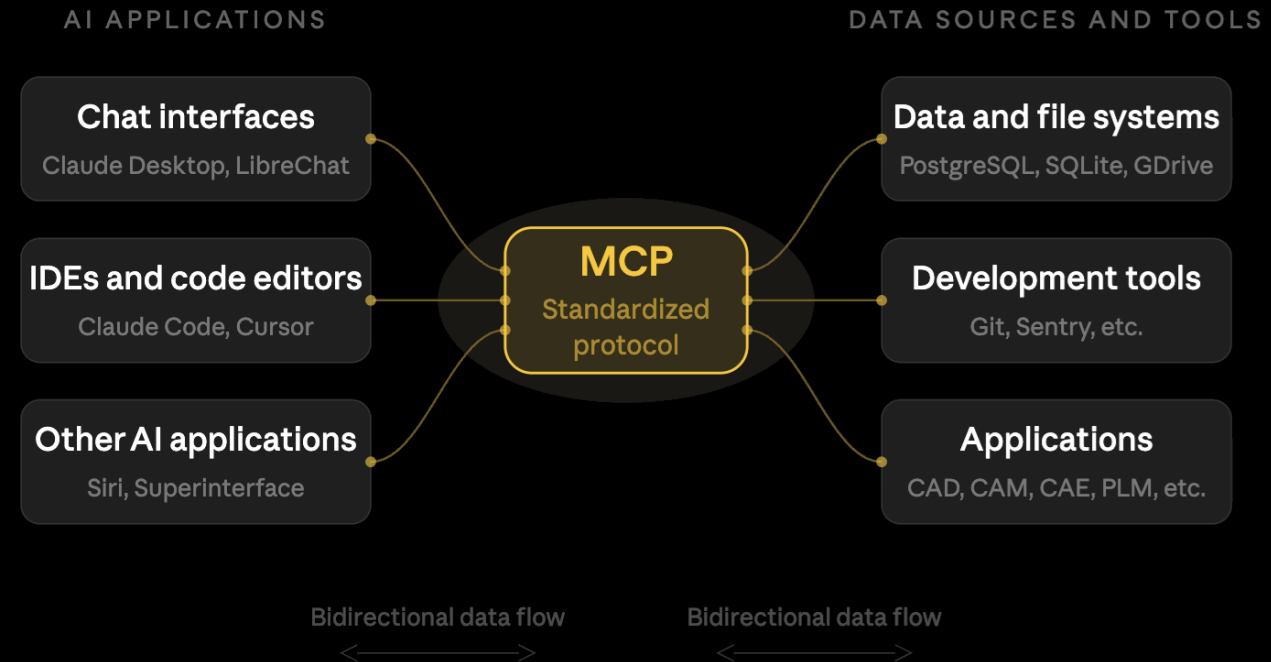
- Standardized protocol for AI ↔ tools & data
- Connects models to real-world systems
- Enables seamless, bidirectional integration

Why it Matters

- AI is limited without access to real systems
- Today's integrations are fragmented and manual
- MCP unlocks scalable, reusable connectivity

The Impact

- Faster workflows
- Less manual effort
- More reliable, consistent outcomes



Why Autodesk MCP Servers?

01



Enterprise ready
security

02



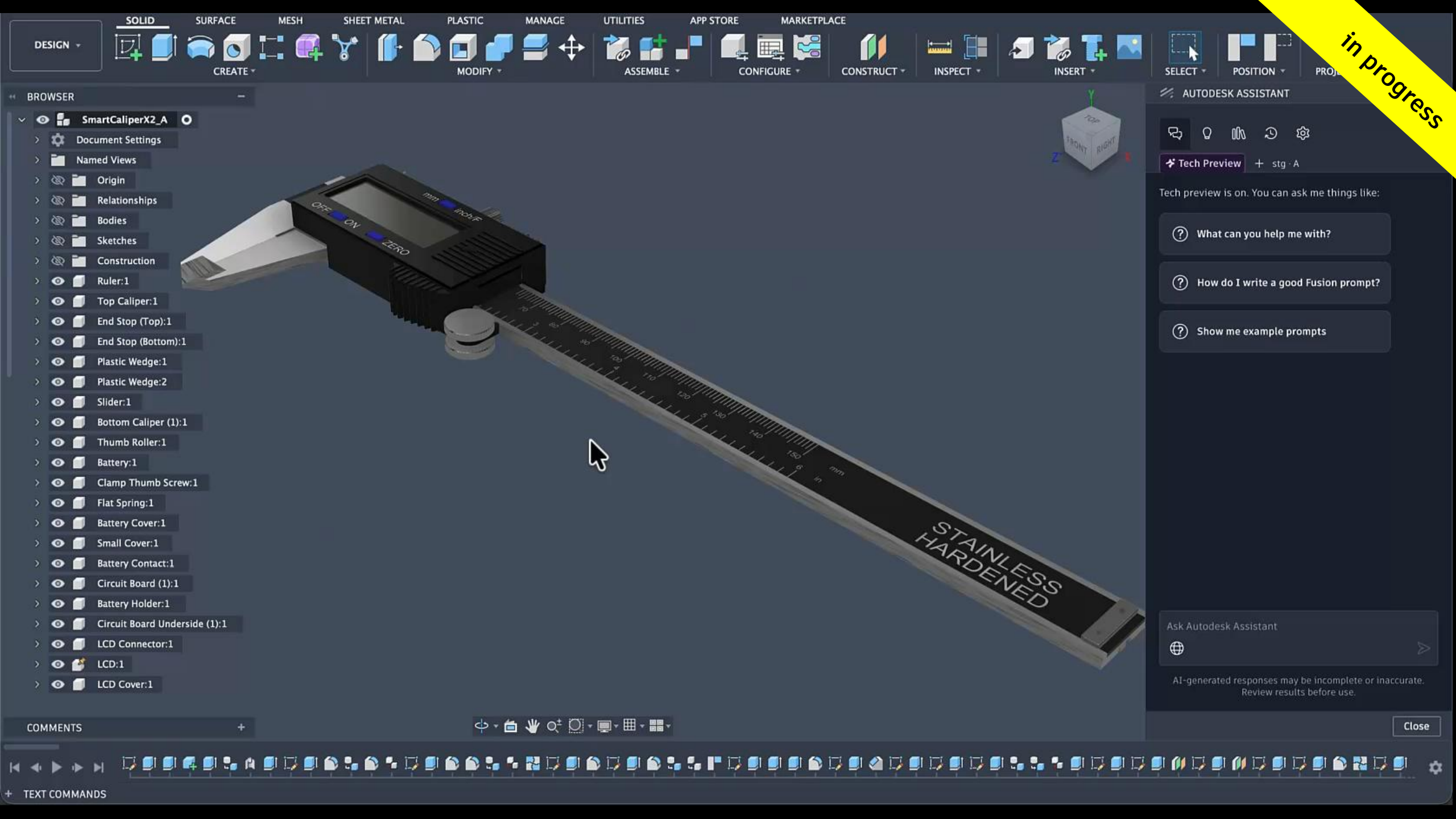
Reliable, resilient,
smart

03



Context-aware

in progress



DESIGN

SOLID SURFACE MESH SHEET METAL PLASTIC MANAGE UTILITIES APP STORE MARKETPLACE

CREATE

MODIFY

ASSEMBLE

CONFIGURE

CONSTRUCT

INSPECT

INSERT

SELECT

POSITION

PROJECT

BROWSER

SmartCaliperX2_A

Document Settings

Named Views

Origin

Relationships

Bodies

Sketches

Construction

Ruler:1

Top Caliper:1

End Stop (Top):1

End Stop (Bottom):1

Plastic Wedge:1

Plastic Wedge:2

Slider:1

Bottom Caliper (1):1

Thumb Roller:1

Battery:1

Clamp Thumb Screw:1

Flat Spring:1

Battery Cover:1

Small Cover:1

Battery Contact:1

Circuit Board (1):1

Battery Holder:1

Circuit Board Underside (1):1

LCD Connector:1

LCD:1

LCD Cover:1

AUTODESK ASSISTANT

Tech Preview + stg - A

Tech preview is on. You can ask me things like:

What can you help me with?

How do I write a good Fusion prompt?

Show me example prompts

Ask Autodesk Assistant



AI-generated responses may be incomplete or inaccurate. Review results before use.

Close

COMMENTS +



TEXT COMMANDS

Systems Automation | Remote MCP Servers

in progress

Description: Connect any AI client to Autodesk's data and automation engines in the cloud through MCPs that allow live read/write access to data and provide a session orchestrator that lets agents design, iterate, and export without a local installation.

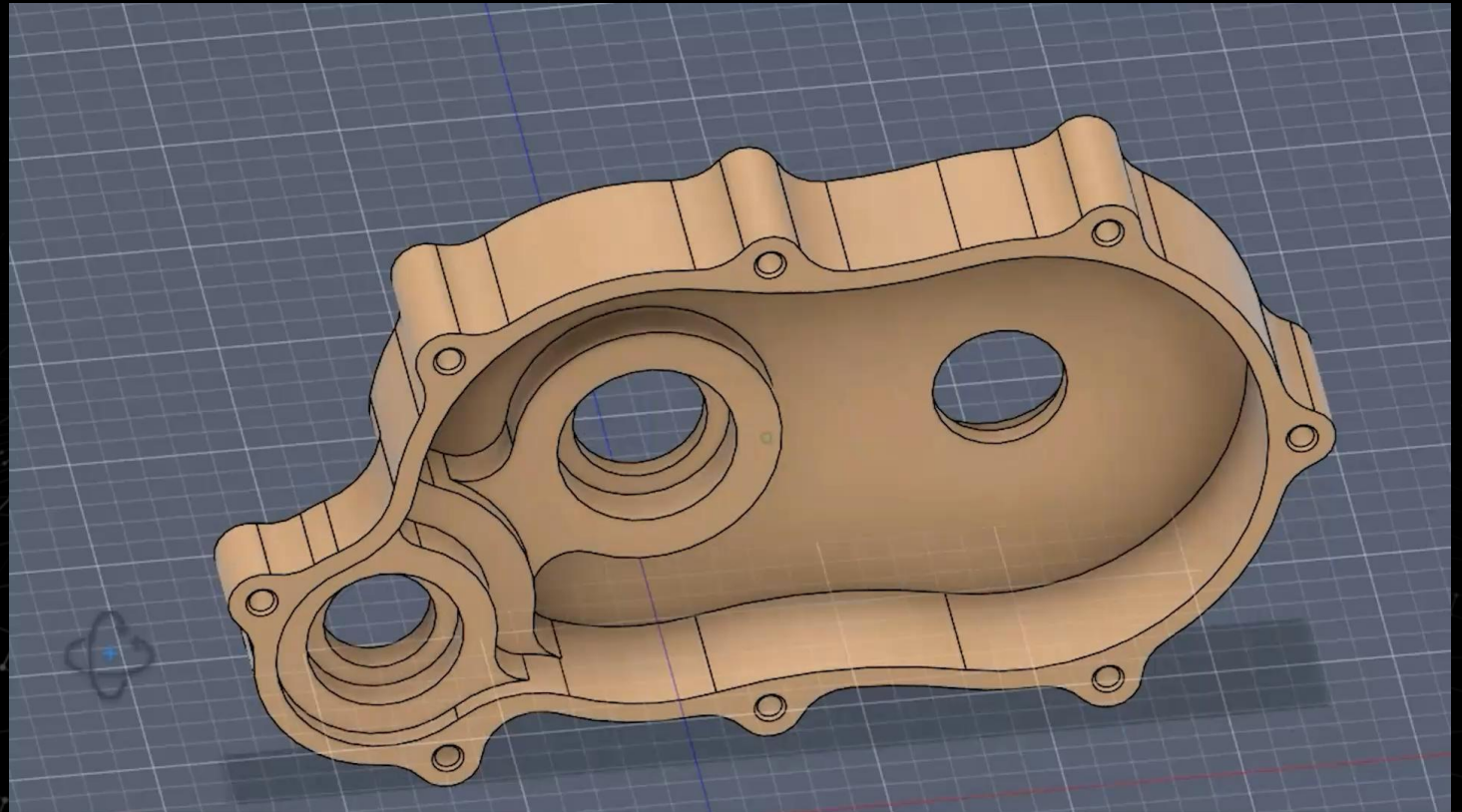


Autodesk MCP Servers

Autodesk MCP Servers standardize design and make context to enable integrated, secure, and scalable collaboration across tools and teams.

Value Proposition

- Secure, cloud-based access to data and automation engines in Autodesk Platform Services
- Persistent, multi-step design sessions driven by natural language from any MCP-compatible client
- No local product installation required, enabling CI/CD pipelines, multi-agent workflows, and partner integrations
- AI coding assistants like Cursor, Claude Code, and Copilot can autonomously create, modify, and validate CAD models



Agenda

- 01 The AI shift
- 02 Autodesk's approach
- 03 What you can do today
- 04** Our recommendations

Recommendations

- 1. Embrace the moment.**
Organizations that lean in now will define the next era of design and manufacturing.
- 2. Explore what's available today**
These capabilities are in your hands right now. Know what they can do for your teams.
- 3. Get hands on** Encourage your teams to experiment on real problems and build confidence through practice.

