Northrop Grumman

Solid Rocket Motor and Warhead Manufacturing

Critical propulsion and energetic components that power and enable air, sea and land-based missile systems.

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Northrop Grumman Weapons & Energetics Facilities

NG Space Systems

20k+ Space and Strategic solid rocket motors produced

Salt Lake Region
(Promontory & Bacchus, UT)

Space Launch, Commercial, Civil & Strategic Propulsion; Defense Energetics; Bombs

NG Defense Systems

1.3M+ Tactical solid rocket motors produced

Elkton, MD

Allegany Ballistics Laboratory, WV

Tactical rocket motors, Ramjet/Scramjet airbreathing engines, Boosters, Control systems, Warheads & Fuzing

Salt Lake Region
Bacchus, Clearfield, Ogden, Roy, & Promontory

Minneapolis Region
Elk River & Plymouth

Sunnyvale

Los Angeles Region
Northridge, Redondo Beach, & Woodland Hills

San Diego

Phoenix Region
Chandler & Mesa

Huntsville

Ronkonkoma

Elkton

ABL

Baltimore

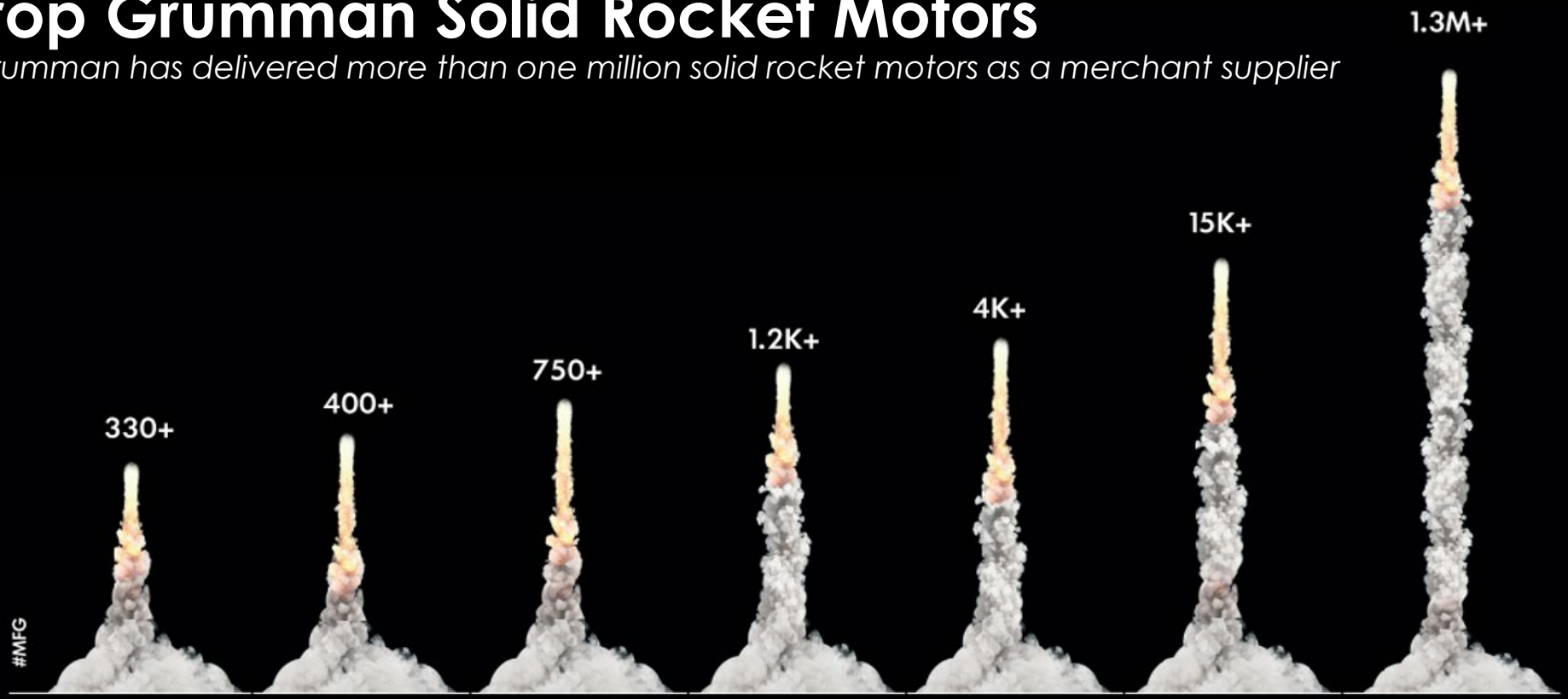
Radford

West Palm Beach

- Missiles
- Electronics
- Munitions
- Armaments
- Propulsion & Energetics Manufacturing

Northrop Grumman Solid Rocket Motors

Northrop Grumman has delivered more than one million solid rocket motors as a merchant supplier

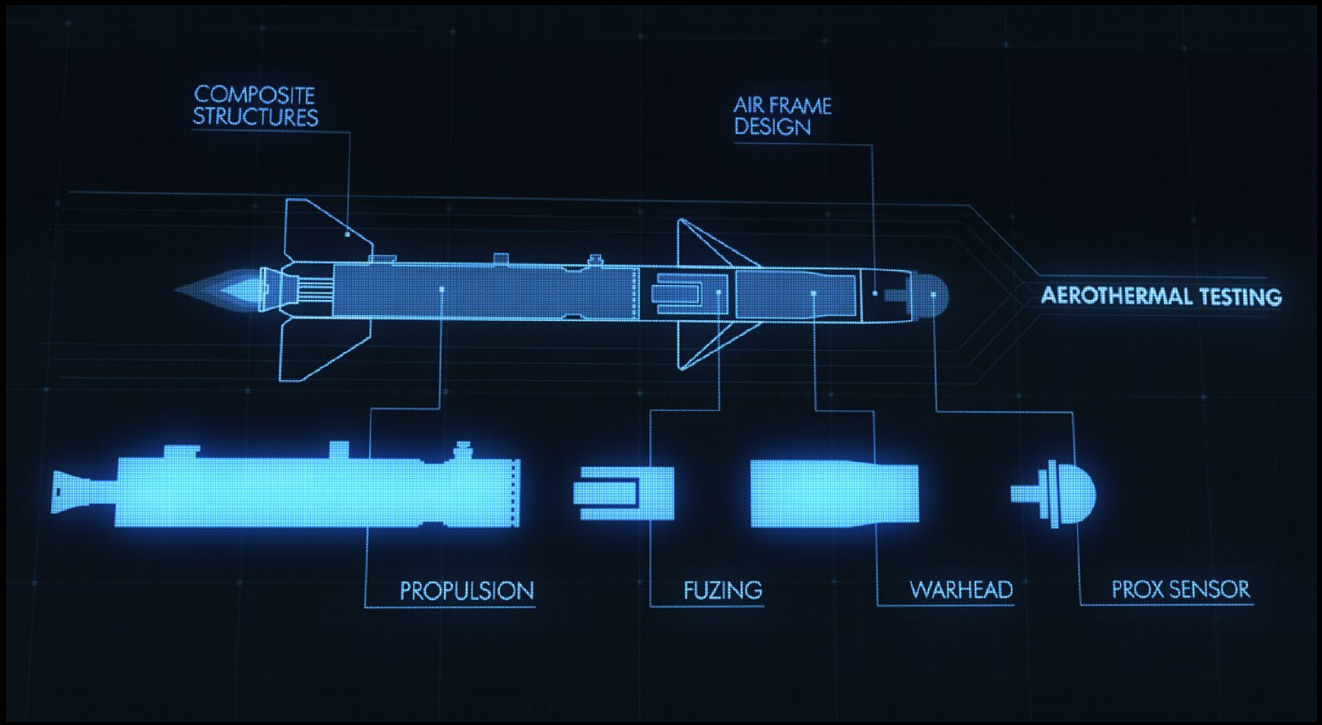


MOTOR	Human Rated	Orion Motors	CASTOR® Motors	GEM Motors	STAR™ Motors	Strategic Motors	Tactical Motors
PROGRAM	Space Shuttle, SLS, Orion Spacecraft	Pegasus®, Taurus®, Minotaur I, IV, C, GMD/OBV, X-43, IRBM Target, ICBM Target	Antares™, Athena, Taurus®, Atlas IIAS, Maxis, Targets, H-IIA	Delta II, III, IV, Atlas V, Vulcan	Delta II, IV, Atlas, Athena, Ariane, Space Shuttle, Minotaur, Long March (also GPS spacecraft)	Minuteman I, II, III, Peacekeeper, Trident C4/D5, Polaris A2/A3, Poseidon C3	TOW, Sidewinder, AMRAAM, Hellfire, Harpoon, GMLRS, SM-3, RAM Blk II

Providing propulsion to deter and defend against threats, deliver payloads to space and enable discovery beyond our planet

Complete Propulsion & Ordnance Package

Merchant Supplier: Northrop Grumman operates as a merchant supplier of rocket motors, air breathing propulsion systems, controls, fuzes, Ignition Safety Devices (ISDs), and warheads for domestic and international customers.



- **Defense Industrial Base:** As a leading supplier of mission-critical components, Northrop Grumman supports the U.S. Defense Industrial Base.
- **Diversification:** Extensive portfolio equipped to create systems that optimize size, weight and power for mission-tailorable outcomes.
- **Modernization:** Significant investments into modernizing manufacturing facilities and strengthening supply chains to bring weapons to the warfighter faster than ever before.

NG is a Leader in Advanced Propulsion & Ordnance

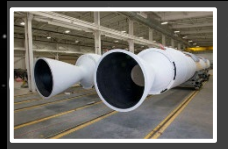
From below the sea to land, air and space, customers rely on Northrop Grumman solid rocket motors and energetics capabilities to execute their most important missions

Today's Focus - Tactical & Extended Range

SPACE LAUNCH

Large motors ranging in size and boost capacity from 2,000 to 1.6M pounds

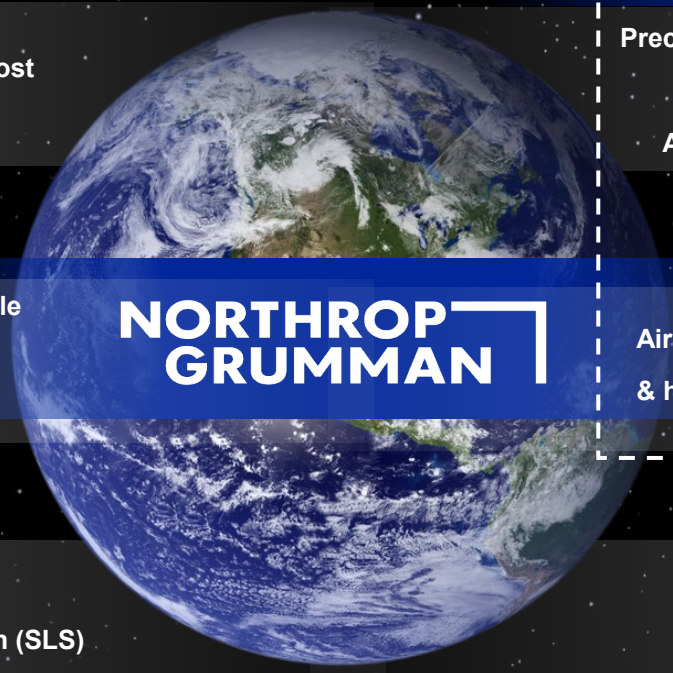
COMMERCIAL



Continuously improved for new vehicle and payload demands; low-cost, high reliability (Orion, CASTOR®, GEM)

CIVIL

Solid rocket propulsion for human spaceflight and scientific exploration (SLS)



TACTICAL PROPULSION & ORDNANCE

Precision fires rockets/missiles (PrSM, GMLRS)
Counter-air & stand-in attack propulsion,
Aviation/close combat, Warheads & Fuzing

ADVANCED MISSILES

Air-breathing (ramjet/scramjet), high-speed & hypersonic standoff, survivability and effects

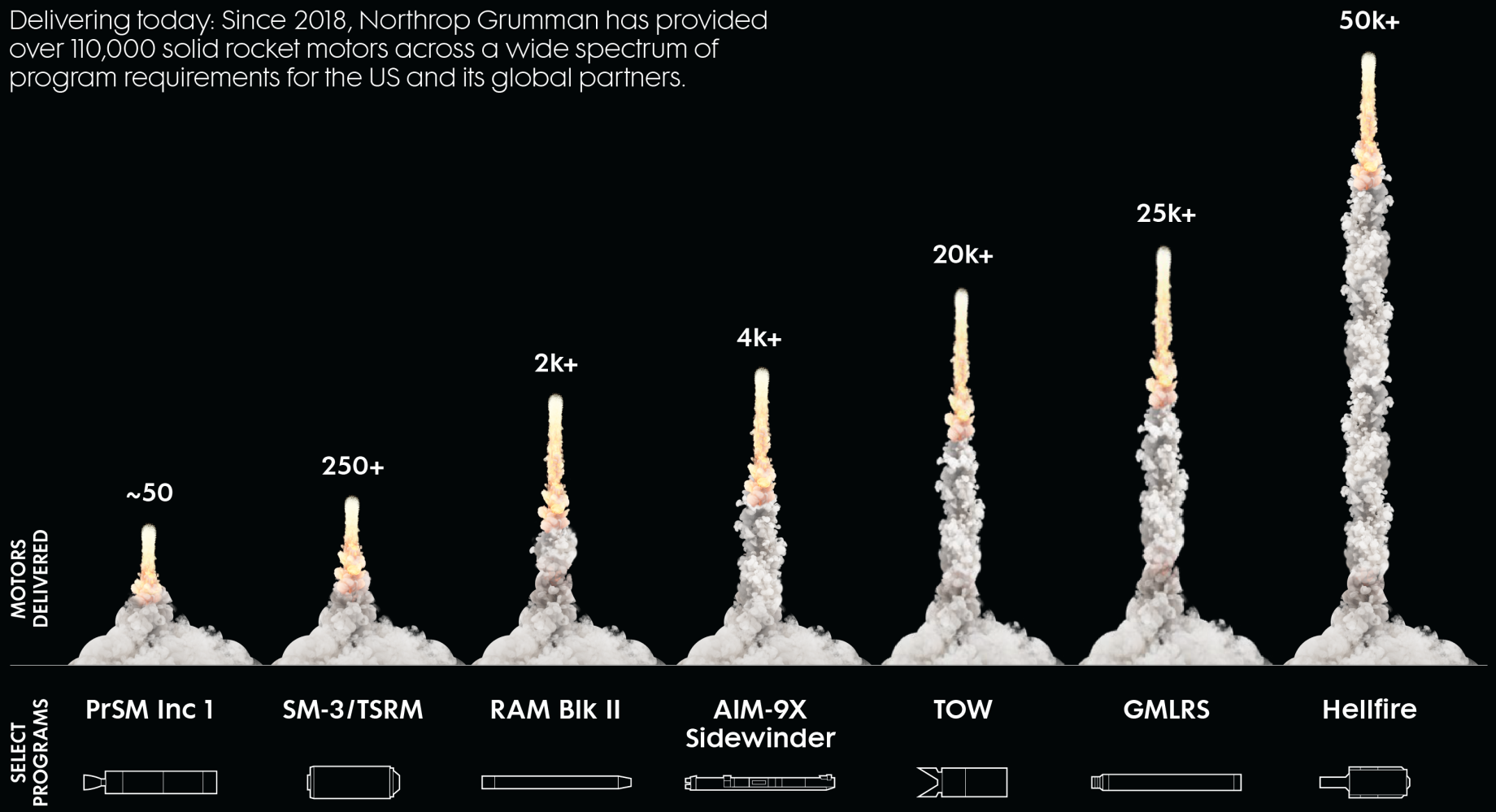
STRATEGIC MISSILES

Strategic-grade motors for Trident II (D5)
Minuteman III and Sentinel missiles

Solid rocket motors power exploration, defense, progress and growth.

Tactical Solid Rocket Motors

Delivering today: Since 2018, Northrop Grumman has provided over 110,000 solid rocket motors across a wide spectrum of program requirements for the US and its global partners.

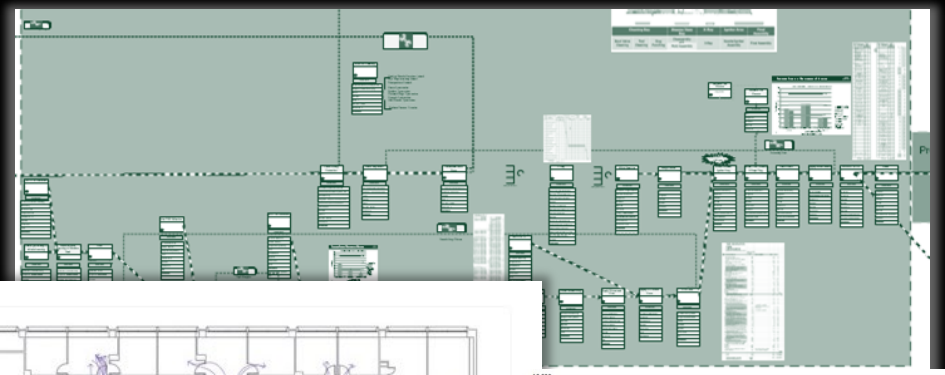


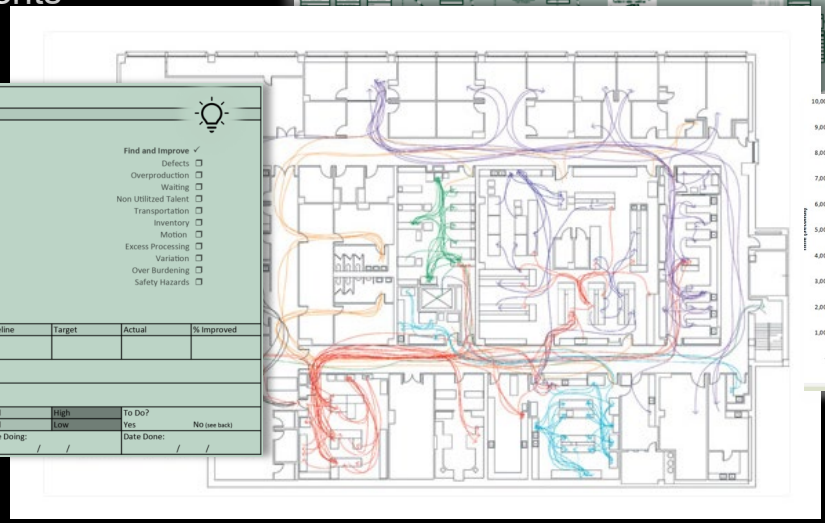
PROVEN PERFORMANCE | INVESTING IN CAPACITY | CONTINUOUS INNOVATION

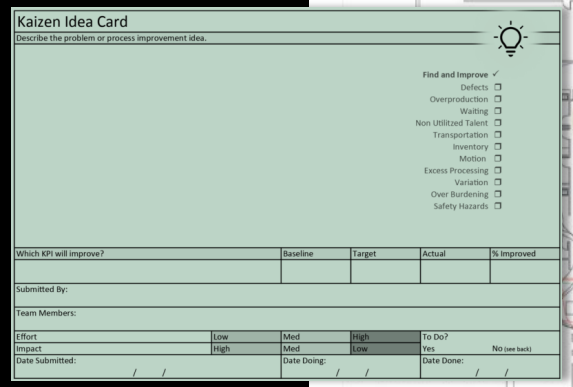
Capacity Planning & Execution

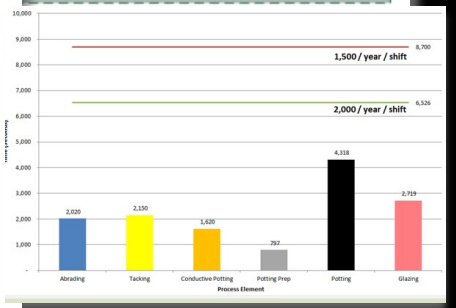
Capacity Planning (The Input Data)

- Understanding the Value Stream **(Value Stream Mapping)**
- Delivering Products based on Customer Demand **(Takt)**
- Optimizing System Performance with Continuous Flow **(Spaghetti Diagram & Kanban)**
- **Cycle Time & Lead Time** as Performance Measurements of Delivering Value
- Everyone is engaged in the process of Continuous Improvements & Elimination of Waste **(Kata & Kaizen)**









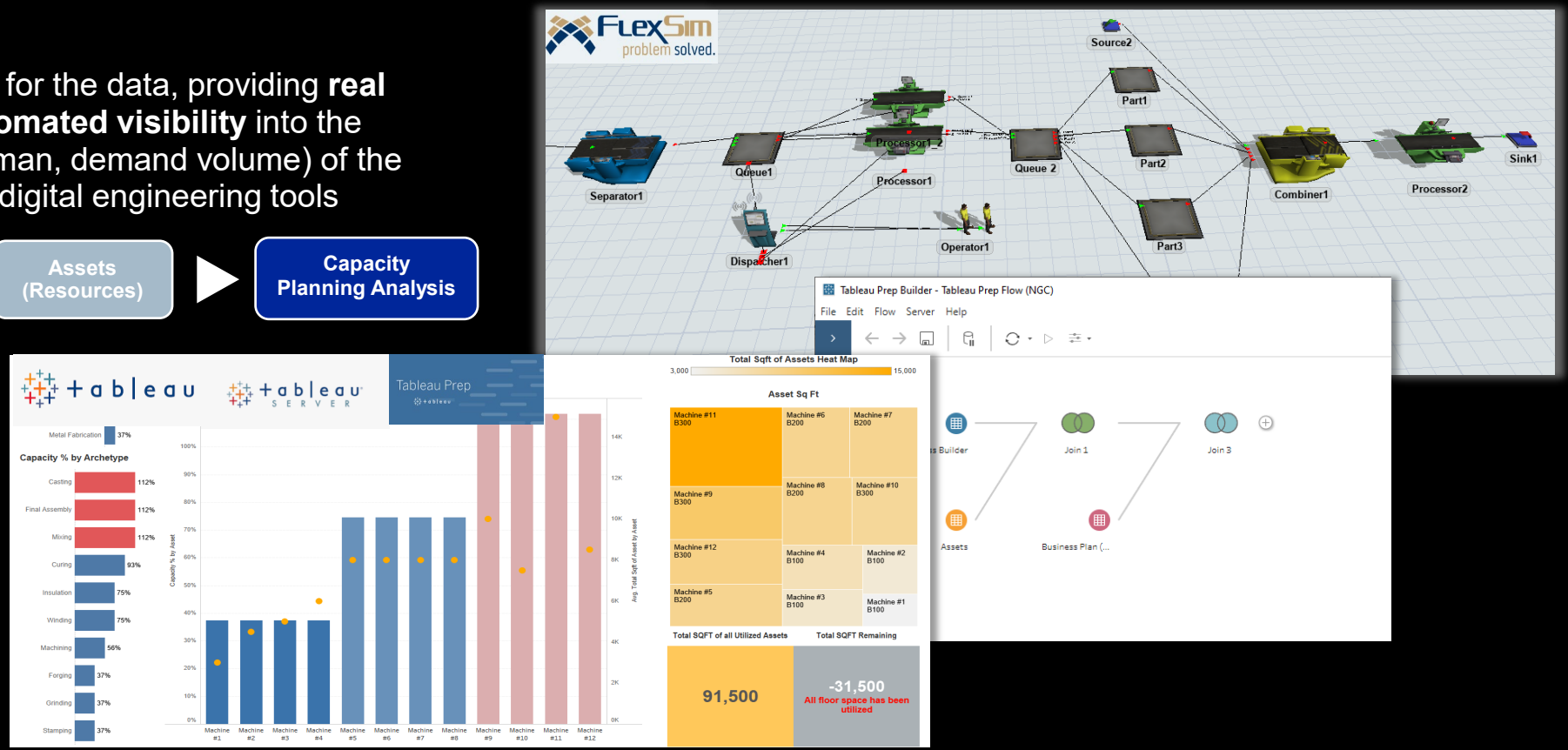
Capacity Planning consists of the application of framework tools as they apply to manufacturing, support and administrative processes

Capacity Planning & Execution

Capacity Planning (The Analysis)

- Enable a single source of truth for the data, providing **real time**, **instantaneous**, and **automated visibility** into the capacity (equipment, tools, human, demand volume) of the facility, utilizing state of the art digital engineering tools

Business Plan Data + **Processing Data** + **Assets (Resources)** ▶ **Capacity Planning Analysis**



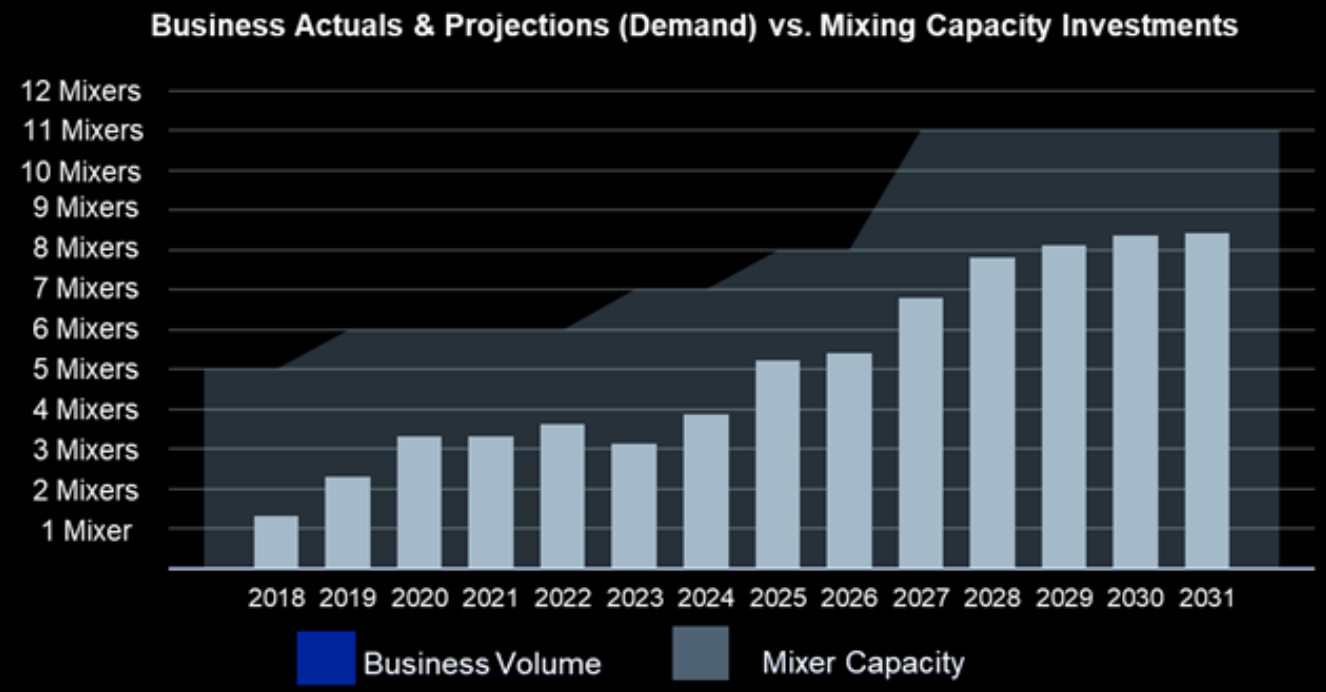
Enterprise-wide Implementation supports cross-site integration and maximizes utilization of available capacity, while supporting key insights to DoD regarding constraints & opportunities to meet the warfighter needs.

Investing in Capacity

Allegany Ballistics Laboratory (ABL) – *Rocket Center, WV*

Hypersonics Capability Center – *Elkton, MD*

Northrop Grumman is delivering proven solid rocket motors at scale today, investing in capacity to anticipate customer needs, and innovating for tomorrow.



Past and Projected Load and Capacity for NG Defense Rocket Motor & Warhead Manufacturing Facilities (Rocket Center, WV + Elkton, MD)

Since 2018, Northrop Grumman has invested over $1B in facilities across three states to increase ability to produce weapons and missile components, including solid rocket motors.

Conclusion

Northrop Grumman is heavily investing in modern and flexible solid rocket motor manufacturing infrastructure to meet our customer's growing needs

Expansion efforts are enabled through decades of experience and mature, data-driven, capacity modeling, which can be used to support Australia's Guided Weapons and Explosive Ordnance (GWEO) objectives