My prediction, about twelve years ago, that the attributes of “Light-Small-Simple-Fast-Smart and Strong” will permeate all of manufacturing turned out to be what still constitutes today’s manufacturing networks.

Then the “Lean” principles started to dominate the efforts on the production floors, followed by government mandates of “Green” and more recently “Blue” (minimizing energy consumption during production).

Spurred on by the need to become more fuel efficient, operate lighter, faster, safer, and lower the environmental footprint, the Aerospace industry, even more so than Automotive, has begun to turn to ever more advanced materials.
Innovative manufacturing processes have part material at the center of it all to secure parts, components, and subassemblies that can meet the stringent demands for increased strength, minimum weight, higher temperature resistance, less maintenance, lower noise level and safe, extended service life.

Given these characteristics and the necessary product changes and enhancements in form and function clearly moves advanced manufacturing from machine centered to material centered regimes.

Titanium, undeniably, is the material of choice for aircraft structures and engine parts. Be it as a single alloy or a stacked material for advanced fan and skin designs or the alternative material for the engine hot zone or the material of choice for landing gears.

High performance Ti-alloys such as 5553 or Intermetallics like TiAl for extreme applications also affect the supply chain vis-à-vis affordability and availability.
The energy and time it takes plus the overall cost to produce and supply the primary metal has the supply chain look for ways to secure reliable, more affordable secondary Ti-streams. Already about 48% of all titanium usage is recovered and recycled metal and its share is to be increased. Reliable collection, precise accounting, efficient distribution are at the center of innovative recycling processes. They consist of advanced technology and advanced systems to secure precise single alloy segregation, washing, accounting, monitoring, and accurate value streaming for its predetermined distribution cycle.

High performance material for high performance application meet high performance supplies for best practice in cost-quality-time.

-Dr. Erdel.
THE SHIFT TO MATERIAL-CENTERED MANUFACTURING
DRIVERS

• **Attributes**
  • Light, small, simple, fast and strong

• **Mandates**
  • Lean, Green, Blue

• **Requirements**
  • Fly faster, lighter, safer, smarter, more economical
  • Less environmental footprint, less maintenance

• **Advanced Materials**

• **Advanced Processes**
ADVANCED MATERIAL - ADVANCED PROCESSES

- Jet Engine Materials
  - Titanium
  - Super Alloys

- Jet Structure Materials
  - Titanium
  - Titanium Composites
  - GLARE
  - Super Alloys
THE 360 IMPACT ON MANUFACTURING

• Dramatically changing the way we:
  • manufacture and machine parts.
  • procure and supply material.
  • recover and recycle metal.
THE 360 IMPACT ON MANUFACTURING

- New generation metal alloys to meet higher physical demands.
- Concern about availability and cost of advanced metal alloys.
- Secondary stream of metal supply even more relevant ("no scrap left behind")
THE 360 IMPACT ON MANUFACTURING

• Search for:
  • **innovative** recovery and recycling processes.
  • **advanced** supply and distribution.
  • solutions of **100%** metal **return** into the supply chain.
TITANIUM INCREASE

1987

F-15E 49% Aluminum, 32% Titanium, 2% Composites, 11% Other

F/A-18E/F 31% Aluminum, 21% Titanium, 10% Composites, 29% Other

F-22 16% Aluminum, 24% Titanium, 21% Composites, 24% Other

Present

787 Dreamliner 39%
TECHNOLOGY BASED KNOWLEDGE
CLOSED MONITORING
ACCURATE ACCOUNTING
PRECISE INFORMATION 24/7
SEAMLESS INTERFACE
TRUE MARKET VALUE
CLOSED COMMUNICATION
RELIABLE SEGREGATION
REVERTS
ADVANCED SERVICES
IN REAL-TIME - 24/7, THUS SUBSTANTIALLY REDUCING COST, MITIGATING RISK, INCREASING YIELD.
INNOVATIVE TOOLING

Features of Ti-NAMITE-M include:

- high wear resistance
- reduced friction
- excellent prevention of cutting edge build up.

This coating provides superior material removal rates and tool life when used in high performance operations with difficult to machine materials like Titanium.

**Hardness (HV):** 3600  
**Oxidation Temperature:** 1150°C / 2100°F  
**Coefficient of Friction:** 0.45  
**Thickness:** 1-4 Microns (based on tool diameter)
MARKET OUTLOOK BY “ROSKILL”

• “…With the new generation of aircrafts from Airbus and Boeing using greater volumes of CFRP, which are compatible with titanium and not aluminum, titanium’s position as a key material in Aerospace is assured and growing…”

• “Aerospace accounts for half of the demand for titanium in the USA, Europe, and Russia, while industrial application dominate in Asia. These differentiated markets will be the main drivers behind a growth of 4.6% through 2018.”

• “Research continues into new, lower cost technologies for the machining of titanium metal…”
You cannot solve TODAY’S problems with YESTERDAY’S solutions and expect to be competitive TOMORROW.

- DR. BERT P. ERDEL