IMMS Science & Technology Gaps & Goals

Short-Term | Mid-Term | Long-Term Goals

2016	17	18	19	20	21	22	23	24	25	30	35	40	45	2050

High-Performing Mathematics, Computational Modeling, and Mechanics

- Near Real-Time Computation
- Real-Time (RT) Computation
- RT Virtual Multi-Scale M/S
- Bio-Computing & Processing
- Autonomous Real-Time Data Fusion and Analytics

Single Computing Power | Distributed Computing Power | Projected Computing Power

IBM: 2012	Titan: 2012	Tianhe2: 2013	BOINC: 2014	Folding: 2015	Cray, Inc: 2020	SNL: 2030	2050
16.0 PF	17.6 PF	33.9 PF	5.6 PF	25.2 PF	*ExaFLOPS*	*ZettaFlops*	*ZettaFlops +*

Bio-inspired Materials & Healing Mechanics

- Self-Sensing
- Failure Precursor (FP) Sensing
- Self-Energy Harvesting
- Lightweight & Adaptive
- Multifunctional (MF) Materials
- Living Skin for Next-Gen Structures

FP Identification & Characterization	*MF Materials & Manufacturing*	*Materials in Extreme Environment*	*Bio-inspired Materials Replication*	*Bio-Inspired Materials & Intelligence Enabler*	*Bio-Inspired Hybrid Systems*

Materials Genome Sequencing, Cloning, & Next-Gen Manufacturing

- Next-Gen "Fatigue-Free" Structural Prototype Using Additive Manufacturing
- Digital Nanomaterials Architecture (DNA) Sequencing Tools & Methods
- Beta
- Validation & Verification

Materials Property Mapping	*Materials Cloning a Reality?*	*Qualification*

Science of Failures and Intelligent Sensing Materials & Mechanics

- Progressive FP Tracking
- Physics-Based Models
- Sensing Network & Fusion
- RT Failure Precursor Capturing

Inadequate Failure Precursor Knowledge	*Sensing Materials/Systems*	*Failure Precursor Tracking*

Materials Property & Structure Performance Controls & Sustainment

- Tracked FP Properties
- Feedback Loop
- FP-Based Controls Systems
- Intelligent Material State Awareness

FP - Controls Interface	*Autonomous Feedbacks*	*Intelligent Reconfigurable Controls*	*Machine-Human Interactions*

Gaps, Goals, & Technologies after Next