MATERIALS, ENGINEERING & MAN - BENEFITS & RISK

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LEVEL OF MATERIAL PROPERTIES	ENGINEERING CAPABILITY	USAGE	BENEFIT	RISK	RELIABILITY
INTRINSIC Glass, Stone, Brick, Wood Native Cu, Sn, Au, Ag, Fe Natural Rubber/Glues	**PRE-INDUSTRIAL** Based on Experience (Guilds) Resolving Power - 1x (Eye) Little Understanding of Structure/Property Links	**LIMITED**	**LOW** in Life **HIGH** in Death	**LOW** to User **HIGH** to Maker/Tester **NIL** to Capitalist	**ACCEPTABLE**
		Mainly Utility Items Quality Variable With Status High Apparent Craftsmanship at Upper Echelon		*Caveat Emptor*	
ENHANCED BY ENGINEERING Vulcanised Rubber Stainless Steels Carbon Steels Large Castings Fusion Welding	**PRIMARY INDUSTRIAL (SMOKE STACK)** Basic Property Testing Resolving Power - 1000x (Microscope) Limited Structure/Property Knowledge Life Prediction Impossible Life Assurance by 'Factor of Safety'	**WIDE**	**HIGH** in Ease of Living **LOW** in Quality of Life **FAIR** in Death	**HIGH** to Workers **HIGH** to Operator **LOW** to Capitalist **HIGH** to Insurer	**LOW** (At Frontiers of Knowledge) • Titanic • Liberty Ships • Comet • Cleveland LNG
		Mass Production Craftsmanship Present - Often Bypassed by Poor Function/Performance		*Engineering Insurance*	
CONFERRED BY ENGINEERING Î Materials-Related Composites - Laminated Glass - Fibre and Particle Reinforced Shape Memory Alloys DS and SC Turbine Blades Electronic Materials Optical Materials Ï Processing/Fabrication Near-Net Shape Processing - Extrusions -Investment Casting - Semi Solid Forming Bonding Dissimilar Materials - Explosive Welding - Diffusion Bonding	**SECONDARY INDUSTRIAL (HIGH TECHNOLOGY MICRO-PROCESSOR CONTROL)** Sophisticated Testing Resolving Power - 1 atom (FEM) Deep Understanding of Structure/Processing/Property Relationships Defect Tolerant Design Fracture Control Plans	**GENERAL**	**'LUXURY'** Items Now Available Generally **JOY** of Ownership **LOW** in Death* (Fast Obsolescence)	**LOW** to Workers **LOW** to Operators **HIGH** to Capitalist **ACCEPTABLE** to Insurer	**HIGH/VERY HIGH** (Occasional Severe Human Error) • Alexander Kielland • Challenger • RO-RO Ferries
		Individual Craftsmanship Bypassed by High Quality Automation * Change From Spiritual Outlook to Materialistic One?		*Product Liability Insurance* *Loss of Profits Insurance*	