# INTRODUCTION TO COMPOSITES


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# COMPOSITES

- ***INTRODUCTION:***
- *A COMPOSITE IS A STRUCTURAL MATERIAL THAT CONSISTS OF TWO OR MORE COMBINED CONSTITUENTS THAT ARE COMBINED AT A MACROSCOPIC LEVEL AND ARE NOT SOLUBLE IN EACH OTHER. ONE CONSTITUENT IS CALLED THE REINFORCING PHASE AND THE ONE IN WHICH IT IS EMBEDDED IS CALLED THE MATRIX .*
- ***EXAMPLES:*** *CONCRETE REINFORCED WITH STEEL AND EPOXY REINFORCED WITH GRAPHITE FIBRES,*
- *NATURALLY LIKE WOOD.*

# NEED FOR COMPOSITES

- THE GREATEST ADVANTAGE OF COMPOSITE MATERIALS IS STRENGTH AND STIFFNESS

COMBINED WITH LIGHTNESS. BY CHOOSING AN APPROPRIATE COMBINATION OF REINFORCEMENT AND MATRIX MATERIALS, MANUFACTURERS CAN PRODUCE PROPERTIES THAT EXACTLY FIT THE REQUIREMENTS FOR A PARTICULAR STRUCTURE FOR A PARTICULAR PURPOSES

FOR EXAMPLE: GENERALLY USED FOR BUILDING S , BRIDGES, AND STRUCTURE SUCH AS BOAT HULLS , SWIMMING POOL PANNEL S ETC,. ALSO AS MULCH,SOIL AMENDMENT, USING COMPOST IN POTTING MIXERS, AND COMPOST TEA.

# ENHANCEMENT PROPERTIES OF COMPOSITE MATERIALS

1. **HIGH STRENGTH TO WEIGHT RATIO:** FIBER COMPOSITES ARE EXTREMELY STRONG FOR THEIR WEIGHT. BY REFINING THE LAMINATE MANY CHARACTERISTICS CAN BE ENHANCED.

**EX** SAY 3MM CHOPPED STRAND MAT IS QUITE FLEXIBLE COMPARED TO A 3MM PLY

2. **LIGHTWEIGHT**

**3.FIRE RESISTANCE:**A – FIRE RESISTANT AND FIRE RESISTAND

**4. ELECTRICAL PROPERTIES**

**5 . COLOUR**

**6. TRANSLUCENCY**

**7. DESIGN FLEXIBILITY**

**8 LOW THERMAL CONDUCTIVITY**

**9 MANUFACTURING ECONOMY**

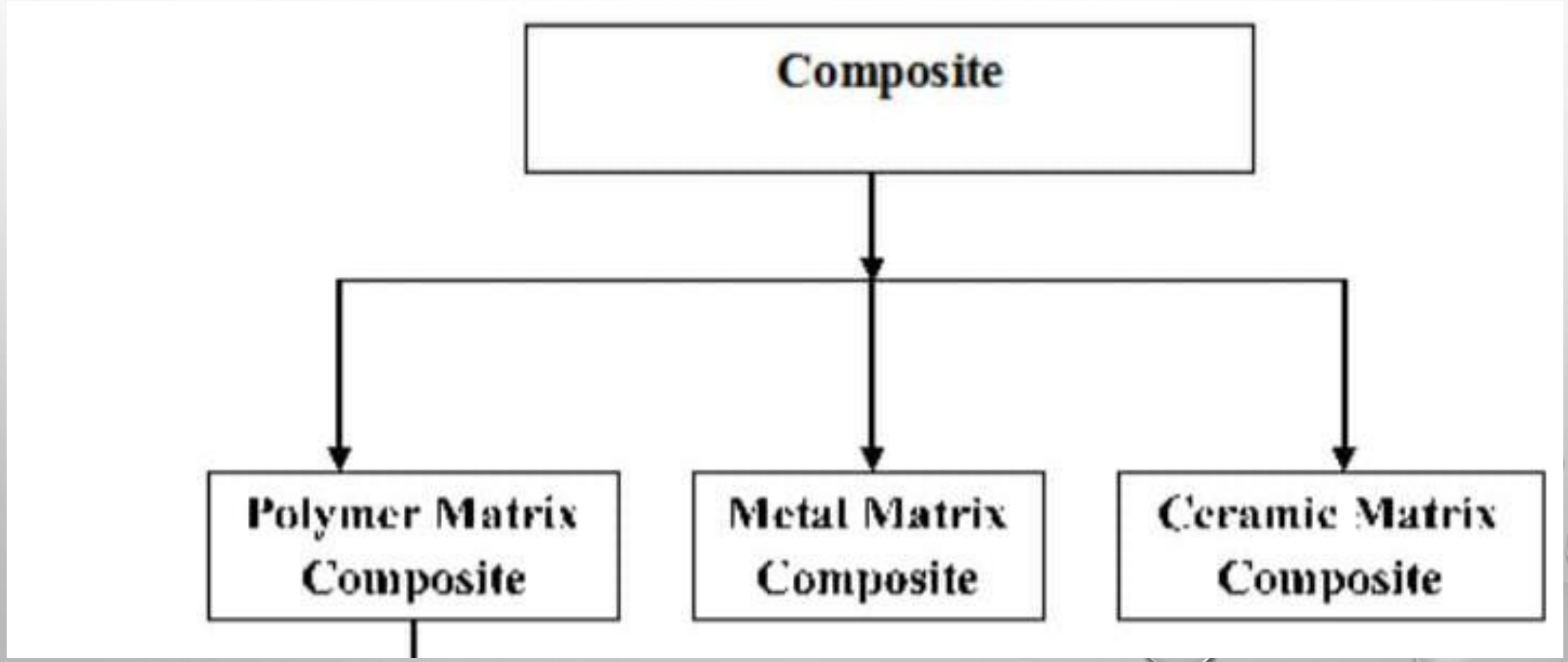
# ADVANTAGES

- LOWER DENSITY (20-40%)
- HIGHER DIRECTIONAL MECHANICAL PROPERTIES ( SPECIFIC TENSILE STRENGTH, RATIO OF MATERIALS STRENGTH TO DENSITY)4 TIMES GREATER THAN THAT OF STEEL AND ALUMINIUM.
- HIGHER FATIGUE ENDURANCE.
- EASY TO MACHINE,COST,IT CAN ALSO COMBINE WITH OTHER PROPERTIES (DAMPING AND CORROSION) VERSATILE. TOUGHNESS MORE THAN IN CERAMIC

# DISADVANTAGE S OF COMPOSITE MATERIALS

1. POLYMERIZATION SHRINKAGE
2. TECHNIQUE SENSITIVE
3. HIGHER COEFFICIENT OF THERMAL EXPANSION
4. DIFFICULT AND TIME CONSUMING
5. LOW MODULUS OF ELASTICITY
6. LACK OF ANTICARCINOGENIC PROPERTIES
7. STAINING AND COSTLY.

# CLASSIFICATION OF COMPOSITE MATERIALS



# Polymer Matrix Composite

**PMC IS A COMPOSITE MATERIALS COMPOSED OF VARIETY OF SHORT OR CONTINUES FIBRES BOUND TOGETHER BY A MATRIX OF ORGANIC POLYMERS.THESE ARE DESIGNED TO TRANSFER LOADS BETWEEN FIBRES OF A MATRIX.**

**FOR EXAMPLE: FIBER GLASS BOATS**

# METAL MATRIX COMPOSITES (MMC'S)

MATERIALS CONSISTING OF METALLIC MATRICES, REINFORCED WITH CERAMIC PARTICLES OR FIBRES ARE KNOWN AS MMC'S

THE VOLUME FRACTION OF THE REINFORCEMENT IS TYPICALLY IN THE RANGE 10-70%.

- MMC'S CAN OFFER A RANGE OF PROPERTY ENHANCEMENT OVER MONOLITHIC ALLOYS.

# CERAMIC MATRIX COMPOSITES (CMC'S)

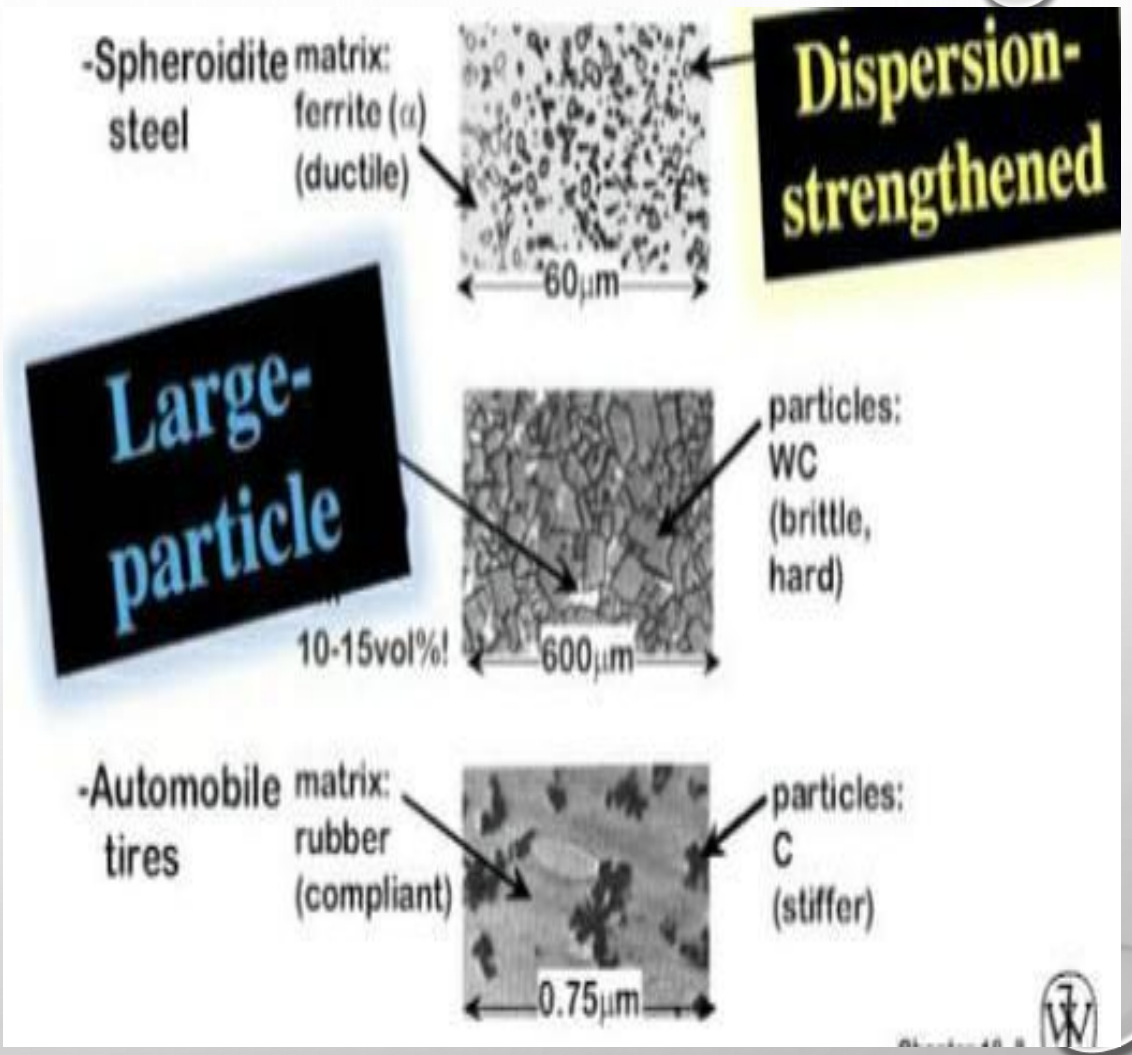
CMC’S ARE SPECIAL TYPE OF COMPOSITE MATERIALS IN WHICH BOTH REINFORCEMENT (REFRACTORY FIBRES) AND MATRIX MATERIALS ARE CERAMIC S.

CMC’S ARE MAINLY USED IN AEROSPACE SECTOR (GAS TURBINES) AND ENERGY SECTOR (HEAT EXCHANGER S, FUSION REACTOR WALLS)

# PARTICLES REINFORCEMENT COMPOSITES

PARTICULATE COMPOSITES CONSISTS OF A MATRIX REINFORCED WITH A DISPERSED PHASE IN THE FORM OF PARTICLES.THESE ARE THE LEY PARAMETER IN DETERMINING THE MECHANICAL BEHAVIOUR OF THE COMPOSITE.

EXAMPLE: <u>PORTLAND CEMENT</u>



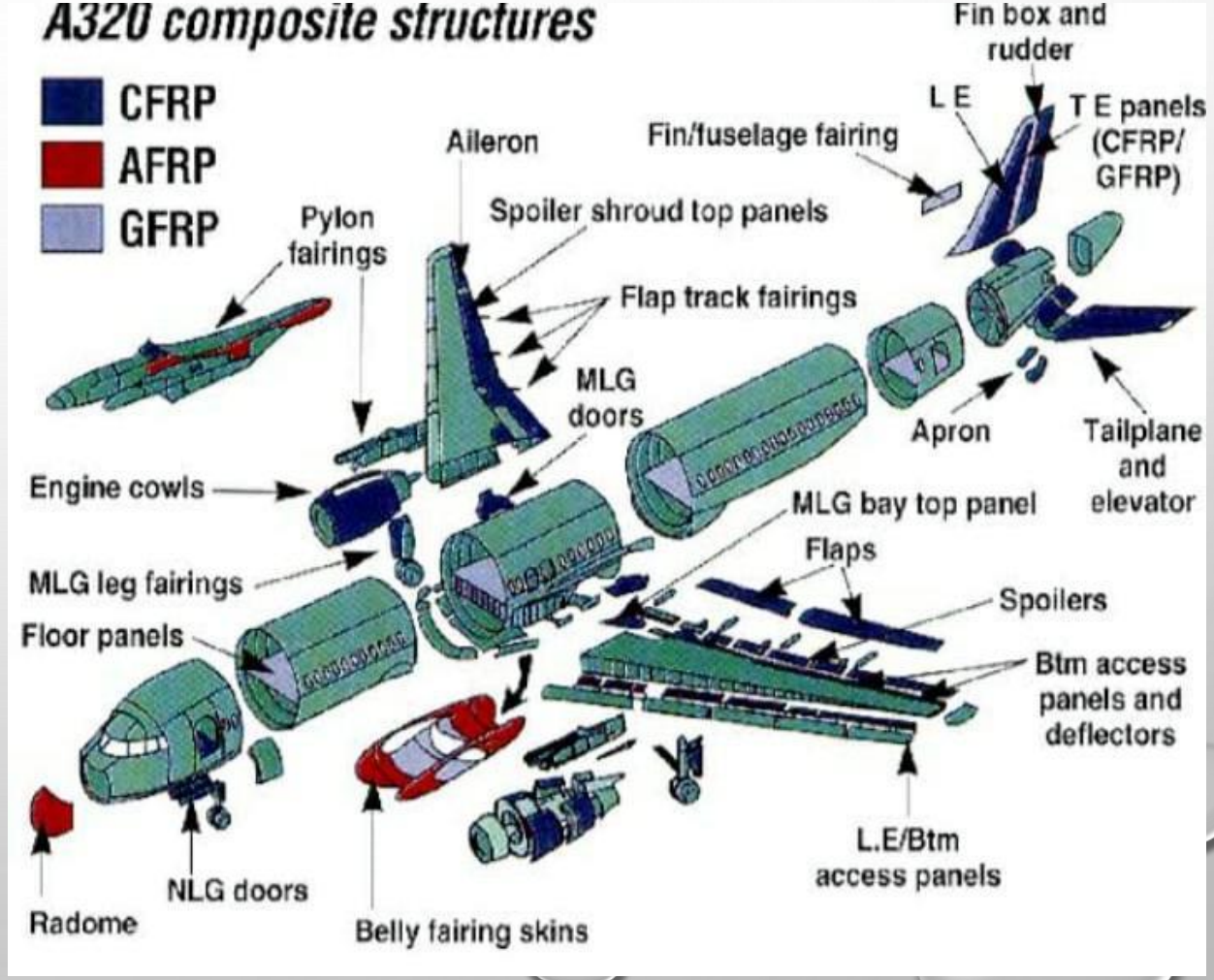
# FIBRE REINFORCED COMPOSITE MATERIALS

FIBRE REINFORCED POLYMER COMPOSITES CAN BE DEFINED AS “A MATRIX OF POLYMERIC MATERIAL THAT IS REINFORCED BY FIBRES OR OTHER REINFORCING MATERIALS”

SOME EXAMPLE LIKE – CARBON FIBRE,RESINS, NANOTUBES, NATURAL FIBRES, GLASS FIBRES ETC,.

# APPLICATION OF COMPOSITE MATERIALS IN VARIOUS FIELDS

1. **AEROSPACE:** USED IN ENGINE BLADES, BRACKET S, INTERIORS,NACELLERS, PROPELLER OR ROTORS,WIDE BODY WINGS AND SINGLE AISLE WINGS ETC,.



# IN AUTOMOTIVE S

WEIGHT REDUCTION IN AN AUTOMOBILE COMPONENTS EXHIBITED BY COMPOSITE MATERIALS INCREASED THE FUEL EFFICIENCY WITH REDUCED AUTOMOBILE EMISSIONS..IN ADDITION COMPOSITE MATERIALS OFFERS SAFETY AND COMFORT WITH IMPROVED VEHICLES PERFORMANCE DUE TO SUPERIOR MECHANICAL PROPERTIES OVER CONVENTIONAL MATERIALS.

# IN MEDICAL SECTOR

**BIOMEDICAL COMPOSITES HAVE BEEN INVESTIGATED FOR DIFFERENT ORTHOPAEDIC APPLICATION INCLUDING BONE FRACTURES REPAIRS, TOTAL JOINT REPLACEMENT (FOR KNEES ETC) AND REPAIR OF CONNECTIVE TISSUE SUCH AS TENDON AND LIGAMENTS.**

# IN SPORTS SECTOR

SINCE COMPOSITE MATERIALS LIKE CARBON FIBRE ARE SOO LIGHT, THEY **HELP IN IMPROVING THE ATHLETIC PERFORMANCE.**

TAKE CARBON FIBRE IN SPORTS LIKE TENNIS 🎾 ,AS AN EXAMPLE

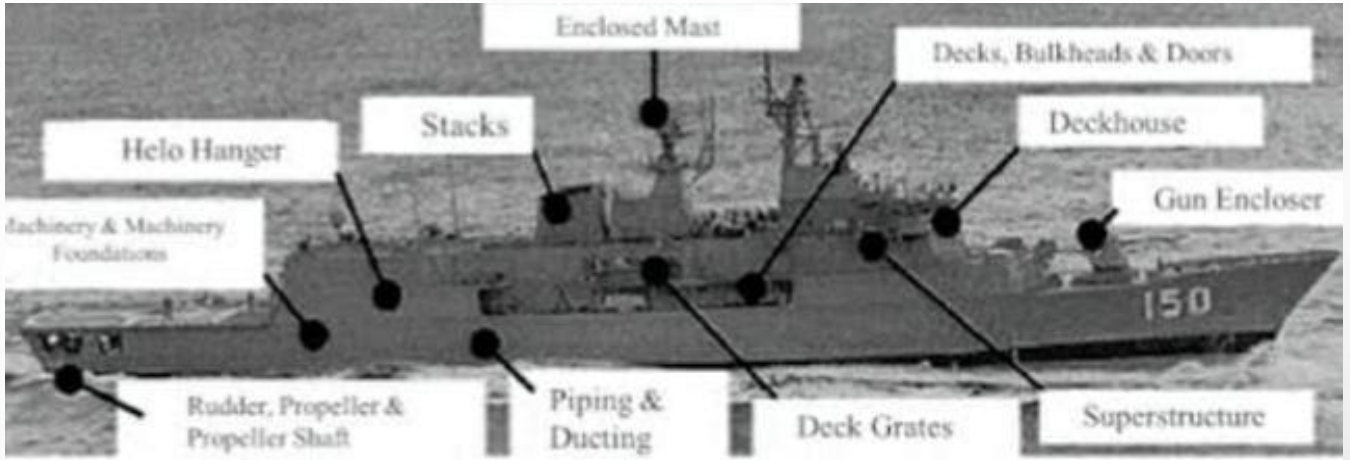
THE USE OF THESE COMPOSITES DRASTICALLY REDUCES THE WEIGHT OF TENNIS RACKET S, THIS REDUCES WEIGHT THAN MAKES IT EASIER TO RAISE THE RACKET

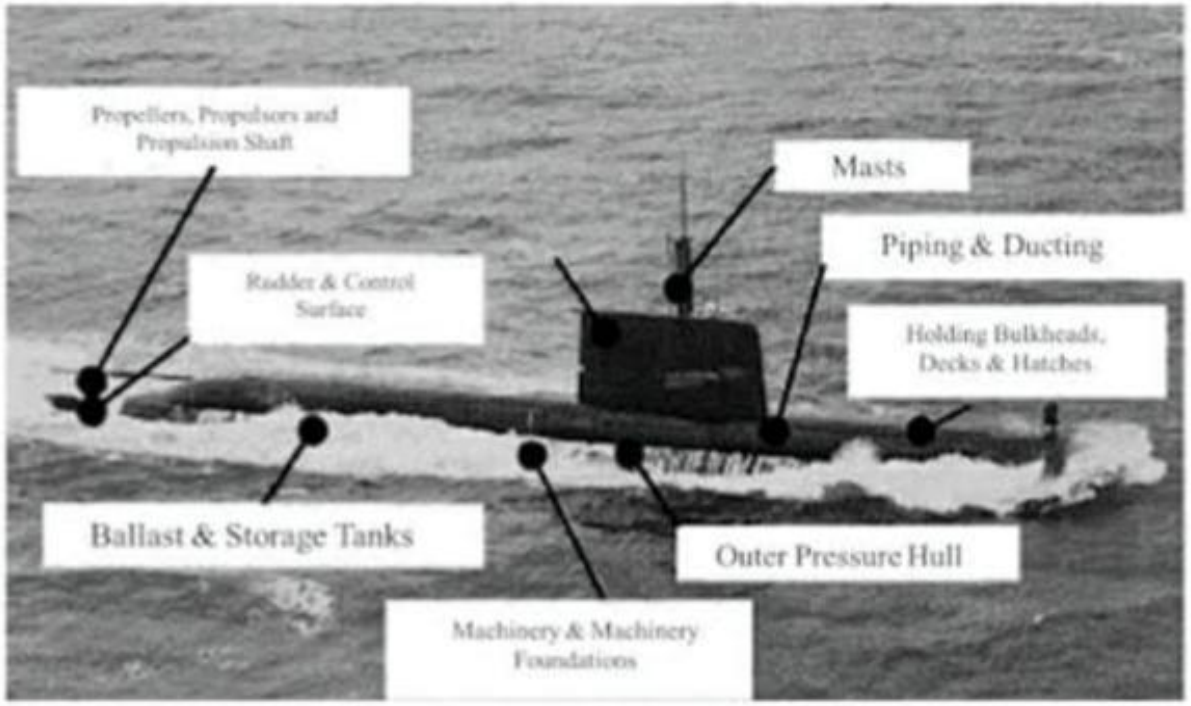
# IN MARINE INDUSTRIES

IN HIGH SPEED BOATS, FISHING BOATS,SHIP COMPONENTS, NAVAL VESSELS,SAIL BOAT ARE MANUFACTURED BY USING COMPOSITE MATERIALS.

THESE HAVE THE POTENTIAL TO REDUCE MAINTENANCE AND FABRICATION COST, REDUCES COMPONENTS WEIGHT,ENHANCE AESTHETIC APPEAL ETC,.

AND THE STRUCTURE LIKE HULLS, PROPELLER,HATCH COVERS, RAILINGS, VALVES,SONAR DOMES ETC,.



# THANKYOU