Marine production

- Production
  - Ships and offshore petroleum platforms
    - Production characteristics:
      - Middling levels of mechanization
      - Middling levels of flexibility
      - Low levels of standardization
      - High levels of planning complexity
  - 3 main 'areas' for ships
    - Hull
    - Superstructure
    - Machinery
    - See Fig. 3-4

- Production hierarchy
  - Fabrication of parts
  - Assembly of parts
  - Assembly of blocks
  - Erection of hull
  - Outfitting
  - See Fig. 3-2

- Fabrication and assembly of parts
  - Fabrication of parts is the first level of manufacturing
    - See Fig. 3-9
    - Work is grouped by stage and area.
    - Stages are plate joining (or not), followed by marking & cutting, followed by bending (or not).
    - Areas include parallel parts from plate, non-parallel parts from plate, internal parts from plate, parts from rolled elements, other parts such as pipes.
  - Part assembly is the second level of manufacturing
    - See Fig. 3-10
    - Stages are assembly.
    - Areas are sub-block part (e.g., welding brackets on a stiffener, and joining a rolled element to a built up piece.)

- Hull block construction method
  - Blocks
    - In production planning, a ship design might be broken down into "blocks".
    - The maximum block size should correspond to the maximum lifting capacity of the production facility.
    - The block sizes are of the same general size, weight and work content, although there can be variations.
    - Each block has to be structurally sound (to avoid the need for temporary supports).
    - The block size (and number of blocks) will influence the work flow and the work flow balance in the manufacturing process.
Sub-block assembly

- Assembly continues to sub-block assembly level
  - See Fig. 3.11
  - 'Stage' is assembly.
  - 'Areas' include similar work content in large or small quantities, for example, (e.g. stiffeners welded to plates).
  - Sub- and semi-block are similar in the sense that both describe units that are relatively small. These are likely to be done off the main process lanes and joined to the appropriate block.

Block assembly

- Block assembly is the next main manufacturing level.
  - It is usually done in a main process lane, unless special needs warrant a 'job shop' approach.
  - See Fig. 3.13
  - 'Stages' include plate joining, part assembly (e.g. welding stiffeners to flat plates), framing (e.g. longitudinal girders and transverse floors), and assembly of the block (e.g. welding the frames to the stiffened plates).
  - The example shown is for a flat plate area of the ship (the tank between the bottom and tank top of a cargo hold).

(block assembly level)

- More examples of the block assembly level
  - See Fig. 3.14, which shows the assembly of the top of a wing tank.
  - See Fig. 3.15, which shows another block assembly.
  - 'Areas' of block assembly include flat or curved panels (or units) that have no special needs and can therefore be manufactured on a main process lane, and flat or curved panels (or units) that have special requirements, such as jigs or supports, that require a 'job shop' approach.

- More examples of the block assembly level and block joining
  - Fig. 3.18 shows examples of blocks made up of flat plates.
  - Fig. 3.19 shows an example of a block that includes curved plates — in this case it's the bulbous bow of the ship.
  - See also Figs 3-20, 3-21, 3-22, 3-23.

Hull erection

- The hull erection is the final level of hull construction.
  - Areas include hull forward, cargo holds, machinery spaces, hull aft, and superstructure.
  - The stage is erection.