ETLS 509 - Validation & Verification
University of St. Thomas

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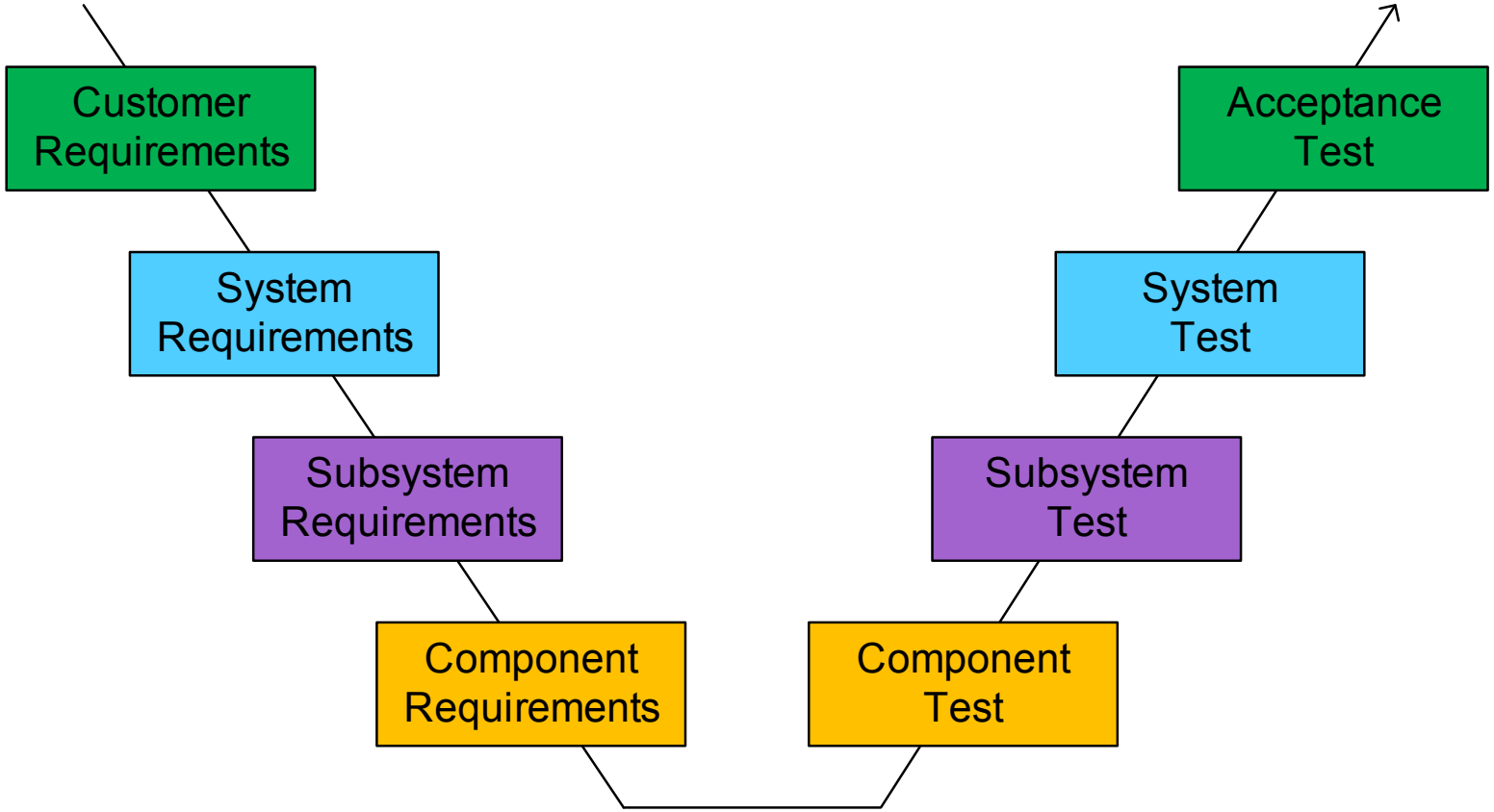
Outline

- **Integrated Logistics Support**

ETLS 509 - Session 10

- **Requirements Definition Logistics & Supportability**



Definition of Support

- **Support / Supportability / ILS**

  A composite of support considerations necessary to assure the effective and economical support of a system or equipment at all levels of maintenance for it's programmed life cycle. It is an integral part of all other aspects of system acquisition and operation.

from Blanchard

Integrated Logistics Support

- **Integrated Logistics Support (ILS) is the management and technical process through which supportability and logistic support considerations are integrated into the design of a system or equipment and taken into account throughout its life cycle. It is the process by which all elements of logistic support are planned, acquired, tested, and provided in a timely and cost-effective manner.[1]**
- **ILS is principally driven by a system's Reliability, Maintainability, and Availability (RMA)**
- **ILS can be a major cost driver in a system and has a major impact on systems design**

1 U.S. Department of Defense, 2005, Dictionary of Military and Associated Terms.

Supply Chain Management

- **Supply Chain Management**
  - is the management of the flow of goods, flow of cash, and flow of information internally and externally of a company or a group of companies that share the same value chain
  - Just in time (JIT) is a strategy for having material available, “just-in-time” versus caring inventory. Just-in-time manufacturing aims to reduce inventory costs as well as inventory space by having components arrive as close to when they are needed as is possible – one implementation approach for supply chain management
- **ILS focuses primarily on the support for systems when deployed, supply chain management tends to focus on the systems prior to this point.**

Basic Elements of Logistics and Maintenance Support

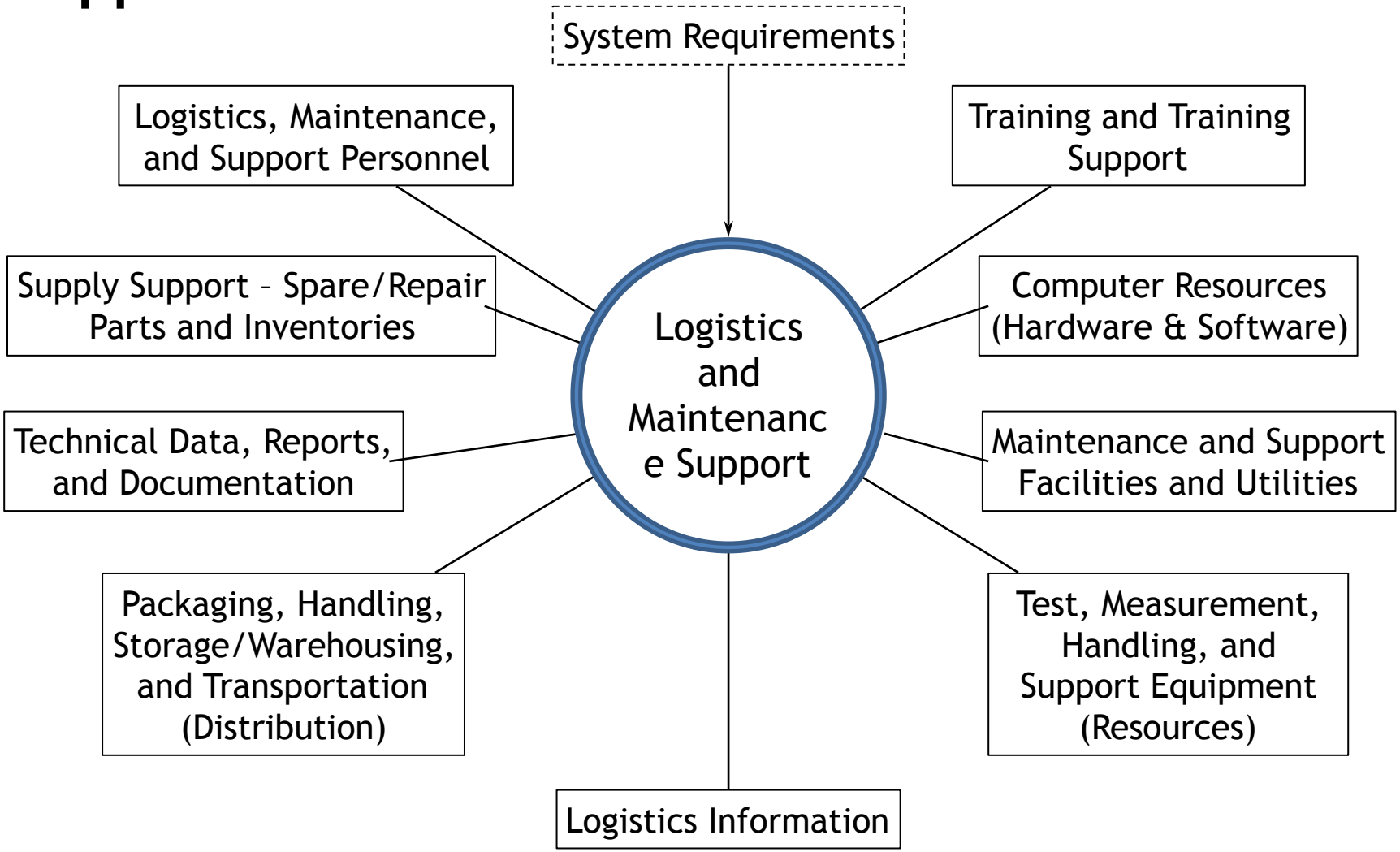
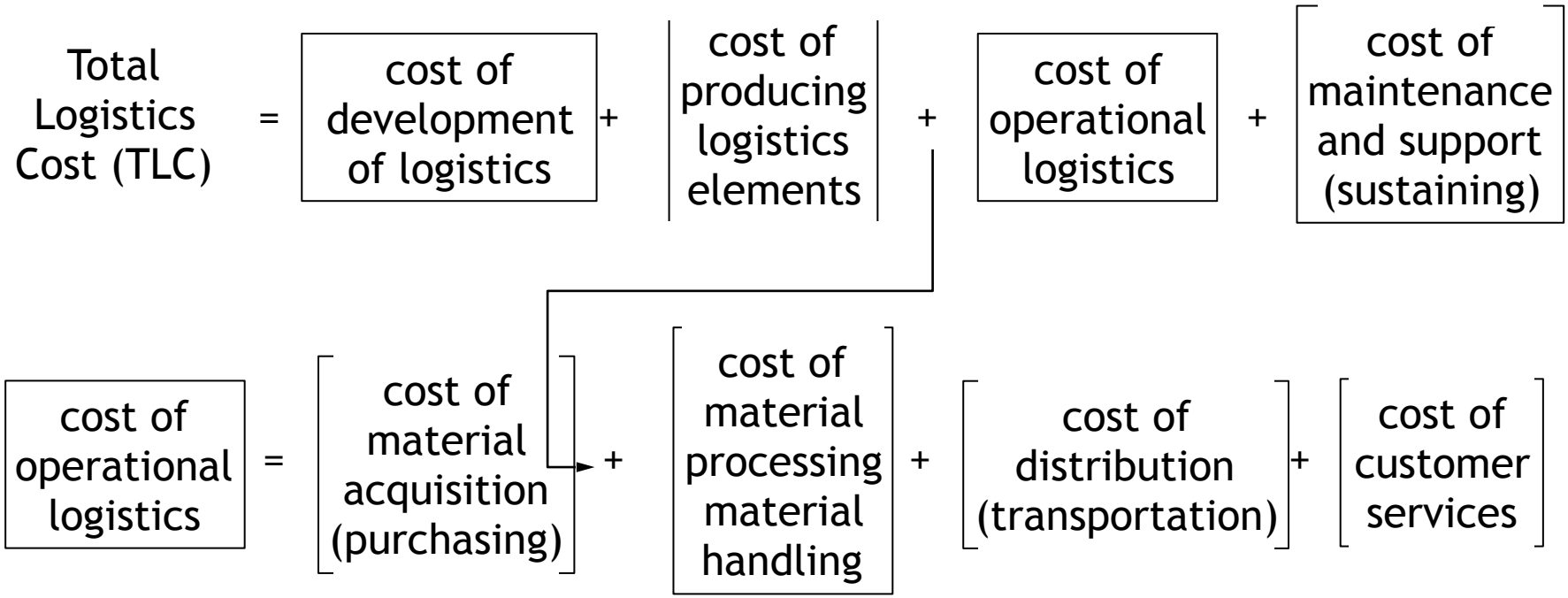


Figure 15.4 Blanchard

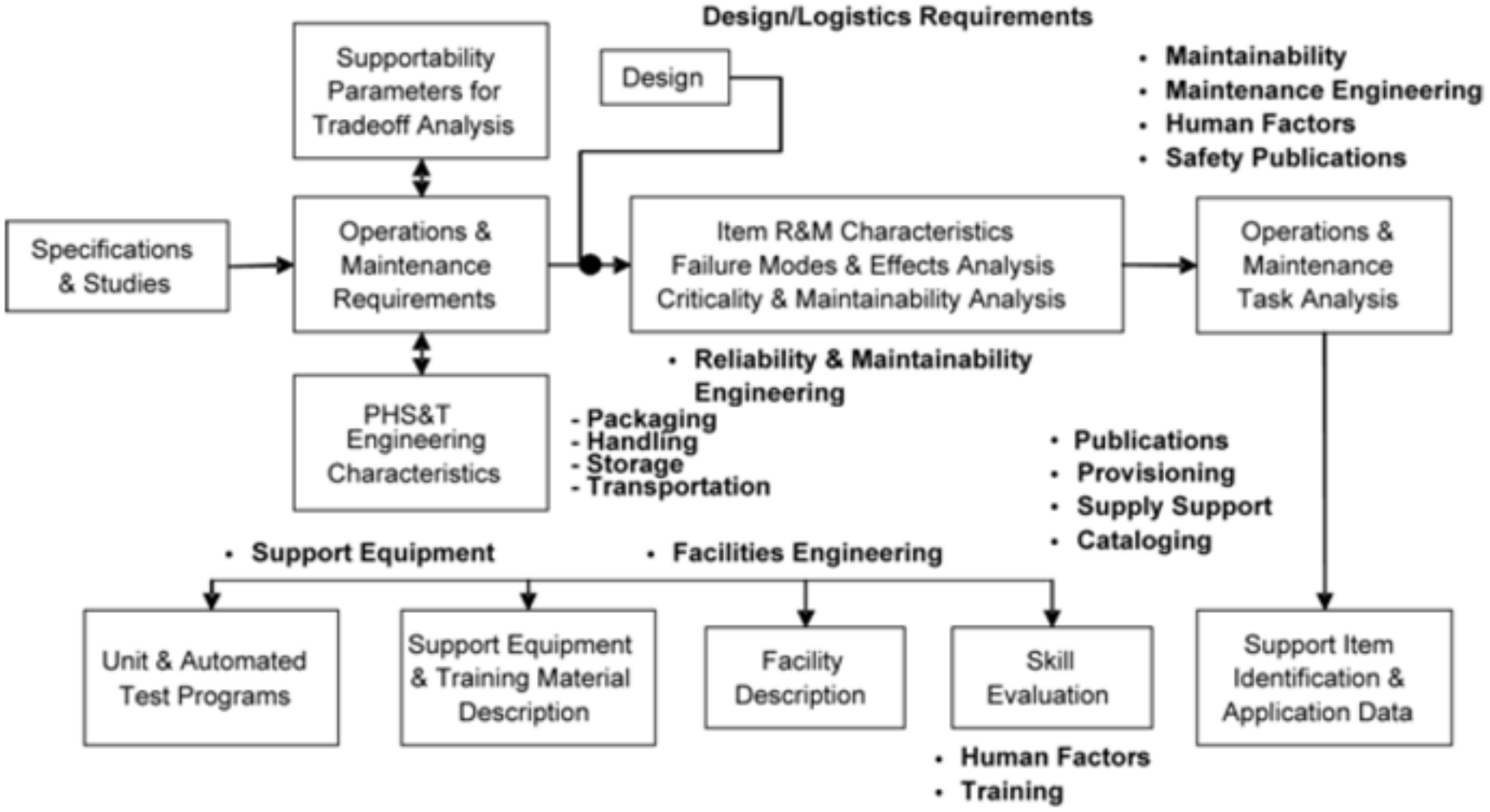
Logistics Cost

- **The cost of logistics can be a major factor in total system cost of ownership.**



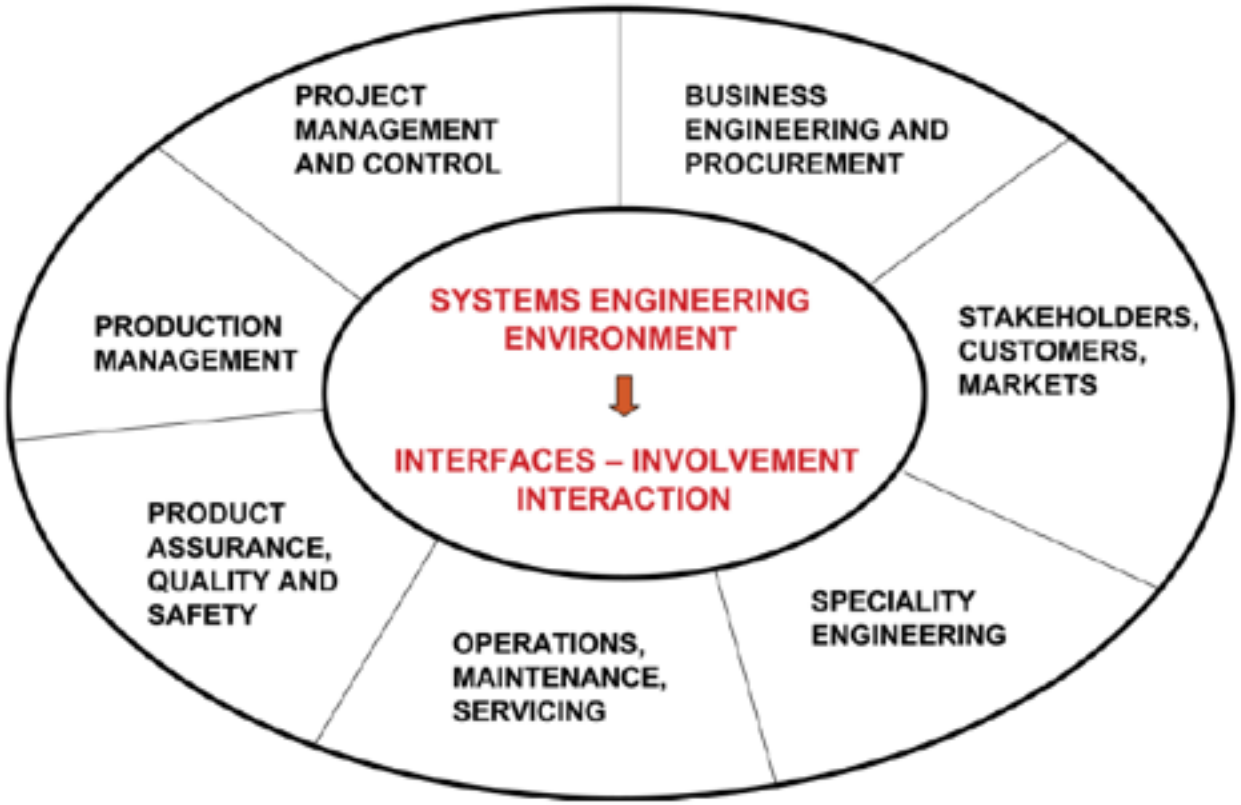
Equation 15.1 Blanchard

Logistics in the Acquisition Process



Systems Engineering Handbook Figure 9-1

Key Systems Engineering Interactions



How does ILS fit in?

Figure 4-1 INCOSE Engineering Handbook

Selected Technical Performance Measures for the Logistics & Support Infrastructure

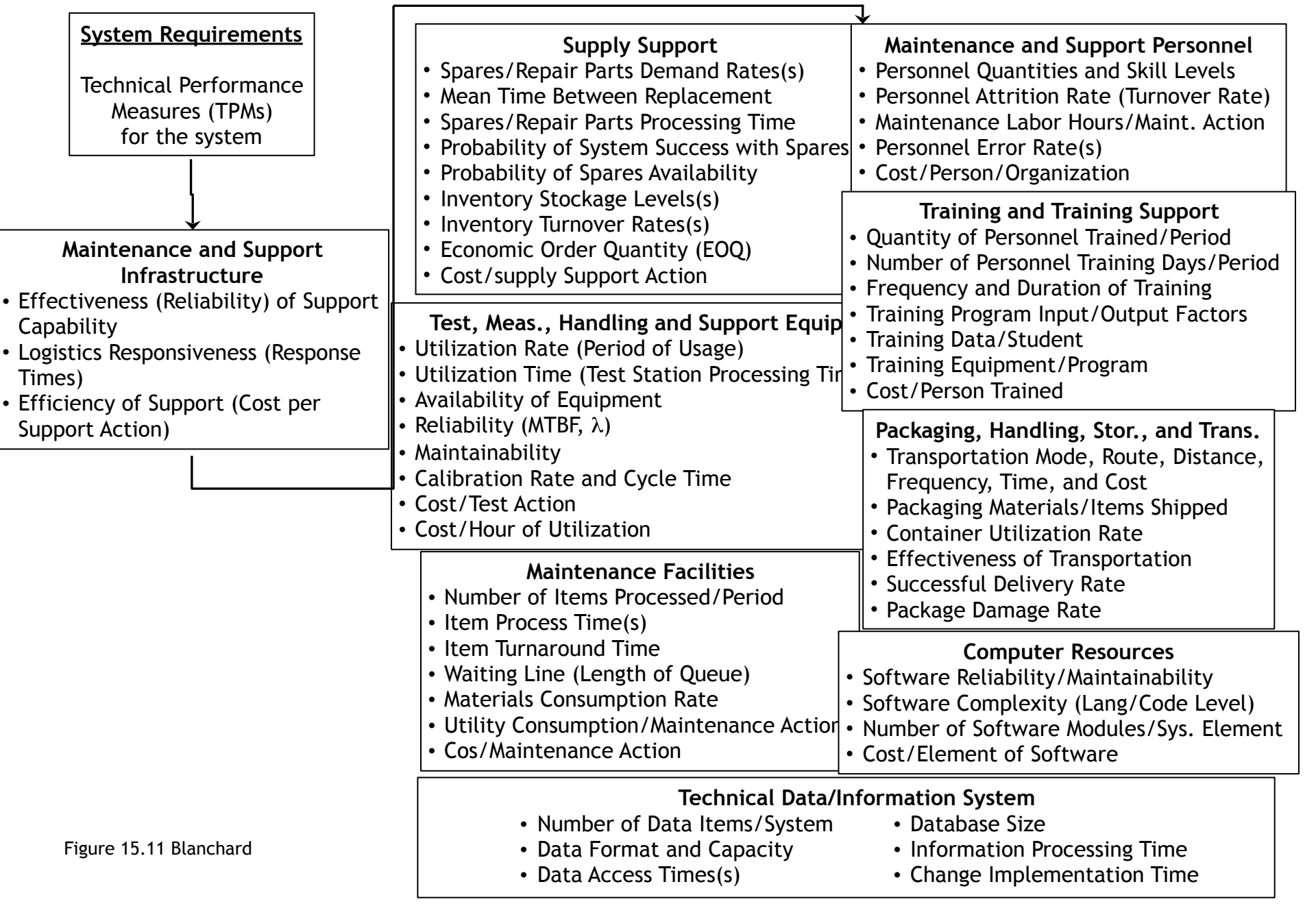


Figure 15.11 Blanchard

Classic Support / ILS disciplines

- **Very people centric part of system design –**
  - Maintenance Planning
    - Preventive – frequency & scope
    - Corrective
    - Conditional based maintenance tasks – what are the indications
    - Maintenance personnel skill requirements and staffing size
      - Training Requirements
  - Supply Support
    - Spare requirements (preventative, corrective, and condition based)
  - Technical Data Requirements
    - Form of technical data
    - Maintenance record requirements
  - Support & Test Equipment
  - Facilities
    - maintenance and training
  - Packaging, Handling, Storage & Transportation (PHS&T)
    - Special requirements, e.g., fuels, batteries, flammable lubricants, temperature constraints
  - Computer Resources Support
    - Test software
    - Data bases
    - Diagnostics
  - Other disciplines as needed
- **How do we verify and validate the support/ILS for a system?**

Supportability Analysis

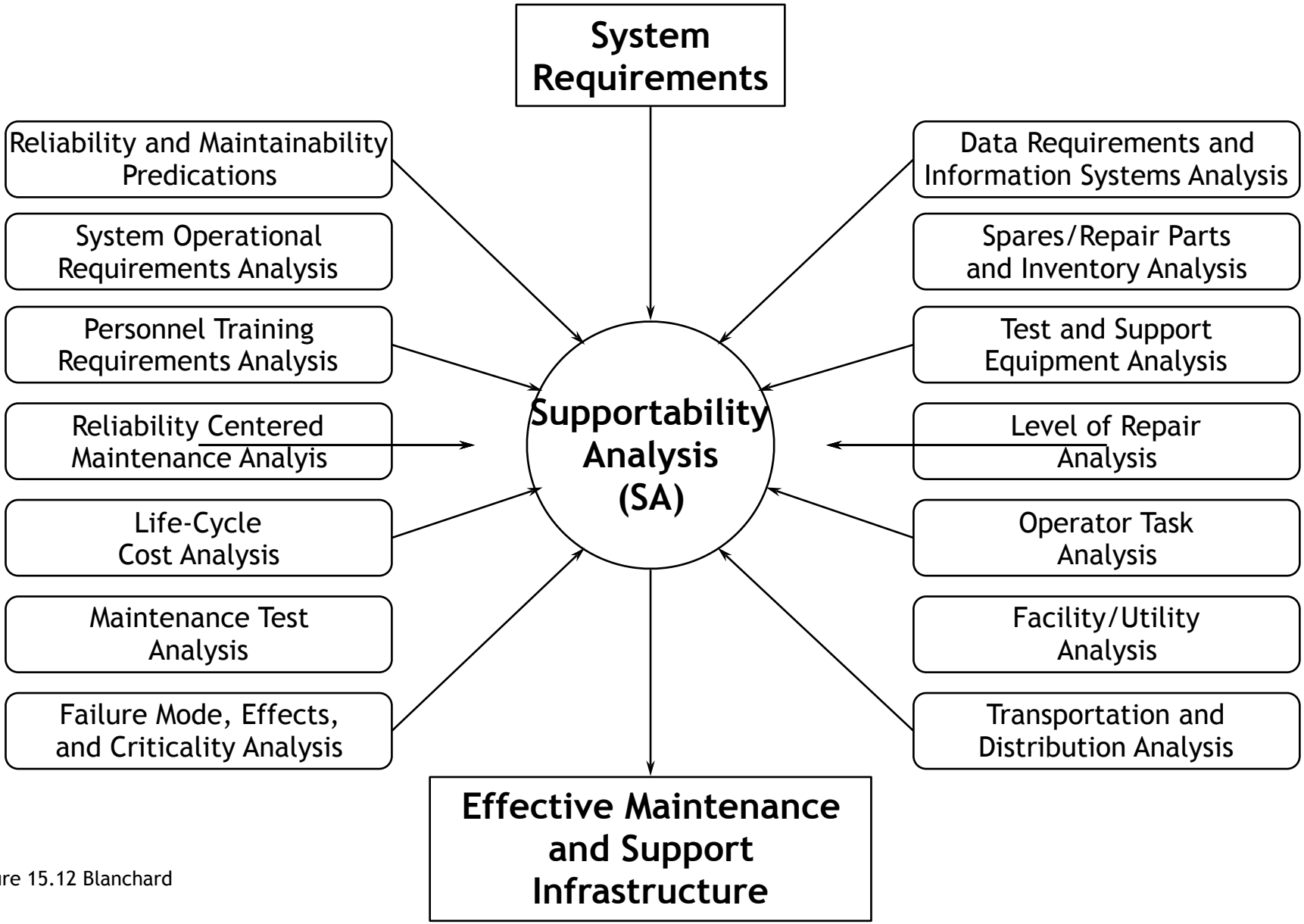
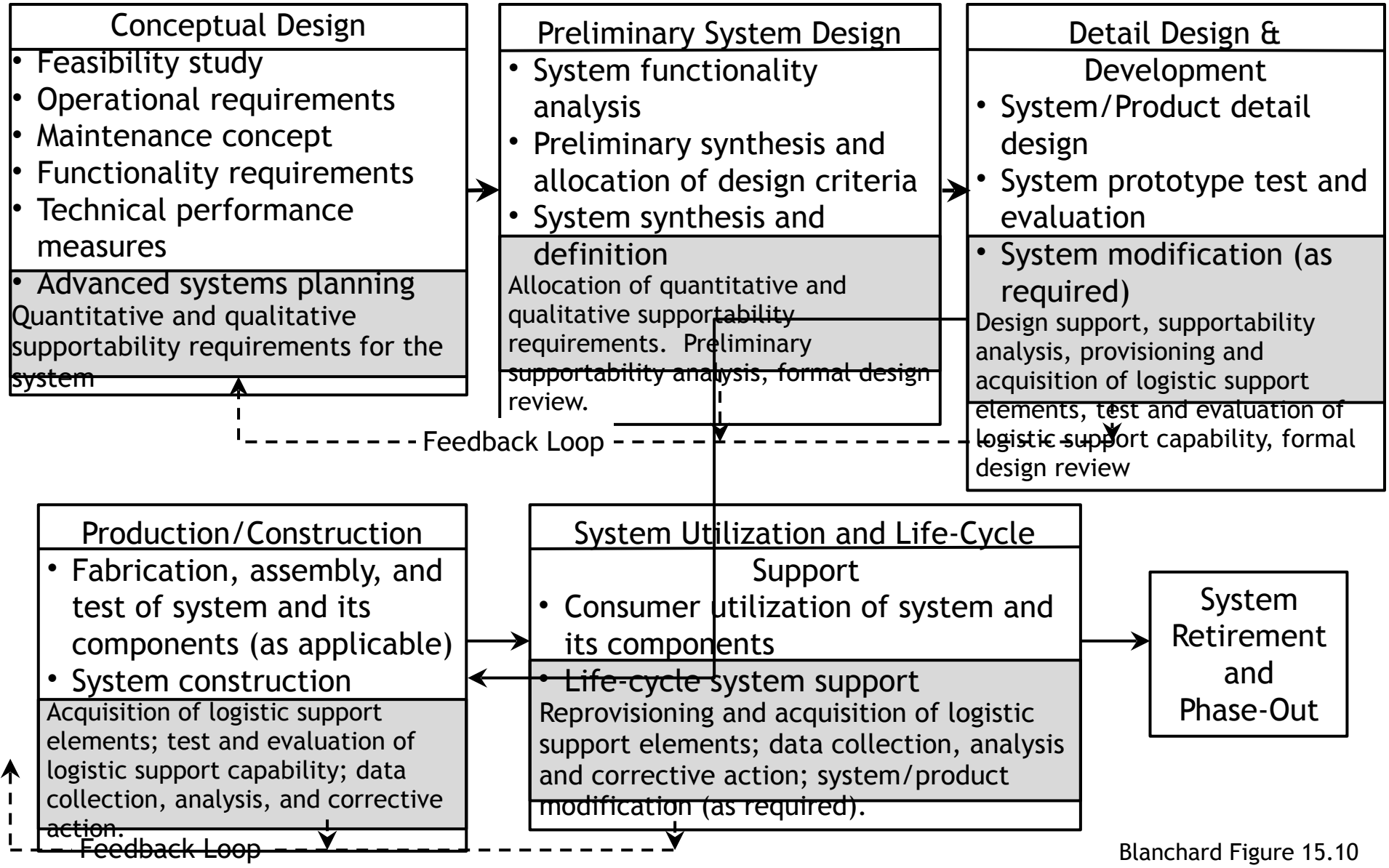


Figure 15.12 Blanchard

System Support Requirements

- **Develop a Support CONOPS**
- **Design for support / support the design**
- **When are support system requirements captured**
  - What are the driving forces behind support requirements
- **When writing requirements, what is the driving force**
- **What requirements are “shall” and what the implicit support requirements needed to meet the overall system measure of effectiveness (i.e., validating the system)**
- **Threshold and objective requirements to give the system design team room to make system trade-offs**

Logistics support in the System Life-Cycle



Blanchard Figure 15.10

ILS Impact on System Effectiveness

- **Recall that the probability that a system when used under stated conditions will operate satisfactorily is normally stated as availability**
- **Availability is determined by a system's reliability and maintainability**
  - Maintainability is impacted by the availability of maintenance staff and spare parts
    - Maintenance staff and spare part availability is part of logistics chain
- **A system that is not operational due to lack of support has a direct impact on the system effectiveness of that system**
  - A system that is not available will not be effective

777 Project

- **What are the Logistics and Supportability considerations for the 777?**
- **What are the maintenance levels of the aircraft?**
  - Line check – every flight
  - A check - performed approximately every 500 - 800 flight hours. It needs about 20 man-hours and is usually performed overnight at an airport gate.
  - B check - performed approximately every 4–6 months. It needs about 150 man-hours and is usually performed within 1–3 days at an airport hangar.
  - C check - performed approximately every 15–21 months or a specific amount of actual Flight Hours (FH) as defined by the manufacturer. The time needed to complete such a check is generally 1–2 weeks and the effort involved can require up to 6000 man-hours.
  - D check - occurs approximately every 5 years. It is a check that, more or less, takes the entire airplane apart for inspection and overhaul. Also, if required, the paint may need to be completely removed for further inspection on the fuselage metal skin. Such a check will usually demand around 40,000 man-hours and it can generally take up to 2 months to complete, depending on the aircraft and the number of technicians involved. It also requires the most space of all maintenance checks, and as such must be performed at a suitable maintenance base. Given the requirements of this check and the tremendous effort involved in it, it is also the most expensive maintenance check of all, with total costs for a single visit being well within the million-dollar range.

- **21st Century Jet - Making the Boeing 777 2-3**
- **British Airways Boeing 747-400 in D-Check (http://www.youtube.com/watch?v=x_yHtfGH0nI)**