THE FUTURE OF VERY LARGE SUBSONIC TRANSPORTS
R. Steven Justice,
Anthony P. Hays, & Ed L. Parrott
Advanced Design
Lockheed Martin Aeronautical Systems
VLST - Past & Present

Dornier Do X (1929)

Saunders-Roe S.R. 45 Princess (1952)

Boeing 747 (1969)
Today's Situation

◆ Slot Limits At Existing Airports
◆ Traffic Growth Outpacing New Airport Development
◆ Bigger Aircraft Required To Increase System Capacity & Productivity
◆ Heavy Airlift Military Aircraft To Be Replaced In Early 21st Century

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Airport Congestion

Kennedy International Airport

International Passengers Vs Aircraft Movements

- SCH INT PAX
- SCH INT A/C

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How Did We Get Here?

- No Significant Increases In Aircraft Capacity Since Early 1970's

Aircraft Size Growth Since 1940
VLST Missions

- Passenger Transport
  - 600 to 800 Passengers Over Global Distances

- Commercial Freighter
  - 6.5% Annual Cargo Growth
  - Increased Use Of ISO & Intermodal Containers

- Military Airlift
  - Payload Of C-5 Over Global Distances
Key Design Challenges

- Size Issues & Constraints
  - Clearances At Gates, Taxiways, & Runways
  - Ground Loading & Floatation
- Increased Aircraft Separation Requirements
  - Increased Power In Wing Vortex
  - Increased Separation Will Reduce Aircraft Throughput At Airport
Key Design Challenges

- Taxiway Clearance

[Diagram showing taxiway clearance with dimensions and overlap]

PANY&NJ Aviation Department

Lockheed Martin
Key Design Challenges

- Loading & Servicing
  - Compatibility With Current Gates
  - Servicing Vehicle Congestion
  - Longer Time Required For Loading & Servicing
Key Design Challenges

- Ground Support

"Airport Support", December 1994
Key Design Challenges

- Gate Compatibility
Key Design Challenges

- Emergency Systems
  - Emergency Exit/Slide Height
  - Passenger Escape From Emergency Site
  - Emergency Systems Must Handle Up To 1,600 Victim Event (2 Aircraft)
Key Design Challenges

- Aircraft Noise Requirements
- Fabrication Of Large Composite Structures
- Control Of A Large Flexible Structure
Enabling Technologies

- Fly-By-Light/Power-By-Wire
- Active Control Systems
- Simple, Effective High Lift Systems
- Laminar Flow (Hybrid & Natural)
- Flight Deck Systems
- Modular Design

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Options For VLST

BOEING 747-400F
- Span: 212 ft
- Length: 231 ft
- Maximum Payload: 280,000 lb

LOCKHEED VERY LARGE AIRPLANE
- Span: 264 ft
- Length: 264 ft
- Maximum Payload: 200,000 lb

MCDONNELL DOUGLAS
BLENDED WING-BODY
- Span: 207 ft
- Length: 172 ft
- Maximum Payload: 200,000 lb

LOCKHEED SPANLOADER
- Span: 243 ft
- Length: 236 ft
- Maximum Payload: 600,000 lb

AIRBUS SUPER
TRANSPORTER
A380-600ST
- Span: 237 ft
- Length: 260 ft
- Maximum Payload: 700,000 lb

MOLNIYA 1000 HERACLES
- Span: 257 ft
- Length: 290 ft
- Maximum Payload: 900,000 lb

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Options For VLST

- Sea Based Vehicles
  - Conventional Seaplane
  - Wing In Ground-Effect (WIG)
- No Runway Construction
- Use Existing Cargo Port/Terminals
- Increased Emergency/Alternate Landing Sites
Options For VLST

- Lockheed/Dornier Sea-Based VLST
  - 3,500 Nm Range With 882k lb Payload
  - 2.2M lb MTOW
Options For VLST

- Lockheed Martin Sea-Based WIG
Who Will Build The VLST?

- McDonnell Douglas
- Boeing
- AIRBUS
- Lockheed Martin
LMAS VLST

1.4 Million Pound Takeoff Weight
282 ft Wing Span (211 ft Folded)
262 ft Length
4 GE90, RR Trent, Or PW4000 Class Engines
3,200 Nm Range With Over 400k lb Payload
Comparison To C-5
LMAS VLST

- Passenger Layout (950 Passengers)
LMAS VLST

- Cargo Layout (16 ISO 40 ft Containers)

[Diagram of cargo layout]
LMAS VLST

- Low Wing Concept
LMAS VLST

- Blended Wing/Body Concept
Routes That Could Use A VLST Today

- London - Tokyo
- London - Hong Kong
- London - Singapore
- New York - London
- New York - Paris
- New York - Frankfurt
- Tokyo - San Francisco
- Tokyo - Los Angeles
- Tokyo - Honolulu
- Hong Kong - San Francisco
**VLST Market**

(By 2010)

- Big Enough For More Than One Aircraft?

<table>
<thead>
<tr>
<th>Region</th>
<th>Quantity</th>
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<tbody>
<tr>
<td>Asia/Pacific</td>
<td>160-200</td>
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<tr>
<td>USA</td>
<td>70-100</td>
</tr>
<tr>
<td>Europe</td>
<td>50-70</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>280-370</strong></td>
</tr>
</tbody>
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(British Airways Forecast)
How Much Money?

• $8-15 Billion Development Cost
  – More Than One Company Can Handle

• $200-300 Million Unit Cost
  – Larger Than Annual Profits For Many Airlines
  – Unlikely To Be Internally Financed By Airline & Leasing Companies
  – Resulting High Capital Cost For Operator
Summary

- VLST Is Technically Possible Now
- Airline Interest Has Decreased Recently Due To Financial Difficulties
- Major Aircraft Manufacturers Are Poised To Act Once Economics Improve
VLST - Argosies Of The Sky!

“For I dipt into the future, far as the human eye could see,
Saw the Vision of the world, and the wonder that would be;
Saw the heavens fill with commerce, argosies of magic sails,
Pilots of the purple twilight, dropping down with costly bales.”

Lord Tennyson