Installed Base Management Opportunity

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Executive Vice President
Customer Support
Installed Base Management
Key messages

Installed Base revenue is expected to grow ~12% CAGR (2020-2025) with a value-based service model plus productivity and performance upgrades.

As Lithography is the constraint in the fab, maximizing good wafers per day is key to optimizing fab capital asset utilization and increasing customer return on investment.

Customer service value depends on three fundamentals:
- High availability and minimal long-term downs
- Lowest possible service cost per wafer
- Maximum good wafers per day

Upgrades provide an efficient means of improving system output and extending the useful life of the tool for future nodes.
• Installed Base business growth

Maximizing service value
- High availability and minimal long-term downs
- Lowest possible service cost per wafer
- Maximum good wafers per day

Extending useful life of equipment through upgrades
Installed Base revenue is a growing portion of ASML business
Installed Base revenue expected to grow ~12% CAGR (2020 – 2025)

* 2021 financials externally published results/outlook, 2025 financials investors’ day
Services and upgrades extend value and life of tool
Over DUV tool lifetime Installed Base revenue is ~130% of system sales

Example: NXT:1960Bi

- **System revenue**
- **Service revenue**
  - Service contract for scanner and laser, service on optics, relocations
- **Upgrades / Options revenue**
  - Performance, productivity & lifetime extensions

Over DUV tool lifetime Installed Base revenue is ~130% of system sales.
Installed Base business growth

• **Maximizing service value**
  - High availability and minimal long-term downs
  - Lowest possible service cost per wafer
  - Maximum good wafers per day

Extending useful life of equipment through upgrades
Fabs are designed with lithography as the constraint. Increasing litho availability increases customer return on investment.

Litho is the fab constraint by design. Improvement in litho availability yields significant improvement in overall Fab capital asset utilization due to rest of Fab having buffer capacity:

<table>
<thead>
<tr>
<th>Fab type</th>
<th>Volume (starts/month)</th>
<th>Estimated capital expenditure total (fab + equipment)</th>
<th>1% improvement in Fab capital asset utilization</th>
</tr>
</thead>
<tbody>
<tr>
<td>DUV Logic</td>
<td>100k</td>
<td>€16B</td>
<td>€160m</td>
</tr>
<tr>
<td>EUV Logic</td>
<td>100k</td>
<td>€24B</td>
<td>€240m</td>
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</tbody>
</table>

Source: Capital expenditure from ASML Market Research.
Fabs are designed with lithography as the constraint. Increasing litho availability increases customer return on investment.

Litho is the fab constraint by design. 1% improvement in litho availability yields significant improvement in overall Fab capital asset utilization due to rest of Fab having buffer capacity.
Fabs are designed with lithography as the constraint. Increasing litho availability increases customer return on investment.

Source: Capital expenditure from ASML Market Research

Reducing long-term downs reduces need for excess capacity in non-litho workstations which saves capital expenditure. 50% reduction in long-term downs potentially reduce buffer capacity by ~10%-15%:
Customer service value depends on three fundamentals:

- High availability and minimal long-term downs
- Lowest possible service cost per wafer
- Maximum good wafers per day
High availability and minimal long-term downs

**DUV**: mature platform with >97% average availability. 1%+ availability improvement still possible

**EUV**: relatively immature platform with larger opportunity of 7%+ availability improvement

Key improvements:

- Design improvements
- Software upgrades
- Using technology to service our systems
- Parts and tools availability
- Operational improvements: site-to-site benchmarking
Lowest possible service cost per wafer

- Perfecting the machine (closed-loop feedback process to perfect the parts, tools and service actions)
- Technology (e.g., diagnostics, Remote Expert Support)
- Standardized processes supported by automation
- Increased parts lifetime and quality
- Logistics: freight, warehousing cost reduction
Maximizing customers’ good wafers per day
Next to minimizing system down time

Historical service model:
Maximize scanner availability

New service model:
Maximize good wafers per day

System uptime capable of producing wafers
System downtime according to standardized definition

System uptime producing customer wafers
System downtime serving customer needs
Process-specific inefficiencies e.g., system down to meet customer specs, layer qualification after system down, defectivity monitoring and more

>90-95%
>85-90%
>100%
## Overview of examples driving three fundamentals

### Foundational aspects

<table>
<thead>
<tr>
<th>Improve system capabilities</th>
<th>Availability &amp; Good Wafers Cost down</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top X continuous module / part improvements</td>
<td>☀</td>
</tr>
<tr>
<td>Lifecycle management &amp; leveraging commonality between platforms</td>
<td>☀</td>
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<tr>
<td>Automated recovery / calibration of systems after maintenance</td>
<td>☀</td>
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<tr>
<td>Improved recoveries to avoid process fingerprint change after part swap</td>
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</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Improve process capabilities</th>
<th>Availability &amp; Good Wafers Cost down</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improved monitoring capabilities &amp; leveraging machine learning towards predictive maintenance</td>
<td>☀</td>
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<tr>
<td>Improved diagnostics capabilities (deterministic diagnostics)</td>
<td>☀</td>
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<tr>
<td>Self-sufficiency of local field offices</td>
<td>☀</td>
</tr>
<tr>
<td>Over-the-shoulder remote support using augmented reality</td>
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<tr>
<td>Inline defectivity monitoring and control strategies</td>
<td>☀</td>
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<tr>
<td>Scanner matching improvements</td>
<td>☀</td>
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<tr>
<td>Alignment mark optimization</td>
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<tr>
<td>Track-delay reductions</td>
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</table>

<table>
<thead>
<tr>
<th>Cost reduction</th>
<th>Availability &amp; Good Wafers Cost down</th>
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<tbody>
<tr>
<td>Freight cost reduction</td>
<td>☠</td>
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<tr>
<td>Inventory reduction via dynamic stocking strategies</td>
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<tr>
<td>Standardized &amp; optimized processes</td>
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<tr>
<td>Excess &amp; obsolescence reduction via improved configuration management &amp; re-use</td>
<td>☠</td>
</tr>
<tr>
<td>Establish local repair centers</td>
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Technology innovations are improving service
ASML Remote Expert Support connects experts virtually to the field

- COVID-19 travel restrictions and quarantine requirements impacted fly-in support of experts to the field
- Real-time data connectivity and over-the-shoulder HoloLens augmented reality enable
  - Faster service recovery cycle time with immediate access to factory experts
  - Reduced service incidents with improved preventative maintenance
  - Pro-actively monitoring tool health to enhance roadmap for predictive maintenance in the field
Technology innovations are improving service
Using diagnostics to improve availability, reduce long-term downs & cost

**Reactive diagnostics**

- Machine down
- Data
  - Automated monitoring to detect real-time failures
  - Pattern recognition to identify failure modes
  - Interactive deterministic flow to guide engineer

**Proactive diagnostics**

- Machine risks
- Data
  - Automated Fab health monitoring to detect risks
  - AI & knowledge-based models to identify corrective actions
  - Interactive deterministic flow to guide engineer
Improving NXT:1980Di fleet productivity at a Memory customer

**Average scanner output**

<table>
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<tr>
<th>Quarter</th>
<th>Wafers per day</th>
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<tr>
<td>Q1</td>
<td>4,500</td>
</tr>
<tr>
<td>Q2</td>
<td>4,700</td>
</tr>
<tr>
<td>Q3</td>
<td>5,100</td>
</tr>
<tr>
<td>Q4</td>
<td>5,300</td>
</tr>
</tbody>
</table>

**Improvement breakdown**

- Improved availability allowing higher utilization: 200 wafers per day
- Optimized production settings: 350 wafers per day
- Productivity package rollout: 250 wafers per day

**Productivity**

- Customer fleet baseline: 4,500 wafers per day
- Productivity fleet after program: 5,300 wafers per day
Installed Base business growth

Maximizing service value

- High availability and minimal long-term downs
- Lowest possible service cost per wafer
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• Extending useful life of equipment through upgrades
Types of upgrades and buying behavior

Upgrades are a relatively quick and cost-effective way to improve output and process capability of lithography in the fab

- Productivity
- Imaging and overlay
- Life-time extension

Factory utilization dictates ability to install upgrades

- Software upgrades provide quick improvements, always in demand
- Hardware upgrades require longer downtime, in higher demand in time of lower utilization
System Node Enhancement Package (SNEP)
Upgrade to re-use existing scanners for more advanced technology nodes

SNEP brings NXT:1960 to NXT:1980 in 6 weeks with field upgrade

...with the same overlay performance

...and a 28% productivity increase

Machine overlay

230wph  295wph
NXT:1960Bi  NXT:1980Di+PEP

+28%
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