Company Name: ASML
Company Ticker: ASML NA
Date: 2019-01-23
Event Description: Q4 2018 Earnings Call

Market Cap: 60,707.55
Current PX: 142.62
YTD Change($): +5.46
YTD Change(%): +3.981

Bloomberg Estimates - EPS
Current Quarter: 1.537
Current Year: 6.824
Bloomberg Estimates - Sales
Current Quarter: 2734.385
Current Year: 11685.185

Q4 2018 Earnings Call

Company Participants

- Peter T. F. M. Wennink
- Roger Dassen

Other Participants

- Mitch Steves
- Krish Sankar
- David Mulholland
- John William Pitzer
- Pierre C. Ferragu
- Mehdi Hosseini
- C.J. Muse
- Amit B. Harchandani
- Stéphane Houri
- Adithya Metuku
- Andrew M. Gardiner
- Sandeep Deshpande

MANAGEMENT DISCUSSION SECTION

Peter T. F. M. Wennink

Opening Remarks

Good morning, good afternoon, ladies and gentlemen, and thank you for joining us for our Q4 and 2018 annual results conference call

Before we begin the question-and-answer session, Roger and I would like to provide an overview and some commentary on Q4 and the full year 2018, as well as provide our view of the coming quarters

Roger will start with a review of our Q4 and full-year financial performance with added comments on our short-term outlook

And I will complete the introduction with some additional comments on the current business environment and our future business outlook

Roger Dassen

Financial Highlights

Sales and Revenues

- I will first highlight some of Q4 and full year financial accomplishments, and then provide our guidance for Q1 2019
- Q4 net sales came in at €3.14B, slightly higher than our guidance
  - Net system sales of €2.42B was more weighted towards Logic at 60% with the remaining 40% from Memory
- We shipped six EUV systems and recognized EUV revenue of €579mm from five shipments
  - One system was shipped to collaborative research center, imec, was not recorded as revenue, which we mentioned last quarter
- Installed Base Management sales for the quarter came in at €719mm

Gross Margins

- Gross margin for the quarter was 44.3%, which was negatively impacted by the Nikon settlement
- Without this charge, the gross margin was 48.5%
- We signed a Memorandum of Understanding with Nikon to settle our legal dispute over the alleged patent infringements that was initiated by Nikon
  - Therefore, we recorded a provision in our 2018 accounts, which has a negative impact of €131mm on gross margin in 2018

R&D and SG&A Expenses

- Overall, R&D and SG&A expenses came in a little higher than guidance, with R&D expenses at €442mm, and SG&A expenses at €135mm

Balance Sheet Items

Turning to the balance sheet, €345mm worth of shares were repurchased in Q4

This leaves around €1.35B of the 2018-2019 share buyback remaining

We ended last quarter with cash, cash equivalents and short-term investments at a level of €4.03B, which was higher than expected due to early payments by multiple customers at the end of the year

Order Book

- Moving to the order book, Q4 system bookings came in at €1.59B.
- Logic order intake was 80% of total value with the remaining 20% from Memory
- We took five new EUV orders in the quarter

Full Year

Sales and Gross Margins

- For the full year, our net sales grew 22% to a record of €10.9B.
- Net Installed Base Management sales was similar to last year at €2.68B.

- We shipped 18 EUV systems with a total EUV system sales of €1.9B, representing a significant growth over 2017

- Gross margin for 2018 was 46%, which would have been 47.2%, without the Nikon settlement charges
  - We made considerable improvements on our gross margin in 2018, and remain on track to achieving overall gross margins exceeding 50% in 2020 as confirmed during our Investor Day in November of last year

ASML, R&D, Net Income and EPS

- We continue to invest in the long-term future of ASML and increased R&D from €1.26B in 2017 to €1.58B in 2018
- The increase was primarily driven by the acceleration of our EUV roadmap
- Overall R&D investments, as a percentage of 2018 revenue, was about 14%, and SG&A was about 4.5% of revenue, both similar to 2017 as a percentage of revenue
- Net income for the full year grew 25% to a record of €2.6B, resulting in 23.7% of net sales and an EPS of €6.10

Outlook

Sales and Revenues

- With that, I would like to turn to our expectations for Q1 2019
- We expect Q1 total net sales of about €2.1B.
- The lower revenue guidance is due to a combination of revenue pull into Q4 2018, as well as a reduction in shipment due to a fire at one of our suppliers, Prodrive, and some system demand change
- As announced in a press release, on December 3 last year, there was a fire at one of our suppliers of electronics components and modules
  - This resulted in a loss of work in progress as well as some inventory
- Due to the integral cycle time of about one quarter for these modules, our first quarter sales will be negatively impacted by around €300mm, which we expect to largely recover in Q2
  - We expect the remainder to be recovered in H2
- Our total net sales forecast for Q1 includes around €300mm of EUV system revenue
- We currently expect to ship three EUV systems in Q1
  - We expect our Q1 Installed Base Management revenue to be around €600mm, which is primarily due to lower field upgrades as a result of the Prodrive fire

Gross Margins

- Gross margin for Q1 is expected to be around 40%
- The lower gross margin is due to a combination of mix, lower field upgrades, factory loading and EUV service burden

- The mix relates to a reduction in higher margin immersion systems and field upgrades as a result of the Prodrive fire and some system demand change
    - With lower system sales, there is also a reduction in factory loading, which has a negative impact on gross margins

EUV Installed Base

- As our EUV installed base continues to grow, we must expand our service infrastructure to support these systems in the field, which is an increased burden on gross margins, until we start collecting service revenue later this year
- We see the impact from these items continuing in Q2 with an expected recovery in H2
- The positive margin recovery in H2 will be driven by higher revenue, thus improved factory loading, as well as increased field upgrades
    - And we will start shipping the higher-margin NXE:3400C in addition to realizing EUV service revenue

R&D Expenses and SG&A

- We expect to move towards our 2020 target of over 50% gross margin as we exit the year
- The higher R&D expenses for Q1, around €480mm, are due to an acceleration of the NXE:3400 roadmap and growing investments in the High-NA EUV program
- SG&A is expected to come in at around €130mm, which is similar to prior quarter

Growth and Dividend Payment

- Although we are currently going through a period of uncertainty in the industry, we look forward to a growth opportunity in 2019
- As we remain confident in our long-term growth, we will propose a 50% increase in our dividends to €2.10 per share at our Annual Shareholder Meeting, which takes place on April 24 in Veldhoven
- The dividend payment is valued at around €880mm

Peter T. F. M. Wennink

Q4 Highlights

Memory and Logic Customers

Demand and Growth

- As Roger highlighted, we had another good quarter, closing a great year for us, with a record demand from our Memory and Logic customers combined across our entire product portfolio
- While the current geophysical landscape and economic environments are creating volatility in the markets and certainly on the near term, as mentioned before, we still expect overall growth in 2019

- At the very end of last year, we saw the continued slowdown of Memory end market demand, as well as some demand reduction in the Logic end markets, primarily driven by the mobile and the server markets
    - And this translated into push-outs of our planned systems to both Memory and Logic customers from H1 2019 in their attempt to regain balance of supply against demand

NAND Market and DRAM

- The NAND market, as mentioned in prior quarters, remains in an oversupply situation, and is going through a digestion phase after periods of significant 2D to 3D conversions, yield improvements and greater capacity additions
- DRAM is experiencing softening of bit demand, largely driven by decreased demand in mobile market, as well as some inventory correction in the server market

Shipments and Growth in EUV Demand

- All this has resulted in some push-outs of planned shipments by Memory customers in H1 2019
- Customers have indicated that they believe there will be a recovery in H2, as they expect that the inventory levels will be managed down swiftly
- In Logic, while we see some softening in Deep UV demand, which is primarily driven by the mobile market, we still expect strong demand in support of the ramp of 10 and 7-nanometer nodes
    - We also expect to see strong growth in EUV demand supporting customers' ramp up 7 and 7-plus nanometer nodes as well as a transition to the 5-nanometer node

Logic Demand and Installed Base Revenues

- Although, future developments in the macroeconomic environment can impact our current view, we currently expect Logic demand to increase around 50% y-over-y, and Memory to be down around 20% y-over-y
- We still expect single-digit percentage growth of Installed Base revenue

Summary

- In summary, 2019 will be a growth year, largely driven by Logic
- On the ASML product side, let me start with an update of our EUV business
- In EUV, we continue to make solid progress as evidenced in the positive public comments from our Logic and Memory customers, the use of EUV in their most advanced nodes
- Logic customers are installing systems in support of volume manufacturing for the 7 and 5-nanometer nodes

DRAM Customers

- DRAM customers are also working on qualifying EUV for their future nodes
- This year, we expect the first commercial EUV-enabled chip reach the consumer market
- In 2018, we demonstrated over 145 wafers per hour, and we are accelerating our EUV roadmap to deliver 170 wafers per hour with our NXE:3400C with first shipments planned in H2 2019

- NXE:3400C will also include a number of innovations that will further improve availability

EUV Shipments and Deep UV

- As Roger mentioned, we shipped six systems in Q4, which translates to a total of eight EUV shipments in 2018
- With the five orders booked this quarter, our shipment plan of 30 systems for 2019 is covered
- In Deep UV, we shipped 189 systems in 2018, an increase of 17% over 2017, and we were able to further increase our output in support of the demand from both Logic and Memory customers
  - And we continued ramping our latest immersion systems NXT:2000 with a record time to achieve mature customer use

Applications Portfolio and Integrated Products

- Our Applications portfolio has continued to see strong adoption in all market segments
- Our latest YieldStar system continues to gain adoption of Memory customers, following the strong adoption we saw in Logic
- Integrated products, using the combined technology of HMI and HML, are being evaluated at multiple customer sites to help improve customer yields and time to market

Summary

- So, to summarize 2018, our fourth quarter came in slightly above our guidance, and we nearly achieved €11B sales for the year, which was a milestone, originally set for 2020
- Although 2018 was a very good year from a financial perspective, I think it was also a milestone year in terms of technology innovations across all our products
  - This technology provides our customers with higher value solutions, but it also fuels our future growth

Outlook

Investments, Markets, Supply and Demand

- Turning to 2019, we currently see some uncertainty in the market, but after a long period of strong capacity investments, driven by healthy demand over the past years, it is normal to see a period of digestion, which we expect in H1 2019
- With regards to the markets we serve, our customers responded quite late in Q4, slowing demand in their end markets by delaying deliveries of litho systems for H1 2019 with our supply and demand
- We now see our H1 2019 lower than H2 2018 with the reduction being roughly an equal split between Memory and Logic
  - The fundamental drivers of high-performance compute with associated high-performance memory and data storage are still in place, and our customers clearly indicated the need for a strong shipment pattern in H2 2019 in support of their 2020 business potential
- The demand in H2 2019 will, therefore, be 50% higher than H1

- For 2019, the Logic segment is expected to be the growth driver, investing strongly in technology transitions as well as production capacity with our advanced nodes
    - As we have consistently done in prior slowdowns, we sustained or even accelerated our investments in R&D to deliver on the leading edge technology, when the market turns up, which has been and will be the key driver to secure our long-term growth

Investments in R&D

- We expect to increase our investments in R&D to €1.9B for 2019
- We reiterate that we see market demand that supports yet another year of growth for ASML in 2019 with significantly stronger demand in H2

2020 Targets

- As Roger explained, we see similar developments in our profitability with lower margins expected in H1 2019, improving towards our 2020 targets of over 50% as we exit the year
- Despite some uncertainty in the current environment, we remain confident about our sales and profit targets for 2020 and beyond, as we communicated during our Investor Day in November last year
    - We are happy to underline this confidence with our proposal of 50% increase in our dividend

QUESTION AND ANSWER SECTION

<Q - Mitch Steves>: I just had to really focus on Q1 and kind of the quarterly numbers going forward. So, I understand €300mm hit from the fire, but how do I think about June, and then, going forward to September/December in terms of sequential? And then, secondly, also for the gross margin line, I think it's pretty difficult to get from 40% to kind of 50% at the exit. So, any help there would also be very useful.

<A - Roger Dassen>: Let me start by talking about the gross margin and the gross margin drivers, if you like, in Q1, and then reconciling that to how we see the rest of the year. So, as I mentioned in my introduction, the main drivers of gross margin in the quarter of bringing back the gross margin from 48.5%, which is the gross margin that we had in Q4, if you adjust for Nikon, and then bringing it down to the 40% that we essentially guide for Q1. The main drivers there are the loading in the factory, as we said, that is the result of the obviously lower sales level. That would account for about 1% in that bridge. The second element is the mix in DUV, and that is essentially as a result of some of the push-outs from Q1 into essentially H2. And that generates approximately 2.5% impact in that bridge of the gross margin. The biggest impact on gross margin actually is from what we call the field upgrades and service and that has two components to it. And I mentioned both components in my introduction.

One component is the lower field upgrades. And the lower field upgrades that we expect to have in Q1 are, to a very large extent, related to the Prodrive situation, because it means that there is no availability for field upgrades for certain components. So, that's one element.

And if we talk about the EUV service burden, which I mentioned in my introduction, again, just to recap what we mean by that, as you know, the installed base in EUV is growing. A number of our customers are looking into high-volume manufacturing for EUV, not too long from now. That means that we have to support them obviously in the field to get everything up and running, whilst the revenue associated with the service from EUV will only kick in once wafers are being produced, which we expect to happen at the end of this year. So that means that we have a significant cost burden right now, while the revenues only kick in at the end of the year.

If you take those two together, so the lower field upgrades and the EUV service burden, that accounts for approximately 4% in that gross margin bridge that I gave you. And then, there's about 1% left, which is miscellaneous.

That has a number of elements in there. So, that kind of gives you the bridge from the 48.5% to the 40% that we have in Q1.

Now, back to your question, how is all of that going to – how we're going to recover to normal margin levels, if you like, in H2. And as I mentioned, how are we going to get from this situation towards 50% gross margin that we expect as we exit 2019 into 2020. So, as it relates to the mix effect and also the loading effect as a result of the uptake of the business that we expect for H2, that is the main driver behind that. We also expect some of the field upgrades that we lost as a result of Prodrive in Q1, we expect some of that to be recouped in H2 this year.

Third important point in getting the margin up to that level is the shipment in the course of H2 the 3400C model, which is a model that, as you know, has a significantly better margin profile. And then, finally, again related to what I just mentioned, at the end of this year, when high-volume manufacturing starts to kick in on EUV, that's when we also expect service revenue to come up. So, that's essentially how we came back from 48.5% to 40%, but also it gives you the bridge how we believe we are going to exit the year at the level of towards 50% gross margin.

<A - Peter T. F. M. Wennink>: Let me just answer the, let's say, the Q-on-Q sequence, let me say, the half-on-half sequence. First of all, I'd like to reiterate what I said earlier that for the year we expect the Logic sales to be 50% up from last year, Memory about 20% down, and a single-digit growth in Installed Base Management. Now, you can add it all up. And if you then come to that number, that sales number will be divided half-on-half, such that we believe that H2 2019, as I said earlier, will be about 50% higher than the first. So, if you take those numbers, then you can calculate the Q-on-Q – I would say, the half-on-half trends.

<Q - Krish Sankar>: I had two of them. First one, Peter, given the DRAM outlook has incrementally worsened over the last couple of months, and now you view that these tools that have been pushed out from H1 into H2 the year, what kind of tangible data points that you or your customers have on the conviction in H2 shipment recovery? And is there a risk it can get pushed our further? And then, I also had a follow-up.

<A - Peter T. F. M. Wennink>: What our customers are actually seeing is what their customers are telling them what they need. So, there is nobody there with a crystal ball that can tell us that H2 is going to be absolutely certain at a certain level. It's simply not there. I think, therefore, the economic uncertainties are simply there. And they need to basically stabilize to give us a bit more confidence.

However, having said that, the feedback we get, especially from our DRAM customers is and from our largest customers is that they said we should not underestimate their ability to react swiftly and that's what they have done. So they said, to what we're looking – where we're looking now that is a 20% bit growth or even slightly less this year. And then looking what they have installed in terms of capacity and their ability to react swiftly, which they've already done. They believe that with that bit demand, they should be back into a more positive territory in H2 this year. That's what they've told us. But again, if you're asking for absolute certainty, which somebody did during our press conference this morning, there is no absolute certainty. But it's very much related to the economic environment, but based on these data points, our customers believe that we need to be ready to start shipping again in H2.

<Q - Krish Sankar>: And then, just as a follow-up, when I look at your Memory orders in Q4, it's like down almost 80% from the peak, and it's also back to like early 2016 levels. So, should we expect Memory bookings to rebound in calendar Q1 in the current quarter? Or do you think it's going to take a quarter or two, before you see that happening?

<A - Peter T. F. M. Wennink>: It's just what I said earlier, I think it is a swift reaction. So it's quite a significant reduction. And I think the low Memory order intake is a reflection of what the customers decided they wanted to do in Q4 with respect to the 2019 shipments. Now, if they are right on H2, we should see a rebound of those orders in the course of the year.

<Q - David Mulholland>: Just one question, firstly, on the EUV roadmap. Obviously, you've talked a lot about this in your Capital Markets Day, and at some point, us needing to move towards multi-patterning. I think some of the comments that we've seen in some industry events are suggesting that it might even be the case of kind of the 5-nanometer node or the industry 5-nanometer node. So, wondering if you could maybe comment on how you see that progressing. And then, I've got a follow-up.

<A - Peter T. F. M. Wennink>: If you talk about the industry 5-nanometer node, which some of our customers then call the N3 node, there is some discussion on this. Now, I don't think we can say with 100% certainty that it's going to happen, but it's definitely something that's being considered. That's correct.

<Q - David Mulholland>: And then, just in terms of the follow-up, on the comment you made on China, and still seeing, looking quite strong even after what happened on one of the customers there being banned from buying from the U.S., have you started seeing more confirmations on orders from the likes or YMTC or Innotron at this stage?

<A - Peter T. F. M. Wennink>: We have to make a split between the domestic and the non-domestic customers. I think some of the slowdowns that we have seen, they do relate to the non-domestic Chinese customers and affect some of Chinese fabs, but the domestic demand is still as strong as it was one or two or three quarters ago, and it's understandable. If you look at what they are doing, I mean, many of those fabs are new. They are strategic investments. Some of the products have been qualified. That means they can start ramping, which I think, from a strategic point of view, is something that they will do anyhow, which is also, I think, a confirmation of the fact that what they say they're going to do. I mean that's what we see today. So, from a domestic point of view, that was pretty strong.

<Q - David Mulholland>: Just one quick follow-up on the comment in your response to the multi-patterning question. What assumption had you made in the model that you presented for 2025 on the industry 5 node? Were you assuming single patterning in that?

<A - Peter T. F. M. Wennink>: I was not there. And I think it's still uncertain whether it will happen, but we assume single patterning solutions.

<Q - John William Pitzer>: You did a really good job kind of helping us understand for the overall business how that half-on-half [indiscernible] (29:09) would look like in 2019. I'm wondering if you could just do the same thing for the sort of the EUV expectations. Clearly, given the slower start to the year, it feels like the half-on-half growth in EUV needs to be even stronger than the 50% you referenced for the overall business. And I'll be curious, as you think about 30 tools for this year, how that breaks down Logic vs. Memory?

<A - Peter T. F. M. Wennink>: Well, to answer your last question we of course have a customer that does both. You could say, I would assume about 80% to 90% is going to be Logic, and 10%, 15% DRAM related. But we said 80% to 90% Logic. And it's true, I think you will see the same pattern for EUV shipments in H2 being significantly higher than H1. That's the pattern that was actually planned also. I don't think it's got anything to do with the pushback. It's more that just the logistic planning of our customers shapes this pattern. So, yes, it's going to be more than 50%, but it's just a matter of planning logistics, which we already had, nothing changed there.

<Q - John William Pitzer>: And then, as my follow-up for Roger, can you just talk a little bit about the R&D costs going forward? It was a little bit higher than we were modeling both in the December and the March quarters. How should we think about R&D here? And you mentioned kind of the cost you're incurring now for EUV service without service revenue. Is that now fully baked into the model, so that is now a leverageable event as EUV revenue ramps? Or how do we think about that?

<A - Roger Dassen>: The answer is yes. That is modeled – that is included now in the model for sure.

On the R&D side, the guidance we gave for Q1, €480mm. And in essence, that's kind of the run rate that we would expect for the quarters in this year. So, our expectations for the full year would be about 4 times this number. And so this the number that we expect for 2019 with the road maps in there that you're very familiar with, particularly the High-NA, the pulling in of the 3400C, multi-beam and a number of other things. Going into 2020, I think the guidance that we gave there at that stage of around 14% over revenue, that's probably what we see that's for 2020.

<A - Peter T. F. M. Wennink>: And perhaps on the R&D number for 2019, I think when we said we took the decision to accelerate the introduction of the 3400C and High-NA as the logical next node in EUV, the multi-beam development, we accelerated in H2 2018 the hiring of the people to make sure that at the beginning of 2019 we had all the people on board. So, if you take our Q1 guidance, this is a new – and you basically take that on an annual basis. You could argue that we actually created the infrastructure – R&D infrastructure to do this. And we wanted to finalize

that by the end of 2018. And this is what we did. So, this is basically the full year effect that you're seeing now in 2019 of the decisions that we've taken in 2018.

<Q - Pierre C. Ferragu>: I was wondering about like the installation of the 3400C later this year. How is this going to look like in terms of deliveries? Is there a point in time, from which all of the vast majority of your deliveries are going to do 3400C? Or is it going to be more gradual with like half of shipments being 3400B half of shipment being 3400C?

And then, do you have any update or any more like color on how is the economics are going to work between the two tools, with the difference in ASP? And then last, but not least, I was wondering if your 3400B tools that you are shipping today are going to be upgradable to 3400C, and the same thing, what the economics would be there.

<A - Peter T. F. M. Wennink>: The 3400C, it will ship in H2, and you could assume that any shipment in Q4, that will be 3400Cs. And some of it will be in Q3. But the majority of the shipments this year will still be 3400Bs, and everything that we are booking now are 3400Cs. So, it's going to be a handover, you could say, from the 3400B to the 3400C starting in the end of Q3.

<A - Roger Dassen>: On the other two questions, on the economics, as you know, in terms of the specs, the current machine that we ship has a stack of 125 wafers per hour. We've guided that, for the 3400C, it's going to be over 170 wafers per hour, which means approximately a 35% increase in the throughput. And I think as we've guided in the past, you can typically assume that the ASP kind of correlates with that percentage.

So, currently, the ASP for the machine that we ship today is about €100mm, so you can kind of calculate what the ASP expectation is that we have for this machine. In terms of upgrades, indeed, we do have options to have a part of the performance uptick that the 3400C has over the 3400B to also make that available to the 3400B machines in the form of upgrade. Not entirely, but the vast majority of the performance upgrade can be obtained through a few upgrades.

<A - Peter T. F. M. Wennink>: And having said that, I mean it's going to be in question of the economics on this, because it's a different lens. So actually, basically you need to be able to take the hit of quite an expensive upgrade. And that, of course, needs to be balanced with the real performance of the 3400B and the real performance of the 3400C. So, we'll just have to see whether that's going to happen, but when it happens, it's going to be an expensive upgrade, but having a new lens into that system is not trivial.

<Q - Mehdi Hosseini>: Just as a follow-up to the prior question, after 30 system – EUV system in your backlog, how should we think about the mix of the 3400C?

<A - Peter T. F. M. Wennink>: Like I said, Q4 shipments will probably be – going to be all 3400Cs. So, if you think about this, it's probably going to be around five to 10, but the total is 13, but now I'm going to confuse you that some of the 3400Cs will have the fully upgraded new vessels, which is five to 10. So, there's going to be an in-between version of the 3400C, which has older type EUV source vessel.

So, it's 13 in total, but the – really the ones with all the new vessels is going to be five to 10. We'll try to do 10, it could be five, if the supply chain is a bit slower than we think, but all-in-all, it's going to be 13. And that also means that from a price point of view, we will start, of course, significantly higher, but the 35% that Roger mentioned that applies to the full-fledged 3400C with the new modular vessel.

<Q - Mehdi Hosseini>: And I have a follow-up regarding the – just a big picture and how do you see the overall demand environment. If I were to strip away the EUV revenue, it seems like the core business could have a couple of quarters of sequential decline, which is typical of a downturn, if I were to look at the late 2015, early 2016, you had three quarters of sequential decline in revenues. And the prior downturns are also a multi-quarter revenue decline. In that context, how do you see the current downturn compared to prior cycles? What is different now and what are the things that are similar to the prior downturns? Thank you.

<A - Roger Dassen>: Downturns are always similar in the sense that supply is higher than the demand. Now, the question is how big is that difference? To be very frank, we can only repeat or tell you what we get from the discussions from our customers, because they have a better view of their market in the discussions with their customers. So, this is – I can only repeat what I said earlier. They talk about a two quarter correction in inventory. That is driven I

think very much by the macroeconomic situation and the macroeconomic uncertainty. So, this is a big crystal ball that I don't have and nobody has. So, we'll have to see.

I'd like to really comment on what you started your question off with, and that's on, if you strip away EUV and look at the core business, may I remind you that EUV is our core business? And that we can only ship those leading-edge Deep UV tools, because there is an EUV solution for 7 and 5-nanometer. Without the EUV, there would not be a 5 and 7-nanometer transition. So, that means that everything that we are shipping is – and that includes EUV, has to do with the technology transitions that our customers are planning, to actually capture the value of everything that we still talk about and that will happen, which has to do with the cloud, big data, I can repeat the whole thing again. That is innovative. That will happen. And you cannot strip EUV out, because it drives this technology transition. It's part of the core business.

<Q - C.J. Muse>: Another follow-up, excluding EUV, which you may not like. But if you look at 2019 and if I pull out immersion, which is obviously being weighed down by push-outs on the Memory side and exclude EUV, what's interesting I guess is, it looks like KrF and ArF dry, and i-line are actually growing year-on-year. So, can you kind of walk through what you're seeing that's driving that? Whether it's legaCY200-millimeter China advanced Logic? Would love to hear what is driving that, including as well, whether there's a rising litho intensity that we should be thinking about.

<A - Peter T. F. M. Wennink>: It's – C.J., that's answered as well as you are right. If you run those numbers, I think there are two areas, where we see, from a product point of view, an increase which is EUV, which we talked about. And like I said earlier, you cannot strip this out, because it's just part of the entire development in the industry. And indeed, we have KrF, we have dry Deep UV is also higher currently than what we think that we saw in 2018. And that has to do with indeed new fabs, it has to do with China. It is not that much higher, but indeed it doesn't show a reduction in system sales.

And this is also what Roger referred to that this mix, this Deep UV mix, which is a mix of immersion and KrF, is of course in H1, leading to this 2.5% reduction in the gross margin. But with the immersion systems picking up in H2, that will resolve itself. But it is indeed the right conclusion that you drew on the KrF systems being higher than in previous quarters and, of course, EUV in the entirety of 2019.

<Q - C.J. Muse>: And as a follow-up, I guess specific to EUV gross margins, it looks like you came in around 20% in Q4 of 2018, if I pro forma that one-times charge. I think you've talked about exiting calendar 2019 at 30%. Can you walk through how we should think about the ramp there? And as well can you talk about where you're seeing bottlenecks? Is it still primarily Carl Zeiss? Are we still at roughly nine-month cycle time? Can we get it down to six? I would love to hear the working parts to gross margins and cycle times as we go through the year?

<A - Roger Dassen>: The main driver of that improvement is, as we already mentioned, the introduction of the 3400C model, so that is the main driver through its higher ASP. Of course, there is an element in there of further reducing cycle time and as a result of that being more efficient in the manufacturing of the machines. But the main driver in getting to this uptick of 10% in the gross margin on systems really is the higher ASP on the 3400C model.

<A - Peter T. F. M. Wennink>: And on your question on the 20%, I think you're about right, when you say that the blended EUV margin is about 20%. The system margin by the way is over 30%. So, that goes into the right direction. The issue is, and I said it earlier, that we decided in 2018 to at least make sure that we step up the infrastructure for EUV service, that we are at that point. We're not going to grow that any further in 2019. But we do get the full brunt in terms of cost starting January 1, 2019, because that EUV infrastructure, given the ramp profile of our customers, needs to be ready and the learning curve for our people in the field is more than a year.

So, that effectively brings the blended EUV gross margin down, and we said it earlier. We don't have yet coverage of that EUV service infrastructure. That would only start by the end of the year, when we start seeing the first HVM, high-volume manufacturing, wafer output for which, we will get paid. And of course, that will accelerate throughout 2020 and beyond. So, the service burden, and Roger talked about it, I think the main reason why there is a gap between the 30% and the 20% that you calculated.

<Q - Amit B. Harchandani>: Just a quick question, if I may, to begin with on the Installed Base Management side of things. Given your comments, you've talked about a mid-single-digit or single digit growth in Installed Base over the course of 2019. Just wondering if you could elaborate on the puts and takes of that and what could push it lower or higher.

The reason I ask this is because as I look at the number for 2019, and then I look at some of the scenarios you had laid out for 2020, I think the Installed Base number was seen at about €3.6B to €3.7B in 2020. Just wondering, if you still think you could get to that number, what would drive that ramp? And again, what would be the implications for gross margin, because I do understand this is a little of the higher gross margin? Thank you.

<A - Peter T. F. M. Wennink>: I think on the gross margins, you do understand it, so it will have an impact, a positive impact on gross margin. But the single-digit number for this year is also driven by what Roger said earlier. I mean, we did have a supply chain issue, because of the supplier of some of the electronics and the motion control, Prodrive. That fire had an impact on the upgrades that we were planning to do in H1 this year.

Now, we're using those components to shipments. That actually means that the upgrades are coming back in H2, but those are complex upgrades, for which we simply don't have the service capacity to do all those upgrades to basically catch up six months – or it's actually 12 months of business in six months' time. So for the year, you would see that that actually gives you a lot – you just lose upgrade business. And that brings the growth percentage down to the single digits.

Now hopefully, I do assume, we do not have a similar situation in 2020. And that it should really correct itself. So, the single-digit growth has to do with the fact that we cannot recuperate 12 months in six months. That's the main reason.

<Q - Amit B. Harchandani>: You still are quite confident in getting to that €3.6B, €3.7B, it's just a temporary issue...

<A - Peter T. F. M. Wennink>: It's still our target.

<Q - Stéphane Houri>: I have a question about H2 outlook. Just to understand a little bit more what you're saying basically, are you banking on any recovery in the Memory DRAM or NAND space to talk about this [ph] small (47:40) increase? Or is it just based on the Logic business? And if ever it was happening, do you have enough – would you have enough capacity to meet the demand? Thank you.

<A - Peter T. F. M. Wennink>: To answer your last question, yes, we will have enough capacity. [indiscernible] (47:57) it's really driven by Logic, a strength in H2. We do expect when we talk to our Memory customers, that they do expect some recovery in H2. But when you look at H2, it will be a strong Logic-driven half.

<Q - Stéphane Houri>: And I have a short follow-up. You said in your remarks that the EUV delivery, the 30 machines that you're talking about were covered by your order book. How do you see 2020 for EUV shipments? Thank you.

<A - Peter T. F. M. Wennink>: 2020 shipments, well, I can only refer to what we showed at the Capital Markets Day, where we showed you the moderate numbers. You should take that number. Now, that can change. As a very wise person told me, lately, I'm an optimist that worries a lot. But I am optimistic on 2020, because I'm optimistic on the performance of the 3400C. And that means that if we can prove, and I think we will, that by the end of this year, we have an EUV tool that has an availability of over 90% with 170 wafers per hour and the economics for EUV are so convincing, that I believe that our customers are definitely going to – will look at their plans, and see which layers in Logic, but particularly in DRAM are now eligible for EUV introduction.

So, I would refer to – right now, I would refer to the Capital Markets Day, and the moderate market scenario we've put in there, it gives you the EUV number. But I'd then also tell you that I think very much looking forward to the performance of 3400C, for which we have a lot of confidence and that might trigger additional demand in 2020.

<Q - Adithya Metuku>: Two questions, if I could. Firstly, just looking through the ramp that you'll need to deliver on EUV and DUV, I just wanted to better understand what EUV tool capacity you will have in H2 this year? My understanding was, it will be 10 per quarter in 2020. So, any color there would be very helpful.

And then, secondly, just trying to practically think about why R&D would come down in 2020 vs. 2019 levels. Practically, what exactly will drive this? If you could give some color on that, that would be helpful. Thank you.

<A - Peter T. F. M. Wennink>: I think the shipment capability, I think you're about right. In H2 the year, in Q4, we should have a 10 per quarter run rate, which actually means to – one of the earlier questions that the cycle time is coming down, factory cycle time. The integral cycle time of EUV, which includes also the supply chain, is still well over 12 months. But our integral cycle time in the factory should go down to anywhere between 15 and 18 weeks. So, that is a big task for – that will actually mean that we will be able to do 10 shipments per quarter.

<A - Roger Dassen>: As it relates to R&D, an important portion of the acceleration of the R&D effort that we talked about is related to the introduction of the 3400C model, which, as we've already explained, is going to happen this year. So with that essentially done, that means there is some leeway there and that we would be able to manage down the total R&D expenses, because that research is done. And we're very well able to do that, because in addition to our own head count that Peter already talked about, there is a lot of format that we have there. So in that way we think we can manage that down to the number that we've guided for 2020.

<Q - Adithya Metuku>: And just a quick clarification on Q2 gross margin, you clearly said gross margins will improve in H2. Would it be reasonable to assume that Q2 gross margin will be similar to Q1 gross margin? Or would that be too pessimistic?

<A - Roger Dassen>: We'll get there in a couple of months. As we said, we think the conditions that exist for Q1, to a very large extent, also exists for Q2. And the major recovery items that we discussed are going to kick in, in H2.

<Q - Andrew M. Gardiner>: I had another one on EUV, also one follow-up, and then another question. Peter, in response to an earlier question, you suggested that indeed there have not really been any change to the delivery plans or shipment plans through the quarters of 2019. Clearly, you're still saying 30 units in total, but I just wanted to, first of all, make sure that indeed your customers hadn't really changed any plans on that front.

<A - Peter T. F. M. Wennink>: We haven't seen any customer pushbacks on the EUV shipments.

<Q - Andrew M. Gardiner>: And so, in relation to that, there some discussion in part of the industry and parts of the financial markets about perhaps not so much concerns on your customer side, the Memory side. But the customer-customer, some of the fab-less guys, with little bit of trepidation as to how the ramp of the EUV is going to go and what that means for high-volume manufacturing and their ability to get the chips out the other side. Are you having – are you hearing those fears? Are you having those discussions with some of the fab-less chip vendors? What are you doing to help, sort of, satisfy those concerns?

<A - Peter T. F. M. Wennink>: The customers of our customers, they're a bit more distanced, as you can imagine. We do have interactions with customers of customers, but that's largely on the roadmap and not so much on the operational situation at our customers. I mean we don't discuss our customers' production capability or the capacity of our customers. We don't have that insight.

But like I said, we do talk about the roadmap. And I think in the discussions that we had with customers of our customers, it's also in our mind pretty clear, that they all understand that the EUV is here and it actually works.

Now, having said that, what is particularly important is not much lithographic performance, I think the lithographic performance of the machine itself is actually better. Every time, it's better than what was anticipated. And that's what actually drives us a lot of the design. So, this is good. Now, we are, of course, not yet at availability and a – let's say, maturity level that we'd like to see for high-volume manufacturers. The 3400C with all the improvements that are in there, there's is also a lot of availability improvements in there. And that is going to be the proof of the pudding.

And I think this is why I also said in an answer to an earlier question that the 3400C performance is going to be a big driver also in 2020. And we're confident that we're going to get there. And I can imagine the customers of our customers that are further away from us they want to see this first. Well, they will get an opportunity to see this in H2.

<Q - Sandeep Deshpande>: My question is regarding, Peter, about the – you mentioned in one of your press releases that your DRAM windows are looking at EUV at this point. My question is with this throughput going to 170 wafers per hour, I mean, in 2019, you've got majority of your tools going to probably TSMC, will the DRAM guys be able to contribute enough to do that 33 to 35 tools next year? Or do you think they're going to be other contributors beyond DRAM in terms of EUV tools in 2020?

<A - Peter T. F. M. Wennink>: I think DRAM is definitely an additional contributor. It will be small this year, as I said earlier. But they are going to be more – it's just more than one DRAM manufacturer that we're going to ship the retool to. It is very much a function of our ability to bring the 3400C up to maturity levels that customers need for DRAM. I think we can do that. I think everything that we have in front of us, which is the availability improvements in the EUV source, the higher productivity the 170 wafers per hour, those are all ingredients that make it attractive for DRAM customers to start using EUV in DRAM.

I think there's little doubt there. So, it's up to us and to the customer to make sure that what is in the 3400C can actually be used in a high-volume manufacturing. And that will drive 2020 demand also. It's really the success of the introduction that will drive this additional demand.

<Q - Sandeep Deshpande>: And then, one quick follow-up on your gross margin. I mean given the weaker H1 gross margin, with your expectation that there will be a big snapback in H2, do you still think that your gross margin on an overall basis will grow in 2019 vs. 2018?

<A - Peter T. F. M. Wennink>: You can do that math. I mean if you have six months of pushback and lower gross margin, you have to be pretty – it has to be pretty high to make it all up. Now, what we actually said is, I think the recovery, driven by all the reasons that Roger talked about, I think we will see gross margin exiting the year in Q4 that are trending nicely towards the 50%-plus that we said we would see in 2020.