

# **A report on the anticipated acquisition by Thermo Fisher of the Gatan business of Roper**

## **Appendices and glossary**

### *Appendices*

A: Terms of reference

B: Conduct of the Investigation

C: Incentive to foreclose – quantitative analysis

D: Confidentiality provisions in the JEOL Supply Agreement

E: Confidentiality provisions in the Hitachi Supply Agreement

Glossary

## Appendix A: The reference

### Terms of reference

1. On 7 January 2019, the Competition and Markets Authority (CMA), in exercise of its duty under section 33(1) of the Enterprise Act 2002 (the Act), referred the anticipated acquisition by Thermo Fisher Scientific Inc. (Thermo Fisher) of the electron microscope peripherals business (the Target) of Roper Technologies, Inc. (Roper) (the Proposed Merger) for further investigation and report by a group of CMA panel members.
2. In exercise of its duty under section 36(1) of the Act, the CMA must decide:
  - (a) whether arrangements are in progress or in contemplation which, if carried into effect, will result in the creation of a relevant merger situation; and
  - (b) if so, whether the creation of that situation may be expected to result in a substantial lessening of competition (SLC) within any market or markets in the UK for goods or services.
3. In answering these two questions, the CMA will apply a 'balance of probabilities' threshold to its analysis. That is, it will decide whether it is more likely than not that an SLC has resulted, or may be expected to result, from the Merger.
4. Our terms of reference, along with information on the conduct of the inquiry, are set out in Appendix B.
5. This document, together with its appendices, constitutes the CMA's provisional findings. Further information, including a non-commercially-sensitive version of the Parties' response to the phase 1 decision, can be found on the CMA case webpage.<sup>1</sup>

### The parties

6. Thermo Fisher is a US-based corporation, listed on the New York Stock Exchange. Thermo Fisher is a global manufacturer of a broad range of analytical instruments, scientific equipment, consumables, services and software for research, analysis, discovery and diagnostics.

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<sup>1</sup> <https://www.gov.uk/cma-cases/thermo-fisher-scientific-roper-technologies-merger-inquiry>

7. Thermo Fisher manufactures electron microscopes (EMs) through its wholly-owned subsidiary FEI Company (FEI) which it acquired in 2016. Thermo Fisher supplies both transmission EMs (TEMs) and scanning EMs (SEMs) for use in life science, material science and semiconductor applications. Thermo Fisher also supplies EM peripherals such as cameras and detectors, both with its EMs and separately to customers who already have a compatible Thermo Fisher EM.
8. The turnover of Thermo Fisher in 2017 was approximately £16 billion worldwide, of which approximately £[X] million was generated in the UK.
9. Roper is a US-based manufacturer of technological equipment. Roper manufactures and supplies EM peripherals globally under the Gatan brand, including: filters, direct detection (DD) and general imaging (GI) cameras, detectors and specimen preparation kits.
10. The Target's turnover in 2017 was approximately £[X] million worldwide, of which approximately £[X] million was generated in the UK.

## **Appendix B: Conduct of the investigation**

1. We published biographies on the members of the inquiry group conducting the investigation on our web pages on 7 January 2019 and an administrative timetable on 21 January. We published the issues statement setting out the areas on which the investigation would focus and the administrative timetable for the investigation on our webpages on 31 January 2019.
2. We invited a range of interested parties to comment on the Proposed Merger. We sent detailed questionnaires to competitors, and UK customers. In addition, several of these third parties provided us with further information on calls. We also used evidence from the CMA's phase 1 review of the Merger.
3. On 14 February 2019, members of the inquiry group accompanied by CMA staff visited Diamond Light Source Limited at Harwell, Oxfordshire, a major UK customer of Thermo Fisher.
4. We received written evidence from the Parties in the form of submissions and responses to our information requests. A non-confidential version of the Parties response to the phase 1 decision and issues statement was published on 31 January 2019. We also held separate hearings with each of the Parties on 19 March and 27 March 2019.
5. We sent the Parties a number of our working papers and our annotated issues statement for comment prior to the hearings with them on 14 March 2019. The Parties provided comments on those papers on 1 April 2019.
6. A non-confidential version of the provisional findings report will be available on the case web page.
7. We would like to thank all those who have assisted us in our inquiry so far.

## Appendix C: Incentive to foreclose – quantitative analysis

### Introduction

1. In this appendix we present a quantitative analysis of the Merged Entity's incentive to foreclose its rivals using volume and gross profit data provided by the Parties.
2. The Merged Entity's incentive to foreclose depends on its loss of profit in the upstream peripherals market that would result from reduced sales of peripheral products to downstream competitors, relative to the potential gain in profit downstream from increased sales of TEM systems to end-customers that switch their purchase away from downstream competitors.
3. The calculation of these respective changes to the upstream and downstream profits which dictate the Merged Entity's incentive to foreclose is known as 'vertical arithmetic'.
4. We have not relied on precise vertical arithmetic calculations when considering the incentive to foreclose for the following reasons:
  - (a) the output from these calculations is only as good as the underlying assumptions and data used;<sup>2</sup>
  - (b) as noted by the Parties,<sup>3</sup> the vertical arithmetic framework cannot be readily applied to a partial foreclosure strategy; and
  - (c) our calculations reflect the current 'state of the world' excluding the supply agreements and do not attempt to model any possible changes to the incentive to foreclose over time (e.g. due to entry/expansion) given the level of uncertainty related to future market developments.
5. However, even in the absence of precise calculations, our calculations can be used to indicate the relative magnitude of what might be gained if a foreclosure strategy were to be pursued and this helps to highlight the scale of the incentive to engage in total foreclosure if mitigating factors, such as the Supply Agreements and the potential for entry/expansion in the supply of new

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<sup>2</sup> Filters, DD cameras and GI cameras are typically sold as part of a TEM system package and identifying the revenue and profits related to individual peripherals is not straightforward.

<sup>3</sup> See paragraph 3.23 of Compass Lexecon's 'Vertical issues' paper, 20 February 2019

peripheral products, were found not to be fully effective in deterring foreclosure.

## Parties' analysis

6. The Parties have submitted<sup>4</sup> that even if the Merged Entity did (hypothetically) have the ability to foreclose their rivals, they have no incentive to do so as the likelihood of competing entry by JEOL and Hitachi makes foreclosure unprofitable for the Merged Entity, given the Parties' assumptions on when such entry would occur.<sup>5</sup>
7. The Parties have not calculated the benefits of foreclosure that would accrue to the Merged Entity but have focused on JEOL and Hitachi's incentives to develop peripherals in response to foreclosure. Their analysis illustrates the magnitude of JEOL and Hitachi's downstream sales that could be lost due to foreclosure and acknowledges that the profits earned downstream through a TEM sale along with the relevant peripheral are considerably greater than the profits earned upstream through the sale of just the filter, DD camera or GI camera.
8. The Parties calculate that the costs that JEOL and Hitachi could incur downstream in the form of lost TEM sales could together amount to \$127 million per annum or \$[REDACTED] million on a net present value (NPV) basis.<sup>6,7</sup> These figures are greater than our calculated net foreclosure benefits primarily because the Parties assume that the number of TEM sales lost by JEOL and Hitachi is equal to the average number of relevant peripherals sold to them by Gatan.<sup>8</sup>

## Our analysis of the incentive to foreclose calculation

9. Our analysis considers the Merged Entity's incentive to engage in total foreclosure by estimating both the loss of gross profits upstream through the withholding of peripheral sales to JEOL and Hitachi and the expected gain in profits downstream through the switching of prospective JEOL and Hitachi customers who instead elect to purchase a Thermo Fisher TEM in order to maintain access to Gatan's peripherals.

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<sup>4</sup> See paragraph 4.3 of the Parties' 'Response to the CMA's Issues Statement', 19 February 2019

<sup>5</sup> See paragraph 3.3 of Compass Lexecon's 'Vertical issues' paper, 20 February 2019

<sup>6</sup> See table 2 of Compass Lexecon's 'Vertical issues' paper, 20 February 2019

<sup>7</sup> We note that as Thermo Fisher will be the beneficiary of the vast majority of any diverted TEM system sales in this context, significant losses for JEOL and Hitachi also represent significant gains to Thermo Fisher as a result of foreclosure.

<sup>8</sup> Our calculations for Thermo Fisher's net foreclosure benefits assume that not all of these foreclosed peripheral sales are recaptured downstream by Thermo Fisher.

10. We have calculated these annual gross profit 'flows' over a 10 year period and used a discounted cashflow (DCF) approach to determine their NPV with the estimation of a terminal value in year 11.<sup>9</sup>

### **Inputs**

11. We use the following inputs to calculate the Merged Entity's incentive to foreclose.

### **Gross profits earned upstream and downstream**

12. We use the average gross profit for Gatan's worldwide sales to JEOL<sup>10</sup> of each of filters, DD cameras and GI cameras over the period 2016-18<sup>11</sup> and the average gross profit for Thermo Fisher's worldwide sales with the relevant peripheral (i.e. TEM+filter, TEM+DD camera, TEM+GI camera)<sup>12</sup> for the period 2016-18.<sup>13</sup>
13. The average gross profit earned by Gatan (upstream) was: \$[REDACTED] million for filters; \$[REDACTED] million for DD cameras; and \$[REDACTED] million for GI cameras.

### **Figure C.1 [REDACTED]**

[REDACTED]

Source: [REDACTED]

14. The average per unit gross profit earned by Thermo Fisher downstream through the sale of TEM systems was [REDACTED]:
- (a) When a filter was included in the package, Thermo Fisher earned an average gross profit of \$[REDACTED] million.
  - (b) When a DD camera was included in the package but no filter, Thermo Fisher earned an average gross profit of \$[REDACTED] million.
  - (c) When a GI camera was included in the package but no filter or DD camera, Thermo Fisher earned an average gross profit of \$[REDACTED] million.
15. These figures indicate that the per-unit profit earned through initial downstream sales of the TEM and peripheral combination exceed the per-unit

<sup>9</sup> We have used a discount rate of 9.56% - see paragraph 29.

<sup>10</sup> Sales to JEOL make up c. [REDACTED]% of Gatan's sales to third parties. The gross profit from sales to Hitachi is excluded to facilitate the calculation given the data provided.

<sup>11</sup> Roper response to the Market Questionnaire dated 24 January 2019, Annex 057

<sup>12</sup> TEM+GI = TEM system sold with any GI camera products, but no DD camera products or filter (including spectrometer) products; TEM+DD = TEM system sold with any DD camera products, but no filter (including spectrometer) products; TEM+Filter = TEM system sold with a filter.

<sup>13</sup> Thermo Fisher data provided in response to RFI dated 26 February 2019, Annex 026

profit generated through an upstream peripheral sale by [REDACTED] for filters, [REDACTED] for DD cameras and [REDACTED] for GI cameras.

16. In addition to the initial sale of the TEM or TEM peripheral, Thermo Fisher and Gatan earn income through ongoing maintenance and servicing of their products. We have incorporated the average gross profit earned from maintenance and servicing into our calculations based on data provided by the Parties.<sup>14</sup> No figure was provided for the maintenance and servicing of Gatan’s DD cameras and so we have followed a similar approach by using Gatan’s list price [REDACTED] and applied Gatan’s total maintenance and servicing gross margin of [REDACTED]%.

**Table C1: Maintenance and servicing gross profit per annum**

<b>Product</b>	<b>Gross profit (USD) per annum</b>
Filter	[REDACTED]
DD camera	[REDACTED]
GI camera	[REDACTED]
TEM+filter	[REDACTED]
TEM+DD camera	[REDACTED]
TEM+GI camera	[REDACTED]

***Number of peripheral units withheld and sales of TEM units that could be impacted by foreclosure***

17. For the number of peripheral units withheld we use the number of worldwide sales (units) made by Gatan to JEOL and Hitachi for each of the peripherals over the period 2016-18.<sup>15</sup> We assume that each of these sales would have been made to JEOL and Hitachi as part of their supply of a TEM system and therefore the number of peripheral units sold also equals the number of JEOL and Hitachi TEM sale units that may be impacted by the inability to access Gatan’s filters, DD cameras and GI cameras.<sup>16</sup>

<sup>14</sup> Data taken from Tables 1 and 2 of CL’s paper “Response to CMA comments on foreclosure analysis”.

<sup>15</sup> Roper response to the Market Questionnaire dated 24 January 2019, Annex 057.

<sup>16</sup> This is the same approach adopted by the Parties in their incentive to foreclose analysis – see paragraph 2.11 of Compass Lexecon’s ‘Vertical issues’ paper, 20 February 2019. However, we note that should any of these



18. We understand that cameras tend to be replaced during the TEM's working life, with TEMs having a typical lifespan of [X] to [X] years compared to [X] to [X] years for cameras.<sup>17</sup> For the purposes of our analysis we adjust the Merged Entity's profits upstream and downstream under the assumption that, for TEMs sold with cameras, Gatan sells a second camera that yields an equivalent level of gross profit [X] years after the initial TEM and camera sale. We understand that filters are not typically replaced during the life of the TEM and so no replacement sales are included.
19. We assume that Gatan's sales of peripherals to JEOL and Hitachi would have grown at 3% per annum<sup>18</sup> in the absence of foreclosure.

### **Recapture rates**

20. The presence of higher downstream profits per unit sold indicates that a foreclosure strategy is likely to be profitable, but it is necessary to also consider whether the Merged Entity is expected to achieve enough extra downstream sales of TEM systems to compensate it for the loss of upstream peripheral sales.
21. The level of diversion, in this context, reflects the extent to which downstream customers switch from buying JEOL or Hitachi TEMs to Thermo Fisher TEMs because of the foreclosure of Gatan filters, DD cameras and GI cameras by the Merged Entity. The higher the assumed rate of diversion, the greater the gain in sales downstream through foreclosure.
22. We note that the paper on horizontal effects<sup>19</sup> completed by the Parties' economic advisers, Compass Lexecon, already refers to "diversion ratios" as part of its analysis of 'upward pricing pressure'. To help avoid confusion, we will therefore follow the Compass Lexecon approach adopted in their vertical effects<sup>20</sup> analysis by considering the diversion of sales due to foreclosure from the perspective of Thermo Fisher. That is, the extent to which Thermo Fisher would 'recapture' sales that transfer to Thermo Fisher from its TEM rivals.
23. We therefore take 'recapture rate' to represent the proportion of sales of filters, DD cameras and GI cameras which are not made to JEOL and Hitachi

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peripheral sales to JEOL and Hitachi be sold alongside other peripherals included within this same data item then the number of affected TEM sales would be overstated.

<sup>17</sup> See paragraph 3.9 of Compass Lexecon's 'Vertical issues' paper, 20 February 2019

<sup>18</sup> [X]

<sup>19</sup> 'Competition between TEM systems', 20 February 2019, Compass Lexecon.

<sup>20</sup> See paragraphs 3.10-3.12 of Compass Lexecon's 'Vertical issues' paper, 20 February 2019.

due to foreclosure that translate into<sup>21</sup> additional sales of TEM systems for Thermo Fisher.

24. The evidence available to inform the estimation of recapture rates for each of filters, DD cameras and GI cameras is broadly analogous to that used to assess market power when considering ability to foreclose as detailed within our 'Vertical Effects – foreclosure' chapter. Customers are more likely to switch to Thermo Fisher from rival TEMs due to foreclosure when there are fewer effective substitutes available upstream.
25. In a foreclosure scenario, it is likely that the Merged Entity will withhold or erode the offering of Gatan peripherals to both of its main competitors downstream (both JEOL and Hitachi) and therefore almost all JEOL and Hitachi customers that do not buy from JEOL and Hitachi but proceed with a TEM purchase will buy from Thermo Fisher as the only other TEM supply option.<sup>22</sup>
26. We note that Compass Lexecon assumed a recapture rate of 50% for their vertical arithmetic analysis across all three peripherals with a sensitivity of 75%.<sup>23</sup> We consider this unsensitised rate of 50% to be too low for filters and DD cameras but too high for GI cameras.
27. The lack of effective substitutes available for both filters<sup>24</sup> and DD cameras<sup>25</sup> indicates that recapture rates will be high for TEM sales including those products. Many customers indicated that they would have no option but to purchase their TEM system from Thermo Fisher if Gatan's products were not available elsewhere as their choice is driven by their research application needs. We have used recapture rates of 90% for filters and 80% for DD cameras.
28. For GI cameras,<sup>26</sup> we understand that whilst some customers have a strong preference for Gatan's cameras, there are currently viable alternatives available for many customers from suppliers like EMSIS. Our provisional view is therefore that the recapture rate may be low for GI cameras relative to filters and DD cameras and have used a rate of 30% for GI cameras.

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<sup>21</sup> We assume that all peripheral sales made by Gatan to JEOL and Hitachi are to be used as part of a JEOL or Hitachi TEM system sale.

<sup>22</sup> We note that Nion are active in the market (and Tescan plan to enter) but ignore them here given their very small current market footprint and limited offering.

<sup>23</sup> See paragraph 3.11 of Compass Lexecon's 'Vertical issues' paper, 20 February 2019.

<sup>24</sup> See paragraphs 9.172 --9.178 of our 'Horizontal Effects' chapter.

<sup>25</sup> See paragraphs 9.130 - 9.142 of our 'Horizontal Effects' chapter.

<sup>26</sup> See paragraphs 9.74-9.82 of our 'Horizontal Effects' chapter.

## Discount rate

29. We have used Thermo Fisher’s nominal weighted average cost of capital (WACC) of 9.56%,<sup>27</sup> adjusted for an inflation rate of 2.45%.<sup>28</sup>

## Results

30. Based on the inputs outlined above, we have calculated the Merged Entity’s net benefit from foreclosure as shown in Table C3.

**Table C3: Vertical arithmetic outputs**

Vertical arithmetic Outputs	Number of TEM sales impacted	Ratio of downstream: upstream gross profit (initial sale)	Recapture rate	Net (gross profit) benefits of total foreclosure (million)	
				per annum	NPV
GI cameras	[X]	[X]	30%	[X]	[X]
DD cameras	[X]	[X]	80%	[X]	[X]
Filters	[X]	[X]	90%	[X]	[X]
<b>Total</b>	[X]			[X]	[X]

31. Our calculations indicate that the Merged Entity’s incentive to foreclose is large prior to consideration of the Supply Agreements and the impact of any potential future entry/expansion in the supply of filters, DD cameras and GI cameras. Our calculations show total foreclosure resulting in a net gross profit benefit of c.\$[X] million per annum or c.\$[X] million on a NPV basis.
32. Our view is that this incentive to foreclose value is large both in absolute terms and relative to the proposed acquisition price of \$925 million (which reflects a [X] earnings multiple).<sup>29</sup>
33. An incentive to foreclose is present across all of filters, DD cameras and GI cameras. This is highest for filters where a high recapture rate is combined with a large ratio of downstream to upstream gross profit. We note that foreclosure is profitable for GI cameras in spite of the relatively low recapture rate due to the high ratio of downstream to upstream gross profit at stake. The

<sup>27</sup> Thermo Fisher actual average WACC, Q1-Q4 2018. Source: Bloomberg.

<sup>28</sup> US CPI, 2018. Source: US Bureau of Labour Statistics.

<sup>29</sup> Multiple on 2018E EBITDA as a standalone business.

quantum of the benefits for DD cameras is relatively small due to the small number of DD cameras that are sold on a standalone basis (without a filter).

34. As outlined above, we have not relied on these vertical arithmetic calculations when assessing the potential for foreclosure. However, our calculations help to illustrate the scale of the incentive to engage in total foreclosure in the absence of the Supply Agreements and entry/expansion in the supply of new peripheral products and therefore provides context for our assessment of these potential mitigating factors.

## Appendix D: Confidentiality provisions in the JEOL Supply Agreement

6.1 [✂]

6.2 [✂]

6.3 [✂]

6.4 [✂]

6.5 [✂]

6.6 [✂]

7.1 [✂]

7.2 [✂]

7.3 [✂]

7.4 [✂]

7.5 [✂]

7.6 [✂]

## Appendix E: Confidentiality provisions in the Hitachi Supply Agreement

“5.5 [✂]

[...]

[10.2(b)] [✂]

## Glossary

<b>The Act</b>	The Enterprise Act 2002
<b>CMA</b>	Competition and Markets Authority
<b>CSI</b>	Commercially Sensitive Information
<b>DD</b>	Direct Detection
<b>EELS</b>	Electron Energy Loss Spectrometers
<b>EFTEM</b>	Energy Filtered Transmission Electron Microscopy
<b>Ems</b>	Electron Microscopes
<b>FEI</b>	FEI Company
<b>Gatan</b>	The electron microscope peripherals business of Roper.
<b>GI</b>	General Imaging
<b>GMS</b>	Gatan Microscopy Suite
<b>The Hitachi Supply Agreement</b>	The memorandum of understanding agreed between Thermo Fisher / Gatan and Hitachi.
<b>ITT</b>	Invitation to Tender
<b>The JEOL Supply Agreement</b>	The memorandum of understanding agreed between Thermo Fisher / Gatan and JEOL.
<b>The Merged Entity</b>	Thermo Fisher and Gatan together
<b>The Parties</b>	Thermo Fisher and Roper
<b>The Proposed Merger</b>	The anticipated acquisition by Thermo Fisher of the electron microscope peripherals business of Roper.
<b>Roper</b>	Roper Technologies, Inc.
<b>SEMs</b>	Scanning Electron Microscopes
<b>SLC</b>	Substantial Lessening of Competition
<b>SPA</b>	Single Particle Analysis
<b>The Supply Agreements</b>	The JEOL Supply Agreement and the Hitachi Supply Agreement together.
<b>TEMs</b>	Transmission Electron Microscopes
<b>Thermo Fisher</b>	Thermo Fisher Scientific Inc.
<b>TOH</b>	Theory of Harm
<b>UK</b>	United Kingdom