

**ASSESSMENT OF NOISE IMPACT OF NEW CHIMNEYS AND AIR
HANDLING PLANT AT THE MAGELLAN AEROSPACE FACTORY,
LLAY, WREXHAM**

**On behalf of:
Magellan Aerospace (UK) Ltd**

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1.0 INTRODUCTION

- 1.1 Hepworth Acoustics Ltd was commissioned by Magellan Aerospace (UK) Ltd to carry out a noise impact assessment in connection with new chimney stacks, and associated air handling plant, that are being installed at the Rackery Lane factory in Llay. The new equipment is necessary as part of an installation of new flaw detection equipment.
- 1.2 The Magellan Aerospace premises in Rackery Lane, Llay is a long established factory which manufactures aluminium components for the aerospace industry. The factory operates 24 hours a day, 7 days a week.
- 1.3 From information provided by the client we understand that Magellan Aerospace is having to install a Tactic Sulphuric Anodising (TSA) line to meet recently revised REACH legislation requirements. These new requirements aim to phase out using hazardous substances such as chromium. Due to switching away from using chromium, the new TSA processes require a different method of testing to ensure that the manufactured aerospace products are safe. The new processes require the company to use a Penetrant Flaw Detection technique on all manufactured parts and new test booths are being installed for this purpose.
- 1.4 The new equipment includes four new chimney stacks for exhaust air and four new air supply stacks, which will be driven by fans installed within a total of four new air handling units. In terms of environmental noise impact there is potential for noise from the fans to be emitted, predominantly from the air supply and air outlet chimneys. Therefore, it is necessary to ensure that any such noise emissions will not result in any harm to the amenity of nearby residents. Specifically, the Environmental Protection department of Wrexham Council requires that the rating level of any noise generated by the new plant, assessed in accordance with British Standard 4142:2014, is controlled such that it does not exceed the background noise level by more than 5 dB(A).
- 1.5 The new plant and chimneys will be located approximately halfway into the site from Llay Road. The new air supply stacks are less tall than the new air extract stacks. Two of the new air handling plant installations are located within a building, and the other two are located externally on a gantry in a well screened position between two existing buildings.
- 1.6 The nearest residential area to the new chimneys is Birch Court, located to the south of the factory site on the other side of Llay Road. Llay Road is a busy road in the daytime, with associated road traffic noise, but is less busy at night. Therefore, the noise assessment has focussed on the middle of

the night when the background noise climate of the area can be expected to be at its lowest, and any potential noise impact of the new equipment will be at its greatest.

1.7 As at the time that we were commissioned, the installation of the new plant/chimneys was nearing completion the approach has been to carry out a 'before and after' noise survey i.e. before and after the new equipment became operational. The data has then been assessed in accordance with BS 4142:2014.

1.8 The noise assessment has therefore included:

- i. An inspection of the location of the new chimneys;
- ii. Measurement of background noise levels outside nearby dwellings during a late night period before the chimneys were commissioned;
- iii. Measurement of noise levels outside nearby dwellings during a late night period with the new chimneys and associated new plant in operation;
- iv. Evaluation of the environmental noise impact by reference to the relevant British Standard and requirements of Wrexham Council.

1.9 The qualifications and experience of the author of this report are as follows: :

- BSc (Hons.) in Environmental Science;
- Institute of Acoustic's 'Diploma in Acoustics & Noise Control';
- MSc in Environmental Acoustics;
- 30 years of experience in monitoring and assessment of environmental noise;
- Author of papers on environmental noise issues;
- Fellow of the Institute of Acoustics.

1.10 The various noise units and indices referred to in this report are described in Appendix I. All noise levels mentioned in the text have been rounded to the nearest decibel, as fractions of decibels are imperceptible.

2.0 INTRODUCTION TO BRITISH STANDARD 4142:2014

- 2.1 The primary British Standard that provides relevant guidance on control of environmental noise impact of the proposed new plant installation is BS 4142:2014 'Methods for rating and assessing industrial and commercial sound'. This standard is summarised below, in the context of the new equipment installation at the Magellan Aerospace site.
- 2.2 BS 4142: 2014 describes methods for rating and assessing sound of an industrial and/or commercial nature, including sound from fixed installations which comprise mechanical and electrical plant and equipment. This requires the sound from a specific source (in L_{Aeq}) to be compared with the existing background sound level (L_{A90}) outside residential locations.
- 2.3 BS 4142 states in respect of background sound levels that *"that values are reliable and suitably represent the particular circumstances and periods of interest... the objective is not simply to ascertain a lowest measured background sound level, but rather to quantify what is typical during particular time periods"*. In the case of a new sound source to be introduced at an established factory or industrial estate the background sound includes any existing established sound from the factory/estate.
- 2.4 BS 4142 requires noise impact to be assessed over a 1-hour period in the daytime and over a 15 minute period at night.
- 2.5 A 'character correction' is added to the specific sound level where *'certain acoustic features can increase the significance of impact'* at the residential locations. Penalties ranging from 2 – 9 dB are added where the sound sources are considered tonal or impulsive or *'otherwise are readily distinctive against the residual acoustic environment'*.
- 2.6 The quantitative BS4142 analysis is an 'initial assessment' and, where relevant, contextual factors may also need to be taken into account.
- 2.7 BS 4142 describes three levels of noise impact – significant adverse impact, adverse impact, and low impact. The standard states that if the rated sound level exceeds the L_{A90} background sound level by around 10 dB or more it *'is likely to be an indication of significant adverse impact'*. An excess of around 5 dB over the background sound level is *'likely to be an indication of an adverse impact'* but not amounting to a significant adverse impact. The lower the rating level is relative to the measured background sound level, the less likely it *'will have an adverse impact or a significant adverse impact'*.

Where the rating level does not exceed the background sound level, *'this is an indication of the specific sound source having a low impact'*.

BS4142 Noise Control Requirement for the Proposed New Plant at Magellan Aerospace

- 2.8 In a memorandum from Ian Jones, Public Protection Service Manager of Wrexham Council to the Planning Control Manager dated 6 March 2019, the Council's noise control requirements for the new plant at Magellan Aerospace are stated. Specifically, the Council requires that the noise impact of the new plant is assessed in accordance with BS4142 and that the rating level of any noise generated by the new equipment is controlled such that it does not exceed the background noise level by more than 5 dB(A). This requirement forms the basis of the noise assessment described in this report.

3.0 BACKGROUND NOISE SURVEY

Survey

- 3.1 An environmental baseline noise survey has been undertaken to establish the prevailing background noise climate in the vicinity of the nearest residential area to the proposed chimneys i.e. houses in Birch Court. The survey was carried out at the most noise-sensitive time of day i.e. in the middle of the night when there was less noise from road traffic in Llay Road.
- 3.2 Hepworth Acoustics have carried out noise monitoring in Birch Court previously in 2011 and 2013 in connection with other plant installations at Magellan Aerospace. Therefore, the noise survey was carried out in the same location as previously – in the roadway between Nos 3 and 6 Birch Court. This location is slightly back from Llay Road to avoid the noise survey results being dominated by any vehicles passing in Llay Road.
- 3.3 The 2019 background noise survey was carried out in the early hours of 10 April 2019 before the new chimneys were fully installed. The prevailing noise levels were measured in terms of a number of consecutive 15-minute periods. Some additional background noise measurements were taken before and after the commissioning tests (described in Section 4) in the early hours of Friday 10 May 2019.
- 3.4 The noise measurements were carried out using a Rion NA-27 'Type 1' integrating sound level meter. The sound level meter complies with BS EN 60804:2001 and has current independent calibration certification. Also, acoustic calibration of the sound level meter was checked before and after the noise survey using an acoustic field calibrator and no significant variation in the calibrated noise level occurred.
- 3.5 The noise measurements were carried out in general compliance with BS 7445: 2003 and BS 4142:2014. The noise measurements were taken in 'free-field' conditions and at a microphone height of approximately 1.5m above the ground.

Results

- 3.6 The results of the 2019 late night noise survey are presented in Appendix II. The historical data from our previous night-time noise surveys in 2011 and 2013 are also tabled in Appendix II.
- 3.7 The L_{A90} results of the recent (2019) noise measurements have been averaged to obtain a representative background noise level of 35 dB L_{A90} .

- 3.8 This representative late night background noise level has been used in the assessment of noise impact later in this report.

4.0 NOISE SURVEY WITH NEW PLANT OPERATING & ASSESSMENT

Survey

- 4.1 A noise survey was carried out at the first opportunity during commissioning of the new equipment.
- 4.2 The system had been set to extract which is the noisiest cycle with all inlet and exhaust fans operating simultaneously. Also, at the time of testing, the system had not been dynamically balanced and external enclosures proposed for the external air handling units had yet to be installed, so the noise survey was undertaken in very much worst case conditions.
- 4.3 Also, we understand that once the new equipment is fully commissioned some existing chimney stacks at the factory will be decommissioned, resulting in removal of those sources of noise.
- 4.4 The noise survey was carried out in the early hours of 10 May 2019 at the monitoring location in Birch Court.
- 4.5 The noise measurements were carried out using a Rion NA-27 'Type 1' integrating sound level meter. The sound level meter complies with BS EN 60804:2001 and has current independent calibration certification. Also, acoustic calibration of the sound level meter was checked before and after the noise survey using an acoustic field calibrator and no significant variation in the calibrated noise level occurred.
- 4.6 The noise measurements were carried out in general compliance with BS 7445: 2003 and BS 4142:2014. The noise measurements were taken in 'free-field' conditions and at a microphone height of approximately 1.5m above the ground.
- 4.7 As the purpose of the noise measurements were to try and ascertain the 'specific sound level' from the new equipment (i.e. without any extraneous noise from traffic, distant aircraft, etc) a series of short term (30 secs-1 minute) noise measurements were taken when there was no, or minimal, extraneous noise.

Results

- 4.8 The results of the late night noise survey with the new equipment running are presented in Appendix III and are described below.

- 4.9 The equipment was switched on at 02:55 and a series of short-term noise readings were taken between 02:57 and 03:05 with all the new equipment running (i.e. all extract and supply fans running simultaneously). During this period the measured L_{Aeq} noise levels averaged 40 dB(A), and the L_{A90} levels averaged 39 dB(A). At this time the sound of the fans (air movement noise) was audible at the noise survey location and it is considered that the measured noise levels were due mainly to noise from the new equipment.
- 4.10 After 03:05 the audible sound and the measured noise levels reduced, settling to a level of 37 dB L_{Aeq} . We understand that at this time some of the new equipment (two of the four handling units) had tripped out.

Assessment to BS 4142

- 4.11 Therefore, for assessment purposes it is considered that the 'specific sound level' of the new plant operating fully on extract mode (i.e. with all supply and extract fans running) should be taken as 40 dB L_{Aeq} .
- 4.12 With all the new plant running the resulting noise was of a steady character with no distinct tonal components. Nor did the sound have any impulsive or intermittent characteristics. However, the air movement sound was of a different character to the residual sound such that it was distinguishable. Therefore, it is considered that the 3dB penalty for 'other sound characteristics' (as defined in BS 4142) should be applied.
- 4.13 This means that the BS 4142 noise 'rating level' of the new plant, in the middle of the night in worst case operating conditions, is 43 dB.
- 4.14 The BS 4142 rating level of 43 dB therefore exceeds the representative late night background noise level of 35 dB L_{A90} by 8 dB.

Conclusions on Noise Impact

- 4.15 Therefore, noise from operation of the new plant exceed the Council's noise control requirement (of no more than 5dB(A) above the background sound) by 3 dB(A). Therefore, the implementation of noise control measures is necessary in order to reduce the noise emissions to within the Council's noise control limit.

- 4.16 As only a relatively small sound reduction is necessary this should be straightforward to achieve. However, if bespoke noise control measures are necessary for this particular equipment a reasonable lead in time will be required to allow those works to be designed, commissioned and installed.
- 4.17 In the meantime, we consider that the operation of the new plant would not give rise significant noise impact on the amenity of nearby residents. The plant noise level is likely to be well below the ambient noise climate of the area in the daytime and evening. Also, at night, the specific sound level of the new plant is similar to the late night $L_{Aeq(15 \text{ min.})}$ residual sound levels that were measured during the ambient noise survey. Furthermore we do not consider that the plant noise is of a level or character that would be expected to result in sleep disturbance.
- 4.18 We therefore conclude that planning permission should be granted for the new equipment subject to a condition requiring noise control works to be implemented in order to ensure that noise from the new plant, rated in accordance with BS 4142:2014, does not exceed the background level by more than 5 dB(A).

5.0 SUMMARY AND CONCLUSIONS

- 5.1 The environmental noise impact of new equipment that has been installed at Magellan Aerospace factory at Rackery Lane, Llay has been assessed.
- 5.2 The new equipment involves installation of air handling plant and associated chimneys.
- 5.3 The assessment has involved 'before' and 'after' noise surveys (i.e. with and without noise from the new) outside houses in Birch Court in the middle of the night.
- 5.4 The noise impact of the new plant has been assessed in accordance with BS 4142 and the noise limit specified for the new plant by Wrexham Council.
- 5.5 Late at night, when background noise levels are at their lowest, it was found that the noise from the new plant (rated to BS 4142) exceeded the Council's noise design limit by 3 dB(A). Whilst this is only a slight exceedance, noise control measures need to be implemented. The necessary noise reduction should be relatively straightforward to achieve.
- 5.6 In the meantime, it has been concluded that operation of the new plant would not give rise significant noise impact on the amenity of nearby residents. This is because the plant noise levels will be well below the ambient noise climate of the area in the daytime and evening, and at night the plant noise is not of a level or character that would result in sleep disturbance.
- 5.7 We therefore conclude that planning permission can be granted for the new equipment subject to a condition requiring noise control works to be implemented in order to ensure that noise from the new plant, rated in accordance with BS 4142:2014, does not exceed the background level by more than 5 dB(A).

Appendix I: Noise Units & Indices

Sound and the decibel

A sound wave is a small fluctuation of atmospheric pressure. The human ear responds to these variations in pressure, producing the sensation of hearing. The ear can detect a very wide range of pressure variations. In order to cope with this wide range of pressure variations, a logarithmic scale is used to convert the values into manageable numbers. Although it might seem unusual to use a logarithmic scale to measure a physical phenomenon, it has been found that human hearing also responds to sound in an approximately logarithmic fashion. The dB (decibel) is the logarithmic unit used to describe sound (or noise) levels. The usual range of sound pressure levels is from 0 dB (threshold of hearing) to 120dB (threshold of pain).

Due to the logarithmic nature of decibels, when two noises of the same level are combined together, the total noise level is (under normal circumstances) 3 dB(A) higher than each of the individual noise levels e.g. 60 dB(A) plus 60 dB(A) = 63 dB(A). In terms of perceived 'loudness', a 3 dB(A) variation in noise level is a relatively small (but nevertheless just noticeable) change. An increase in noise level of 10 dB(A) generally corresponds to a doubling of perceived loudness. Likewise, a reduction in noise level of 10 dB(A) generally corresponds to a halving of perceived loudness.

The ear is not equally sensitive to sound at all frequencies. It is less sensitive to sound at low and very high frequencies, compared with the frequencies in between. Therefore, when measuring a sound made up of different frequencies, it is often useful to 'weight' each frequency appropriately, so that the measurement correlates better with what a person would actually hear. This is usually achieved by using an electronic filter called the 'A' weighting, which is built into sound level meters. Noise levels measured using the 'A' weighting are denoted dB(A) or dBA.

Frequency and Hertz (Hz)

As well as the loudness of a sound, the frequency content of a sound is also very important. Frequency is a measure of the rate of fluctuation of a sound wave. The unit used is cycles per second, or hertz (Hz). Sometimes large frequency values are written as kiloHertz (kHz), where 1 kHz = 1000 Hz.

Young people with normal hearing can hear frequencies in the range 20 Hz to 20 kHz. However, the upper frequency limit gradually reduces as a person gets older.

Glossary of Terms

When a noise level is constant and does not fluctuate, it can be described adequately by measuring the dB(A) level. However, when the noise level varies with time, the measured dB(A) level will vary as well. In this case it is therefore not possible to represent the noise climate with a simple dB(A) value. In order to describe noise where the level is continuously varying, a number of other indices can be used. The main indices used in this report are described below.

L_{Aeq} This is the A-weighted 'equivalent continuous noise level' which is an average of the total sound energy measured over a specified time period. In other words, L_{Aeq} is the level of a continuous noise which has the same total (A-weighted) energy as the real fluctuating noise, measured over the same time period. It is increasingly being used as the preferred parameter for all forms of environmental noise.

L_{A90} This is the A-weighted noise level exceeded for 90% of the time period. L_{A90} is used as a measure of background noise.

Appendix II: Background Noise Survey Results

2019 Survey 2	Date:	Early Hours of Friday 10 May 2019
	Equipment:	Rion NA27 Sound Level Meter (sn: 10632001), calibrator.
	Weather:	Dry (roads damp from earlier rain), overcast, calm, cool (6°C)
2019 Survey 1	Date:	Early Hours of Wednesday 10 April 2019
	Equipment:	Rion NA27 Sound Level Meter (sn: 10632001), calibrator.
	Weather:	Dry, clear sky, cold (2°C) and calm.
2013 Survey	Date:	Early Hours of Wednesday 31 July 2013
	Equipment:	Rion NA27 Sound Level Meter (sn: 00590966), calibrator.
	Weather:	Dry, mild (15°C) and calm.
2011 Survey	Date:	Early Hours of Tuesday 8 March 2011
	Equipment:	Rion NA27 Sound Level Meter (sn: 00590966), calibrator.
	Weather:	Dry, cold (-2°C) and calm.

Location : In Birch Court (in roadway near No. 6)

Recent Data

Date	Time (hours)	Noise levels (dB)			Comments
		L _{Amax}	L _{Aeq}	L _{A90}	
10/5/19	02:42 – 02:55	64.9	41.0	33.6	Occasional distant traffic, faint steady plant, 1 van & 1 car passed in Llay Road, distant aircraft.
"	03:27 – 03:32	43.7	35.9	35.1	Faint steady plant, occasional distant traffic. (No passing cars in Llay Road)
10/4/19	02:27 – 02:42	64.1	41.6	35.4	Distant traffic, occasional passing vehicles in Llay Road, distant robin, faint steady plant sound.
"	02:42 – 02:57	64.2	40.6	36.0	Distant traffic, occasional passing vehicles in Llay Road, distant robin, faint steady plant sound, resident putting recycling out.
"	02:58 – 03:13	58.6	38.9	36.6	Distant traffic, distant robin, faint steady plant sound, v. distant aircraft, resident.
Average L _{A90} Value				35.3	

Historical Data

Date	Time (hours)	Noise levels (dB)			Comments
		L _{Amax}	L _{Aeq}	L _{A90}	
31/7/13	02:45 – 02:50	62.0	42.2	36.7	Distant steady noise from Industrial Estate. 1 car & 1 van passed in Llay Road
“	02:51 – 02:56	69.5	46.6	37.3	Distant steady noise from Industrial Estate. 1 lorry tractor unit & 1 car passed in Llay Road. Distant aircraft.
“	02:57 – 03:02	52.3	38.4	37.8	Distant steady noise from Industrial Estate. Distant vehicle.
“	03:03 – 03:08	65.1	42.0	37.7	Distant steady noise from Industrial Estate. 1 van passed in Llay Road
“	03:08 – 03:13	76.3	50.9	37.7	Distant steady noise from Industrial Estate. 1 articulated lorry & 1 car passed in Llay Road. V faint distant rivetting few secs at a time (?).
“	03:14 – 03:19	61.6	41.5	36.7	Distant steady noise from Industrial Estate. 1 car & 1 van passed in Llay Road.
8/3/11	02:55 – 03:00	58.6	40.9	38.2	Distant steady noise from Industrial Estate. 1 car passed in Llay Road
“	03:00 – 03:05	66.7	47.6	38.0	Distant steady noise from Industrial Estate. 1 car, 1 lorry & 1 van passed in Llay Road
“	03:05 – 03:10	52.2	38.6	37.8	Distant steady noise from Industrial Estate. No passing cars. Occasional distant traffic.
“	03:10 – 03:15	67.9	45.7	38.4	Distant steady noise from Industrial Estate. 1 milk truck passed in Llay Road. Birds.

Appendix III: Noise Survey With New Plant Operating

Date: Early Hours of Friday 10 May 2019
 Equipment: Rion NA27 Sound Level Meter (sn: 10632001), calibrator.
 Weather: Dry (roads damp from earlier rain), overcast, calm, cool (6°C)

Location : In Birch Court (in roadway near No. 6)

Date	Time	L _{Aeq}	L _{A90}	Comments
10/5/19	02:57 – 02:57	39.9	39.5	Steady fan sound
“	02:58 – 02:58	39.8	39.3	As above
“	03:00 – 03:00	40.1	39.8	As above
“	03:02 – 03:03	39.4	38.9	As above
“	03:04 – 03:05	39.4	38.7	Steady fan sound, distant traffic
“	03:06 – 03:07	37.6	36.1	Less steady fan sound.
“	03:07 – 03:08	37.2	36.5	As above
“	03:09 – 03:10	37.0	36.4	As above
“	03:11 – 03:12	37.3	36.4	As above
“	03:16 – 03:17	37.5	36.8	Steady fan sound, faint general steady plant
“	03:21 – 03:22	38.1	37.4	Steady fan sound, faint general steady plant, distant traffic.