

# A Technical and Economic Case for a Dedicated Weather Radar in the Shetland Islands

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## *Executive Summary*

Shetland is the only inhabited archipelago in the United Kingdom that sits below the effective observational horizon of the national weather radar network. The Earth's curvature places the beam floor of the nearest radar stations — at Costa Hill in Orkney and Hill of Dudwick in Aberdeenshire — at approximately 2,300 metres above the surface of the Shetland Islands at minimum operational elevation. The low-level rain, freezing drizzle, wet snow, and squall lines that cause the greatest economic damage here are, from existing radar perspectives, structurally invisible.

This report presents an evidence-based technical and economic case for deploying a compact X-band dual-polarisation weather radar in Shetland. The case draws on verified data from the Scottish Environment Protection Agency, Shetland Islands Council statistics, Scottish Government marine economic reports, Met Office procurement records, and a directly comparable operational precedent in the Faroe Islands.

A system with an annualised lifecycle cost of approximately **£50,000** would generate verifiable annual economic benefits conservatively estimated at **£967,777**, yielding a Benefit-Cost Ratio (BCR) of approximately **19:1**. This is consistent in scale with the 18.8:1 BCR established by London Economics for the national Met Office investment, reflecting Shetland's exceptionally high concentration of weather-dependent economic activity.

The report recommends a phased approach: an initial locally-governed X-band deployment — modelled on Atlantic Airways' four-year operational success at Sornfelli in the Faroe Islands — followed by a formal case to the Met Office for inclusion in the national C-band renewal programme, using Phase 1 operational data as evidence.

### **The Council is asked to:**

1. Approve a feasibility study and site assessment for an X-band weather radar on Ronas Hill or an equivalent elevated Shetland site.
2. Initiate formal engagement with the Met Office, HIAL, SSEN, Lerwick Port Authority, and relevant funding bodies.
3. Commission the additional data-gathering work identified in Section 7 to strengthen the economic case for a Phase 2 national submission.

## **1. Introduction**

The Shetland Islands face meteorological conditions that are, by any measure, among the most demanding in the United Kingdom. Situated at 60°N in the North Atlantic, the archipelago experiences frequent severe weather: winter storms depositing catastrophic ice loading, rapid convective flash floods, coastal storm surges, and persistent low cloud and fog that routinely disrupt aviation and maritime operations.

These conditions are economically consequential. Shetland’s primary industries — aquaculture, maritime logistics, port operations, crofting, tourism, and North Sea aviation support — are all substantially weather-sensitive. The ability to forecast with hyper-local precision is not a scientific amenity in this context; it is an operational necessity on which livelihoods depend.

Yet Shetland currently receives a structurally degraded level of meteorological service compared to any comparable community in Scotland, the UK or even Europe. As the Scottish Environment Protection Agency has formally acknowledged: “*The lack of coverage in the Shetland Islands means Flood Watch services are restricted for the Islands.*”<sup>1</sup>

This report sets out why the observational gap exists, what can be done about it at achievable cost, and what the economic return on that investment would be.

## **2. The Meteorological Observation Gap**

### **2.1 The National Radar Network and Shetland’s Structural Exclusion**

The United Kingdom Weather Radar Network, co-funded by the Met Office and the Environment Agency, provides real-time rainfall data and hydrometeor classification across the British Isles in support of flood forecasting and numerical weather prediction.<sup>2</sup> The network was designed primarily around the flood-forecasting requirements of large mainland river basins, where high population density and extensive property exposure produce straightforward national cost-benefit cases.

Shetland’s situation is structurally different. The archipelago’s catchments are small and fast-responding. Its primary hydrological risks are coastal storm surges and localised surface water flash flooding, not major river inundation. National cost-benefit models have consequently treated extension of radar coverage to Shetland as delivering a “poor cost–benefit ratio” — a conclusion derived from aggregate, population-weighted metrics that fundamentally fails to account for the concentration of high-value, weather-sensitive economic activity in the islands. This structural bias has left Shetland without adequate coverage across successive cycles of national radar network investment.

1 SEPA. Shetland Local Plan District Flood Risk Management Plan. [https://consultation.sepa.org.uk/evidence-and-flooding/flood-risk-management-plan-shetland/supporting\\_documents/LPD4%20Shetland%20full%20FRMP%20consultation%20document.pdf](https://consultation.sepa.org.uk/evidence-and-flooding/flood-risk-management-plan-shetland/supporting_documents/LPD4%20Shetland%20full%20FRMP%20consultation%20document.pdf)

2 Met Office. Radar systems. <https://www.metoffice.gov.uk/research/weather/observations-research/radar-systems>

## 2.2 The Physics of the Problem

The root cause is geometric. Radar beams travel in straight lines subject to standard atmospheric refraction, and the Earth curves away beneath them. The minimum observable beam height above the surface increases with distance from the radar antenna, governed by the 4/3 effective Earth radius model.<sup>3,4,5</sup>

At the operational minimum elevation angle of 0.5°, the beam floor from the Costa Hill radar in Orkney over Lerwick — approximately 160 kilometres distant — sits at approximately **2,300 metres** above sea level. The meteorological phenomena that most affect Shetland almost universally occur below 2,000 metres:

- Low-level stratiform precipitation and coastal drizzle
- Wet snow and freezing rain (the primary cause of power infrastructure ice-loading)
- The transition altitude of the melting layer (“bright band”)
- Low cloud boundaries affecting aviation minimums
- Squall lines and convective cells generating flash flooding

These phenomena are not merely poorly resolved by the existing network — they are structurally below the radar horizon and therefore invisible to it.<sup>6</sup> Precipitation detected at altitude may evaporate before reaching the surface, creating further inaccuracies in surface-level rainfall estimates that undermine hydrological modelling.<sup>7</sup>

## 2.3 Operational Consequences

The observational gap has direct consequences across every weather-sensitive sector:

- Flood warnings cannot be triggered with sufficient lead time because Quantitative Precipitation Estimates from distant radars are unreliable at low altitudes over Shetland.
- Power network operators cannot distinguish between approaching dry snow and the wet snow or freezing rain that causes catastrophic ice loading until the event is already underway.
- Sumburgh Airport dispatchers lack high-resolution squall-tracking data needed to identify safe operational windows.
- Ferry masters on the Aberdeen–Lerwick route make go/no-go decisions with coarser meteorological data than their counterparts on mainland routes.
- Aquaculture operators cannot reliably identify the 2–6 hour weather windows needed to conduct safe offshore harvesting operations.

3 Pearson. Earth Curvature Calculator. <https://www.pearson.com/channels/calculators/earth-curvature-calculator>

4 MathWorks. range2height — Convert propagated range to target height. <https://www.mathworks.com/help/radar/ref/range2height.html>

5 Radartutorial.eu. Height or Altitude. <https://www.radartutorial.eu/01.basics/Calculation%20of%20height.en.html>

6 Met Office. Factsheet 15 — Weather Radar (2023).

[https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/research/library-and-archive/library/publications/factsheets/factsheet\\_15-weather-radar-2020\\_2023.pdf](https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/research/library-and-archive/library/publications/factsheets/factsheet_15-weather-radar-2020_2023.pdf)

7 Met Office. Factsheet 15 — Weather Radar (2023).

[https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/research/library-and-archive/library/publications/factsheets/factsheet\\_15-weather-radar-2020\\_2023.pdf](https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/research/library-and-archive/library/publications/factsheets/factsheet_15-weather-radar-2020_2023.pdf)

- Lerwick Port Authority and commercial operators at the harbour have no real-time precipitation and squall tracking for vessel scheduling.
- Crofters have no local data to guide animal husbandry scheduling.
- Tourism operators — accommodation providers, excursion companies, wildlife tour guides — cannot confidently programme outdoor activities around micro-forecast windows that the regional forecast cannot provide.

### **3. The X-Band Solution: A Proven Island Model**

#### **3.1 The Technology**

Modern solid-state X-band dual-polarisation weather radars offer a practical, cost-effective solution for localised meteorological monitoring. Unlike the large parabolic dish installations forming the national C-band network — a standalone C-band antenna procured for the Met Office’s East Anglia upgrade cost £226,938 including VAT,<sup>8</sup> with total greenfield site costs estimated at £2.5 million<sup>9</sup> — compact X-band systems are lightweight, low-power, and engineered for remote, unattended operation in harsh environments.

Dual-polarisation is a critical technical requirement for Shetland’s meteorological profile. Transmitting and receiving both horizontal and vertical polarisation yields advanced variables including Differential Reflectivity ( $Z_{DR}$ ), Correlation Coefficient ( $\rho_{hv}$ ), and Specific Differential Phase ( $K_{DP}$ ).<sup>10</sup> These parameters enable automated classification of precipitation type — distinguishing freezing rain from wet snow from dry snow — which is directly relevant to the ice-loading threat to power infrastructure, aviation safety decisions, and ferry operational planning.

#### **3.2 The Faroe Islands Precedent**

A directly applicable precedent exists in the Faroe Islands — an island group of closely comparable geography, climate, and economic structure to Shetland.

Atlantic Airways, the Faroese national carrier, deployed a **Furuno WR-2100** dual-polarisation X-band weather radar on **Sornfelli mountain** (elevation 749m) to provide real-time rainfall and precipitation data for the islands’ helicopter service. As of November 2022, the system had been operating **unattended for four consecutive years**, demonstrating operational resilience and low maintenance burden in a high-latitude North Atlantic environment directly comparable to Shetland’s.<sup>11</sup>

8 Find a Tender. Provision of Radar Antenna — C-Band, Met Office (2025). <https://www.find-tender.service.gov.uk/Notice/046955-2025/PDF>

9 National Weather Service. NEXRAD Service Life Extension Program completion. <https://www.weather.gov/news/241908-weather-radars>

10EUMETNET OPERA. Cost-benefit of dual-pol exchange (2019). <https://www.eumetnet.eu/wp-content/uploads/2019/02/Cost-benefit-of-dualpol-exchangeV4.pdf>

11Jensen, Niels Einar. Atlantic Airways’ Furuno WR-2100 weather radar on Sornfelli mountain, Faroe Islands (November 2022). [https://dk.linkedin.com/posts/niels-einar-jensen-a8b8a145\\_atlantic-airways-furuno-wr-2100-](https://dk.linkedin.com/posts/niels-einar-jensen-a8b8a145_atlantic-airways-furuno-wr-2100-)

This deployment is instructive on multiple levels:

- The radar was procured and operated by a **commercial aviation operator**, not a national meteorological agency — demonstrating that local governance of this technology is practically and financially achievable.
- Four years of unattended Arctic-margin operation validates the platform’s suitability for the climate conditions Shetland shares.
- The deployment model — elevated mountain site, remote monitoring, aviation-focused data application — maps directly onto a Shetland scenario.

**Ronas Hill** (450m elevation, the highest point in Shetland) offers an analogous deployment site: elevated above terrain shielding, free of radio interference, and within communications range of the main population centres. A site feasibility assessment is recommended as the immediate next step.

### 3.3 Cost Profile

Academic network design analysis and industry assessments indicate compact X-band gap-filler systems carry an initial capital cost of approximately **£200,000**, with annual operational and maintenance costs of approximately **£40,000**.<sup>12</sup> These figures reflect solid-state transmitter technology — eliminating deteriorating magnetron components — and the minimal civil engineering footprint of a lightweight (approximately 65 kg) antenna that does not require a heavy structural tower.

*Note: These cost figures are indicative. See Technical Annex A3 for a discussion of what a fully commissioned, site-hardened installation in a remote Shetland location may require, and the recommendation for vendor quotations before final commitment.*

Amortised over a standard 20-year operational lifecycle:

<b>Expenditure Category</b>	<b>Total Cost</b>	<b>Annualised Cost (20-yr)</b>
Capital Expenditure	£200,000	£10,000
Annual Operational Expenditure	—	£40,000
<b>Total Annualised Cost</b>		<b>£50,000</b>

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## 4. Cost-Benefit Analysis

### 4.1 Methodology

The following analysis draws on five distinct methodological approaches:

1. Pro-rata downscaling of independently audited national meteorological value assessments

weather-activity-6993946202887053312-a-89

12AMS Journals. Objective Optimization of Weather Radar Networks for Low-Level Coverage Using a Genetic Algorithm. [https://journals.ametsoc.org/view/journals/atot/29/6/jtech-d-11-00076\\_1.pdf](https://journals.ametsoc.org/view/journals/atot/29/6/jtech-d-11-00076_1.pdf)

to Shetland’s economic scale.

- 2.Scenario analysis of documented, high-impact historic weather events with verified cost data.
- 3.Sectoral productivity modelling for weather-dependent industries using published economic statistics.
- 4.Transport and port logistics disruption modelling.
- 5.Official flood risk baseline data from SEPA’s Shetland Flood Risk Management Plan.

All primary figures in this section carry HIGH or MEDIUM reliability ratings based on their sourcing (see Verification Log in Appendix I). Assumptions that are indicative or currently unvalidated are presented in the Technical Annex with specific recommendations for further evidential work.

## 4.2 Baseline Value of Meteorological Services to Shetland

In 2024, an independent economic evaluation by London Economics concluded that the Met Office delivers **£56 billion in economic value** to the UK over the period 2024–2033 — an annual value of £5.6 billion — with a national benefit-to-cost ratio of **18.8:1**.<sup>13141516</sup> The Hadley Centre Climate Programme alone generates a return of £33 for every £1 invested.<sup>17</sup>

A demographic pro-rata allocation to Shetland (population approximately 23,000 within a UK total of approximately 67 million) yields:

**$(23,000 \div 67,000,000) \times £5,600,000,000 = \text{approximately } £1.92 \text{ million per year}$**

This is the baseline annual value of weather services to Shetland under a population-only model. However, this figure substantially underestimates Shetland’s actual weather-dependency. In 2023, Shetland produced 33,414 tonnes of Atlantic salmon worth £251.9 million — over 22% of the Scottish national total — and 8,694 tonnes of mussels worth £9.7 million, constituting 84.3% of total Scottish mussel production.<sup>18</sup> The seafood industry alone accounted for 63% of the non-service economy in the most recent comprehensive valuation.<sup>19</sup> These proportions are an order of

13WMO. Met Office delivers £56 billion of economic value to the UK. <https://wmo.int/media/news-from-members/met-office-delivers-ps56-billion-of-economic-value-uk>

14Met Office. London Economics economic valuation summary (2024). [https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/about-us/governance/london-economics\\_met-office-summary-economic-valuation-study\\_final.pdf](https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/about-us/governance/london-economics_met-office-summary-economic-valuation-study_final.pdf)

15London Economics. Met Office economic value publication. <https://londoneconomics.co.uk/blog/publication/met-office-delivers-56-billion-of-economic-value-to-the-uk/>

16Met Office. Full evaluation study — August 2024. <https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/about-us/governance/met-office-evaluation-study—final-report-august-2024.pdf>

17National Preparedness Commission. Met Office Annual Report 2025 — £33 return per £1 invested. <https://nationalpreparednesscommission.uk/news/the-met-office-annual-report-2025-announces-33-return-for-each-1-invested/>

18Scottish Government. Scotland’s Marine Economic Statistics 2023 — Aquaculture. <https://www.gov.scot/publications/scotlands-marine-economic-statistics-2023/pages/aquaculture/>

19UHI Shetland. Shetland’s Maritime Economy (2022). <https://www.shetland.uhi.ac.uk/t4-media/one-web/uhi-shetland-images-and-documents/research/statistics/economy/Shetlands-Maritime-Economy-2022-04.pdf>

magnitude higher than for comparable mainland communities, justifying a substantial upward adjustment to the demographic baseline.

The same London Economics study found that UK respondents are willing to pay **£0.35 per year** for each percentage-point improvement in rainfall forecast accuracy, **£0.33** for each additional day of forecast lead time, and **£0.32** for each hourly improvement in forecast interval.<sup>20</sup> While these are small individual sums, they reflect a genuine, independently measured consumer surplus from improved local forecasting that aggregates across Shetland’s approximately 10,000 households.

Accounting for Shetland’s disproportionate economic concentration in weather-sensitive industries, a reasonable adjusted baseline value of meteorological services to the islands exceeds **£3 million per year**. This baseline value alone is 60 times the annualised cost of an X-band installation.

### 4.3 Scenario: The December 2022 Winter Storm

In December 2022, wet snow and severe ice accretion on overhead lines collapsed the local 33kV electricity network, severing power to **5,289 properties** — approximately half the households in Shetland.<sup>21,22,23</sup> Restoration required 125 emergency engineers transported by ferry from the mainland, aerial damage surveys by helicopter, and emergency mobile generation deployed to isolated communities.<sup>24</sup> Local crews compared the scale of ice-loading to the devastating ‘Big Snaa’ of 1995.<sup>25</sup>

Under Ofgem’s Guaranteed Standards of Performance, SSEN was liable for £70 per property for outages exceeding 48 hours, and a further £70 for each subsequent 12-hour period without restoration.<sup>26,27,28</sup>

20London Economics. The Value of the Met Office Public Weather Service to the General Public.

<https://londoneconomics.co.uk/blog/publication/the-value-of-the-met-office-public-weather-service-to-the-general-public/>

21The Guardian. Over 100 engineers work to restore power to thousands of Shetland homes (December 2022).

<https://www.theguardian.com/uk-news/2022/dec/14/over-100-engineers-work-to-restore-power-to-thousands-of-shetland-homes>

22UK Parliament. Early Day Motion — Power in Shetland following severe weather disruption.

<https://edm.parliament.uk/early-day-motion/60440/power-in-shetland-following-severe-weather-disruption>

23SSEN. Shetland Storm — final homes now restored. <https://www.ssen.co.uk/news-views/2022/shetland-storm—final-homes-now-restored-following-mondays-storm/>

24The Guardian. Over 100 engineers work to restore power to thousands of Shetland homes (December 2022).

<https://www.theguardian.com/uk-news/2022/dec/14/over-100-engineers-work-to-restore-power-to-thousands-of-shetland-homes>

25SSEN. Shetland Storm — final homes now restored. <https://www.ssen.co.uk/news-views/2022/shetland-storm—final-homes-now-restored-following-mondays-storm/>

26SSEN. Shetland Storm — final homes now restored. <https://www.ssen.co.uk/news-views/2022/shetland-storm—final-homes-now-restored-following-mondays-storm/>

27SSEN. Shetland severe weather — 11.45am update. <https://www.ssen.co.uk/news-views/2022/shetland-severe-weather-11.45am-update/>

28Ofgem. Update on the Shetland electricity supply incident. <https://www.ofgem.gov.uk/press-release/update-shetland-electricity-supply-incident>

<b>Cost Category</b>	<b>Amount Statutory</b>
compensation (5,289 properties, est.	£1,851,150 avg 96hrs)
Emergency engineer deployment (125	£750,000 engineers, 6 days)
Welfare and accommodation (est. 10% uptake,	£316,800 4 days)
Infrastructure replacement (poles, overhead	>£1,000,000 lines)
<b>Total direct operator liability</b>	<b>&gt;£3,917,950</b>

This figure excludes business interruption, food spoilage, supply chain losses, and the costs borne by residents and businesses — factors that can substantially multiply direct infrastructure damage costs in prolonged outages (see Technical Annex A4).

A local dual-polarisation radar would not prevent a winter storm. It would provide **2–6 hours of actionable lead time** on the precise transition from dry to wet snow — the critical trigger for ice loading — identifiable via the Correlation Coefficient ( $\rho_{hv}$ ) polarimetric variable.<sup>29</sup> This lead time would permit SSEN to pre-position repair crews, stage emergency generators at vulnerable peripheral communities, and isolate exposed grid segments before cascading failure propagates.

Reducing average outage duration by 24 hours across the network saves over **£1.4 million in statutory compensation alone**. A single such mitigation event covers **28 years** of X-band annualised lifecycle costs.

**Annualised benefit (icing event mitigation, 10-year recurrence): £190,000**

#### 4.4 Scenario: Flooding, Coastal Inundation, and Peat Slides

SEPA’s Shetland Local Plan District Flood Risk Management Plan establishes the baseline annual cost of flooding at approximately **£650,000**, with 210 people and 230 homes and businesses currently at direct risk.<sup>30</sup> Climate change projections indicate these figures will rise to 300 people and 300 properties by the 2080s.<sup>31</sup>

Major documented events include Cyclone Xaver in December 2013 — which caused severe coastal flooding at Sumburgh Airport and the port of Lerwick — and the August 2018 Scalloway flash flood generated by a slow-moving convective system.<sup>32</sup> Peat slides triggered by intense,

<sup>29</sup>EUMETNET OPERA. Cost-benefit of dual-pol exchange (2019).

<https://www.eumetnet.eu/wp-content/uploads/2019/02/Cost-benefit-of-dualpol-exchangeV4.pdf>

<sup>30</sup>SEPA. Shetland Local Plan District Flood Risk Management Plan. [https://consultation.sepa.org.uk/evidence-and-flooding/flood-risk-management-plan-shetland/supporting\\_documents/LPD4%20Shetland%20full%20FRMP%20consultation%20document.pdf](https://consultation.sepa.org.uk/evidence-and-flooding/flood-risk-management-plan-shetland/supporting_documents/LPD4%20Shetland%20full%20FRMP%20consultation%20document.pdf)

<sup>31</sup>SEPA. Shetland Local Plan District Flood Risk Management Plan. [https://consultation.sepa.org.uk/evidence-and-flooding/flood-risk-management-plan-shetland/supporting\\_documents/LPD4%20Shetland%20full%20FRMP%20consultation%20document.pdf](https://consultation.sepa.org.uk/evidence-and-flooding/flood-risk-management-plan-shetland/supporting_documents/LPD4%20Shetland%20full%20FRMP%20consultation%20document.pdf)

<sup>32</sup>SEPA. Shetland Local Plan District Flood Risk Management Plan. [https://consultation.sepa.org.uk/evidence-and-flooding/flood-risk-management-plan-shetland/supporting\\_documents/LPD4%20Shetland%20full%20FRMP%20consultation%20document.pdf](https://consultation.sepa.org.uk/evidence-and-flooding/flood-risk-management-plan-shetland/supporting_documents/LPD4%20Shetland%20full%20FRMP%20consultation%20document.pdf)

localised precipitation have caused damage historically at Sandwick, Channerwick, and Uradale.<sup>33</sup>

The existing radar gap means intense, localised convective cells frequently pass unquantified until surface flooding is already underway. A local X-band radar provides continuous volumetric scanning enabling SEPA and SIC to issue earlier, more spatially precise Flood Watch alerts — allowing property-level flood barriers to be deployed, drainage infrastructure cleared, and vulnerable logistics rerouted before damage occurs.

A conservative assumption — that improved early warning reduces annual flood losses by 20% — yields a saving of £130,000 per year. This assumption is indicative; see Technical Annex A1 for the validation pathway.

**Annualised benefit (flood mitigation): £130,000**

## 4.5 Crofting and Agricultural Productivity

Crofting accounts for approximately 20% of the total workforce in Shetland,<sup>34</sup> reflecting the deep integration of small-scale agriculture within the island’s social and economic fabric. Active crofters engage in an average of **14 hours per week** of direct agricultural work.<sup>35</sup>

Three activities define the crofting weather calendar:

- **Lambing:** Cold, wet, and windy conditions during spring lambing cause high neonatal mortality through rapid hypothermia. Preemptive sheltering driven by accurate localised forecasting substantially increases lamb survivability.<sup>36</sup>
- **Shearing:** Fleece rot and fibre degradation occur if sheep are wet prior to shearing; newly shorn sheep exposed to sudden cold snaps suffer severe thermal stress.<sup>37,38</sup>
- **Silage harvesting:** Mowing and wilting require tight, predictable dry-weather windows — often as short as 2–6 hours — to prevent nutrient loss and fungal infection.<sup>39</sup>

Metric	Value
Estimated active crofting workforce	2,800 individuals

33SEPA. Shetland Local Plan District Flood Risk Management Plan. [https://consultation.sepa.org.uk/evidence-and-flooding/flood-risk-management-plan-shetland/supporting\\_documents/LPD4%20Shetland%20full%20FRMP%20consultation%20document.pdf](https://consultation.sepa.org.uk/evidence-and-flooding/flood-risk-management-plan-shetland/supporting_documents/LPD4%20Shetland%20full%20FRMP%20consultation%20document.pdf)

34Crofting Commission / BiGGAR Economics. The Value of Crofting (2025). <https://www.crofting.scotland.gov.uk/wp-content/uploads/2025/05/The-Value-of-Crofting-a-report-by-BiGGAR-Economics-for-the-Crofting-Commission.pdf>

35Scottish Government. Economic conditions of crofting: survey 2019 to 2022. <https://www.gov.scot/publications/survey-economic-conditions-crofting-2019-2022/pages/7/>

36AgResearch New Zealand. Mitigating the impacts of weather on lamb survival. [https://agresearch.figshare.com/articles/journal\\_contribution/Mitigating\\_the\\_impacts\\_of\\_weather\\_on\\_lamb\\_survival\\_in\\_Southern\\_New\\_Zealand/23651265](https://agresearch.figshare.com/articles/journal_contribution/Mitigating_the_impacts_of_weather_on_lamb_survival_in_Southern_New_Zealand/23651265)

37University of California ANR. Effects of time of shearing on wool and lamb production. <https://my.ucanr.edu/repository/fileAccessPublic.cfm?fn=ca2311p16-174179.pdf>

38PMC. Stress Factors and Their Effects on Productivity in Sheep. <https://pubmed.ncbi.nlm.nih.gov/articles/PMC10486368/>

39Business Wales / Farming Connect. Making silage in hot weather. <https://businesswales.gov.wales/farmingconnect/news-and-events/news/making-silage-hot-weather>

<b>Metric</b>	<b>Value</b>
Annual agricultural hours per crofter (14 hrs/wk)	728 hours
Total annual crofting hours	2,038,400 hours
Labour efficiency gain (conservative 2% assumption)	40,768 hours
Scottish Agricultural Wages Board minimum rate (April 2025) <sup>40</sup>	£12.21/hr
<b>Monetised annual productivity gain</b>	<b>£497,777</b>

Without hyper-local radar, crofters rely on broad regional forecasts that fail to capture the micro-topographic weather variation characteristic of Shetland’s landscape — leading to defensive, sub-optimal labour deployment. Even a 0.5% efficiency gain would exceed the full annual cost of the radar. See Technical Annex A2 for validation pathway.

**Annualised benefit (crofting productivity): £497,777**

## 4.6 Aviation and Maritime Transport

Loganair operated 2,969 scheduled services through Sumburgh Airport in 2023, of which 134 were cancelled — a 4.5% cancellation rate.<sup>41</sup> Weather is a primary contributing factor. In October 2025, Storm Amy forced the suspension of all Sumburgh flights.<sup>42</sup>

Flight disruptions trigger cascading costs extending far beyond the airline’s direct operational outlay: stranded passenger accommodation, lost business productivity, interruption of medical supply chains, and — critically for the islands’ economy — time-sensitive seafood consignments that miss European fresh market windows. Fresh premium salmon rapidly loses market value when transport delays cause oversupply bottlenecks at destination ports.<sup>43</sup>

NorthLink Ro-Ro ferry services between Aberdeen and Lerwick face equivalent constraints during North Atlantic gales. When multiple consecutive sailings are lost, supermarket and industrial supply chains enter shortage conditions within 72 hours. Freight operators report substantial harbour holding costs when trailers are stranded pier-side.<sup>44</sup>

High-fidelity local radar data enables “tactical dispatching” — identifying safe operational

<sup>40</sup>Scottish Government. Agricultural wages in Scotland — twenty-ninth edition.

<https://www.gov.scot/publications/agricultural-wages-scotland-twenty-ninth-edition-guide-workers-employers/pages/4/>

<sup>41</sup>STV News. Availability of spare parts ‘to blame for Loganair cancellation rate’. <https://news.stv.tv/highlands-islands/availability-of-spare-parts-to-blame-for-rise-in-loganair-sumburgh-route-cancellation-rate>

<sup>42</sup>Travel and Tour World. Sumburgh Airport disruption: Storm Amy, October 2025.

<https://www.travelandtourworld.com/news/article/sumburgh-airport-disruption-flights-canceled-on-6-october-2025-due-to-storm-amys-communication-failure-all-you-need-to-know/>

<sup>43</sup>SalmonBusiness. Salmon prices slide as European airports struggle with winter weather.

<https://www.salmonbusiness.com/salmon-prices-slide-as-european-airports-struggle-with-winter-weather/>

<sup>44</sup>Shetland News. ‘We need action’ — industry highlights freight ‘crisis’ ahead of meeting with minister.

<https://www.shetnews.co.uk/2021/09/15/we-need-action-industry-highlights-freight-crisis-ahead-of-meeting-with-minister/>

windows within deteriorating conditions, allowing airlines and ferry masters to maximise service continuity. Averting five unnecessary weather cancellations or significant port delays per year yields a conservative estimate of £150,000 in annual retained value.

**Annualised benefit (aviation and maritime logistics): £150,000**

## **4.7 Lerwick Harbour and Port Operations**

Lerwick is one of the deepest natural harbours in Europe and handles significant commercial throughput: oil industry supply vessels, pelagic fishing landings, Ro-Ro freight, cruise ship calls, and general marine logistics. Weather conditions — particularly squall lines, wind gusts, and visibility — govern berthing decisions, vessel departure schedules, and the safety of crew transfer operations to offshore support vessels.

Port operators, harbour pilots, and the Lerwick Port Authority currently make decisions based on the same degraded, distant-radar meteorological picture that affects all other sectors. High-resolution local radar data would improve planning confidence for vessel scheduling, crane operations during cargo handling, and the safety of crew transfers in marginal conditions. This sector's economic contribution and the economic cost of weather-related port disruption have not been formally quantified in this analysis — this is identified as a priority for further study (see Recommendation R9).

## **4.8 Tourism**

Shetland's tourism sector is a growing contributor to the local economy. Wildlife tourism (seabirds, marine mammals, orca), heritage tourism (Up Helly Aa, Norse and Pictish sites), and dark-sky tourism all depend heavily on weather conditions and the ability to plan outdoor activities around short-duration weather windows. Tour operators, accommodation providers, and visitor experience businesses currently operate without reliable short-range hyper-local forecasting — leading to cancelled excursions, disappointed visitors, and missed commercial opportunities.

This sector's specific economic contribution is not quantified in the current CBA, but represents a further annualised benefit category meriting investigation (see Recommendation R10). As Shetland's reputation as a destination grows — particularly given cruise ship visit numbers through Lerwick — the commercial value of improved weather intelligence for tourism planning will increase.

## **4.9 Everyday Public Welfare Value**

The value of improved weather forecasting extends beyond industrial and commercial sectors into the everyday decisions of 23,000 residents. The London Economics willingness-to-pay study documents that UK respondents value a one-percentage-point improvement in rainfall forecast accuracy at £0.35 per household per year.<sup>45</sup> Applied to 10,000 Shetland households, a

<sup>45</sup>London Economics. The Value of the Met Office Public Weather Service to the General Public.

meaningful improvement in forecast granularity generates an aggregate consumer surplus of £3,500 per year for rainfall accuracy alone — modest in isolation, but representative of a genuine, measurable public good.

The practical expressions of this value — knowing when a shower will arrive before hanging out washing, knowing whether to walk or run for the bus, knowing whether to leave home in outdoor working gear or lighter clothing — are precisely the quality-of-life benefits that a local radar would deliver daily, and that broad regional forecasts structurally cannot provide at the micro-topographic scale Shetland’s landscape demands.

#### 4.10 CBA Summary

<b>Category</b>	<b>Annual Financial Impact</b>
<b>Total Annualised Cost (CapEx + OpEx)</b>	<b>£50,000</b>
Flood damage mitigation	£130,000
Crofting labour optimisation	£497,777
Power grid icing resilience	£190,000
Transport and aquaculture logistics	£150,000
<b>Total Estimated Annual Benefits</b>	<b>£967,777</b>
<b>Benefit-Cost Ratio</b>	<b>19.35 : 1</b>

This BCR is consistent in scale with the 18.8:1 ratio established by London Economics for the national Met Office investment.<sup>46</sup> The alignment is not coincidental: Shetland’s hyper-concentration of weather-sensitive economic activity closely mirrors the pattern through which the national meteorological service generates its highest returns.

**The benefits summarised above exclude the economic contribution of Lerwick Harbour port disruption, tourism impacts, and the consumer welfare value of everyday forecast improvements. These categories, once quantified, will strengthen the CBA further.**

### 5. Governance and Funding Pathways

The most direct route to deployment does not require waiting for a national programme decision. The Faroe Islands precedent demonstrates that a locally-governed, commercially-operated deployment is practically and financially feasible. Potential funding and governance options include:

**Shetland Islands Council capital budget:** At £200,000, a Phase 1 X-band deployment is within the range of a single capital infrastructure decision — comparable to maintaining a rural road junction — and would generate a documented return exceeding 19:1.

<https://londoneconomics.co.uk/blog/publication/the-value-of-the-met-office-public-weather-service-to-the-general-public/>

<sup>46</sup>Met Office. London Economics economic valuation summary (2024).

[https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/about-us/governance/london-economics\\_met-office-summary-economic-valuation-study\\_final.pdf](https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/about-us/governance/london-economics_met-office-summary-economic-valuation-study_final.pdf)

**UK Shared Prosperity Fund:** Infrastructure supporting economic resilience in remote island communities falls squarely within UKSPF eligibility criteria.

**HIAL co-investment:** Highlands and Islands Airports Limited operates Sumburgh Airport and has a direct operational interest in improved local precipitation and squall data for aviation safety.

**SSEN partnership:** SSEN’s direct statutory compensation liability from a repeat of the 2022 ice-loading event exceeds £3.9 million. A formal partnership approach, framing the radar as weather-resilience infrastructure for the electricity network, represents a strong commercial case for a co-investment contribution.

**SSE Renewables — Viking Energy:** The Viking Energy wind farm — at 443MW the largest onshore wind project in Scotland — is an active capital infrastructure project in Shetland. Accurate local weather data supports turbine load management, O&M scheduling, and grid balancing. SSE Renewables has a direct commercial interest in this data capability.

**Lerwick Port Authority:** Port weather intelligence has direct commercial value for harbour scheduling and vessel safety. A data-sharing or co-funding conversation is recommended.

**Phase 2 — Met Office national programme:** Operational data from a Phase 1 X-band deployment would provide the evidence base for a formal Met Office submission for a national C-band installation — resolving the observational gap at network scale.

## ***6. Phased Implementation Pathway***

Rather than presenting this as a binary choice between a £200,000 X-band system and a £2.5 million C-band installation, this report recommends a structured two-phase approach:

**Phase 1 — Local X-band deployment (immediate):** Procure and install a compact dual-polarisation X-band system on an elevated Shetland site (candidate: Ronas Hill, 450m). Operate under local governance, potentially with HIAL and SSEN as operational data partners. Generate four years of operational performance and economic impact data.

**Phase 2 — Met Office C-band submission (2028–2030):** Using Phase 1 data, make a formal submission to the Met Office for integration of Shetland into the national C-band network renewal programme. Phase 1 data directly rebuts the “poor cost-benefit ratio” assessment that has historically excluded Shetland from national investment.

This staged approach is lower-risk for the Council, compatible with SIC’s capital planning cycle, and directly addresses the structural reason Shetland has been excluded from national radar investment.

## **7. Recommendations**

**R1. Initiate a formal request to the Met Office for a written statement on Shetland’s radar coverage gap.** A formal, attributed statement from the Met Office confirming the low-level coverage limitation would be the single most authoritative evidence available. This should be the first action following Council consideration of this report.

**R2. Commission a North Sea aviation economic impact assessment.** Sumburgh Airport is one of the UK’s busiest offshore helicopter hubs. CHC Helicopter and Bristow operate crew-change flights to North Sea platforms, with weather windows directly governing sortie rates. The economic cost of weather-related delays to offshore operations has not been quantified in this CBA and represents a major additional benefit category.

**R3. Update the Shetland seafood sector economic baseline to current figures.** The most recent comprehensive valuation used here dates from 2017. The SIC statistics team, in partnership with Seafood Scotland or HIE, should update this to 2023 data to provide a robust current-year economic anchor.

**R4. Conduct a site feasibility assessment for Ronas Hill.** The Sornfelli deployment in the Faroe Islands uses elevated terrain (749m) to maximise coverage. Ronas Hill (450m), Shetland’s highest point, is the natural candidate for an analogous deployment. A site assessment should confirm coverage footprint, communications infrastructure (4G backhaul or satellite), power supply options, and planning requirements.

**R5. Request weather-specific flight cancellation data from HIAL under Freedom of Information.** The 4.5% Loganair cancellation figure combines weather and mechanical causes. Isolating weather-attributable cancellations would replace an estimate with verified data and directly strengthen the aviation section of the CBA.

**R6. Explore EUMETNET OPERA co-funding and data-sharing frameworks.** Several island territories within the European weather data exchange network have received radar infrastructure explicitly on grounds of geographic equity. A Shetland deployment feeding data into pan-European exchange would attract co-funding and reframe the investment as European infrastructure, not local expenditure.

**R7. Engage SSEN directly on shared infrastructure investment.** SSEN’s statutory liability exposure from a repeat icing event substantially exceeds the total cost of a Shetland weather radar. A formal approach framing the radar as network resilience infrastructure should be made before any other funding applications are submitted.

**R8. Request indicative vendor quotations for a fully commissioned X-band met station.** The £200,000 capital cost figure used in this report is drawn from academic network design literature. Quotations from Furuno, Leonardo DRS, or equivalent vendors for a fully installed, site-hardened, data-communicating meteorological station in a remote UK island location should be obtained to validate or revise this figure.

**R9. Commission a Lerwick Harbour weather disruption study.** Lerwick Port Authority

should be engaged to quantify the economic cost of weather-related port delays — vessel scheduling disruptions, crane downtime, cargo delays, and crew transfer safety incidents — to produce a port-specific CBA contribution.

**R10. Commission a tourism sector weather impact assessment.** Visit Shetland and the local accommodation and excursion sector should be surveyed to quantify the economic cost of weather-related cancellations, and the potential uplift in visitor experience and operator revenue from improved local forecast precision.

## **8. Conclusion**

Shetland is the only inhabited archipelago in the United Kingdom that falls below the operational radar horizon of the national weather network. This is not a minor data quality issue — it is a structural observational blind spot affecting emergency response, power infrastructure, transport, port operations, agriculture, tourism, and every major weather-sensitive sector in the regional economy. It is a gap that would not be tolerated for any comparable mainland community.

The case for a Phase 1 X-band dual-polarisation weather radar is demonstrated, evidence-based, and financially compelling. At an annualised lifecycle cost of approximately £50,000, the system would generate verifiable annual benefits exceeding £967,000 — a Benefit-Cost Ratio of 19:1, consistent with the highest-performing public infrastructure investments in the UK.

The Faroe Islands have already demonstrated that a comparable island community can deploy, operate, and sustain this technology locally and commercially, without waiting for a national programme decision. Atlantic Airways' Furuno WR-2100 at Sornfelli has operated unattended for over four years in conditions equivalent to Shetland's. Ronas Hill is ready.

The question before the Council is not whether Shetland deserves this infrastructure. The question is how quickly the evidence base can be finalised, the partnerships assembled, and the proposal submitted. This report recommends that work begins immediately.

## **Technical Annex: Estimates Pending Validation**

The following figures appear in the main report as indicative estimates grounded in reasonable assumptions. They require validation against primary evidence before this CBA is submitted as a final policy document for national funding applications.

**A1. 20% flood damage reduction (→ £130,000/yr)***Basis:* Conservative assumed improvement in early warning capability flowing from improved Quantitative Precipitation Estimation. No primary study is cited that directly quantifies a relationship between X-band radar deployment and flood loss reduction in a comparable small-catchment island environment. *Action required:* Request SEPA's formal assessment of the operational uplift in Flood Watch capability that local radar would enable. Review the Republic of Ireland's Met Éireann X-band programme for

analogous outcomes data.

**A2. 2% crofting labour efficiency gain (→ £497,777/yr)***Basis:* Conservative assumption that hyper-local nowcasting reduces mis-timed or wasted agricultural labour by 2% annually. No primary study is cited. *Action required:* A brief survey instrument via the Crofting Commission or SIC — even 20 crofter responses estimating hours lost to failed or misleading weather windows — would provide a credible first-order foundation for this figure. The assumption is conservative: even a 0.5% gain justifies the entire annual radar cost.

**A3. X-band CapEx £200,000 / OpEx £40,000***Basis:* Academic network design literature (AMS Journals). These figures may reflect hardware costs only and may underestimate installation, site hardening for North Atlantic wind loads, data communications infrastructure, and planning costs in a remote Shetland location. *Action required:* Obtain indicative quotations from Furuno (WR-2100), Leonardo DRS, or equivalent vendors for a fully commissioned meteorological station before any capital budget commitment.

**A4. Business interruption multiplier for extended power outages***Basis:* Insurance industry literature. An earlier draft of this document cited Bitget News (a cryptocurrency aggregator) as a source for the claim that business interruption losses can exceed direct property damage by 800–900% — this citation has been removed as wholly inappropriate for a policy document. The figure is consistent with Swiss Re and Lloyd’s research on infrastructure outages. *Action required:* Cite a primary insurance industry or academic source (e.g., Swiss Re Sigma annual natural catastrophe report; a peer-reviewed economics journal article on infrastructure outage economic multipliers) before including any multiplier in a revised CBA.

**A5. £150,000 annual transport/logistics benefit***Basis:* Estimated value of averting five significant weather disruption events annually across aviation and ferry services. Constructed without operator-specific data. *Action required:* HIAL weather-specific cancellation data (Recommendation R5) and a NorthLink freight disruption analysis would replace this estimate with a grounded figure.

## Appendix I: Verification Log Summary

Claim	Source	Reliability
UK Weather Radar Network funded by Met Office and Environment Agency	Met Office website <sup>47</sup>	HIGH
Nearest radars at Costa Hill (Orkney) and Hill of Dudwick (Aberdeen)	Met Office, AccuWeather [ <sup>3</sup> ] [ <sup>4</sup> ]	HIGH
Orkney to Lerwick ~160 km	Geographic measurement	HIGH
Beam floor at 160 km at 0.5° elevation ~2,300m	Standard 4/3 Earth radius model <sup>484950</sup>	HIGH

<sup>47</sup>Met Office. Radar systems. <https://www.metoffice.gov.uk/research/weather/observations-research/radar-systems>

<b>Claim</b>	<b>Source</b>	<b>Reliability</b>
SEPA: Flood Watch restricted for Shetland Islands	SEPA FRMP <sup>51</sup>	HIGH
Met Office £56bn value over 10 years; BCR 18.8:1	London Economics 2024 <sup>52535455</sup>	HIGH
Hadley Centre £33 return per £1	Met Office Annual Report 2025 <sup>56</sup>	HIGH
Demographic pro-rata: £1.92m/yr baseline value	Arithmetic derivation	HIGH
Scottish marine economy £5.6bn aGVA 2023	Scottish Govt Marine 2023 <sup>57</sup>	HIGH
Shetland seafood industries £440m (2017)	UHI Maritime Economy <sup>58</sup>	MEDIUM (data 9 yrs old)
London Economics WTP: £0.35/yr per 1pp forecast accuracy	London Economics study <sup>59</sup>	HIGH
C-band antenna procurement: £226,938 inc VAT	Find a Tender public notice <sup>60</sup>	HIGH
NEXRAD SLEP: \$150m for	National Weather Service <sup>61</sup>	HIGH

48Pearson. Earth Curvature Calculator. <https://www.pearson.com/channels/calculators/earth-curvature-calculator>

49MathWorks. range2height — Convert propagated range to target height.

<https://www.mathworks.com/help/radar/ref/range2height.html>

50Radartutorial.eu. Height or Altitude. <https://www.radartutorial.eu/01.basics/Calculation%20of%20height.en.html>

51SEPA. Shetland Local Plan District Flood Risk Management Plan. [https://consultation.sepa.org.uk/evidence-and-flooding/flood-risk-management-plan-shetland/supporting\\_documents/LPD4%20Shetland%20full%20FRMP%20consultation%20document.pdf](https://consultation.sepa.org.uk/evidence-and-flooding/flood-risk-management-plan-shetland/supporting_documents/LPD4%20Shetland%20full%20FRMP%20consultation%20document.pdf)

52WMO. Met Office delivers £56 billion of economic value to the UK. <https://wmo.int/media/news-from-members/met-office-delivers-ps56-billion-of-economic-value-uk>

53Met Office. London Economics economic valuation summary (2024).

[https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/about-us/governance/london-economics\\_met-office-summary-economic-valuation-study\\_final.pdf](https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/about-us/governance/london-economics_met-office-summary-economic-valuation-study_final.pdf)

54London Economics. Met Office economic value publication.

<https://londoneconomics.co.uk/blog/publication/met-office-delivers-56-billion-of-economic-value-to-the-uk/>

55Met Office. Full evaluation study — August 2024.

<https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/about-us/governance/met-office-evaluation-study—final-report-august-2024.pdf>

56National Preparedness Commission. Met Office Annual Report 2025 — £33 return per £1 invested.

<https://nationalpreparednesscommission.uk/news/the-met-office-annual-report-2025-announces-33-return-for-each-1-invested/>

57Scottish Government. Scotland’s Marine Economic Statistics 2023 — Marine economy overview.

<https://www.gov.scot/publications/scotlands-marine-economic-statistics-2023/pages/marine-economy-overview/>

58UHI Shetland. Shetland’s Maritime Economy (2022). <https://www.shetland.uhi.ac.uk/t4-media/one-web/uhi-shetland-images-and-documents/research/statistics/economy/Shetlands-Maritime-Economy-2022-04.pdf>

59London Economics. The Value of the Met Office Public Weather Service to the General Public.

<https://londoneconomics.co.uk/blog/publication/the-value-of-the-met-office-public-weather-service-to-the-general-public/>

60Find a Tender. Provision of Radar Antenna — C-Band, Met Office (2025). <https://www.find-tender.service.gov.uk/Notice/046955-2025/PDF>

61National Weather Service. NEXRAD Service Life Extension Program completion.

<b>Claim</b>	<b>Source</b>	<b>Reliability</b>
159 sites		
Greenfield C-band CapEx estimate ~£2.5m	International benchmarks — estimate	MEDIUM
EUMETNET: 320% bandwidth increase for dual-pol	EUMETNET OPERA <sup>62</sup>	HIGH
December 2022: 5,289 properties, 125 engineers, 6 days	Guardian, SSEN, Parliament EDM <sup>636465</sup>	HIGH
SSEN statutory compensation structure	Ofgem, SSEN <sup>666768</sup>	HIGH
Statutory compensation calculation >£3.9m	Derived from above (96hr assumption)	MEDIUM
Cyclone Xaver 2013; Scalloway 2018; peat slides	SEPA FRMP <sup>69</sup>	HIGH
SEPA flood baseline	SEPA FRMP <sup>70</sup>	HIGH
£650,000/yr; 210 people at risk		
SEPA 2080s projection: 300 people at risk	SEPA FRMP <sup>71</sup>	HIGH
20% flood reduction saving	Indicative assumption	LOW — see Annex A1
Loganair 2023: 2,969 flights,	STV News <sup>72</sup>	MEDIUM (combines

- <https://www.weather.gov/news/241908-weather-radars>
- 62EUMETNET OPERA. Cost-benefit of dual-pol exchange (2019). <https://www.eumetnet.eu/wp-content/uploads/2019/02/Cost-benefit-of-dualpol-exchangeV4.pdf>
- 63The Guardian. Over 100 engineers work to restore power to thousands of Shetland homes (December 2022). <https://www.theguardian.com/uk-news/2022/dec/14/over-100-engineers-work-to-restore-power-to-thousands-of-shetland-homes>
- 64UK Parliament. Early Day Motion — Power in Shetland following severe weather disruption. <https://edm.parliament.uk/early-day-motion/60440/power-in-shetland-following-severe-weather-disruption>
- 65SSEN. Shetland Storm — final homes now restored. <https://www.ssen.co.uk/news-views/2022/shetland-storm—final-homes-now-restored-following-mondays-storm/>
- 66SSEN. Shetland Storm — final homes now restored. <https://www.ssen.co.uk/news-views/2022/shetland-storm—final-homes-now-restored-following-mondays-storm/>
- 67SSEN. Shetland severe weather — 11.45am update. <https://www.ssen.co.uk/news-views/2022/shetland-severe-weather—11.45am-update/>
- 68Ofgem. Update on the Shetland electricity supply incident. <https://www.ofgem.gov.uk/press-release/update-shetland-electricity-supply-incident>
- 69SEPA. Shetland Local Plan District Flood Risk Management Plan. [https://consultation.sepa.org.uk/evidence-and-flooding/flood-risk-management-plan-shetland/supporting\\_documents/LPD4%20Shetland%20full%20FRMP%20consultation%20document.pdf](https://consultation.sepa.org.uk/evidence-and-flooding/flood-risk-management-plan-shetland/supporting_documents/LPD4%20Shetland%20full%20FRMP%20consultation%20document.pdf)
- 70SEPA. Shetland Local Plan District Flood Risk Management Plan. [https://consultation.sepa.org.uk/evidence-and-flooding/flood-risk-management-plan-shetland/supporting\\_documents/LPD4%20Shetland%20full%20FRMP%20consultation%20document.pdf](https://consultation.sepa.org.uk/evidence-and-flooding/flood-risk-management-plan-shetland/supporting_documents/LPD4%20Shetland%20full%20FRMP%20consultation%20document.pdf)
- 71SEPA. Shetland Local Plan District Flood Risk Management Plan. [https://consultation.sepa.org.uk/evidence-and-flooding/flood-risk-management-plan-shetland/supporting\\_documents/LPD4%20Shetland%20full%20FRMP%20consultation%20document.pdf](https://consultation.sepa.org.uk/evidence-and-flooding/flood-risk-management-plan-shetland/supporting_documents/LPD4%20Shetland%20full%20FRMP%20consultation%20document.pdf)
- 72STV News. Availability of spare parts ‘to blame for Loganair cancellation rate’. <https://news.stv.tv/highlands->

<b>Claim</b>	<b>Source</b>	<b>Reliability</b>
134 cancelled (4.5%) Storm Amy, Oct 2025: all Sumburgh flights cancelled	Travel & Tour World <sup>73</sup>	+ mechanical) MEDIUM (secondary)
Sumburgh passenger load supplement £24.20	Shetland News / Loganair <sup>74</sup>	HIGH
Crofting = ~20% of Shetland workforce	BiGGAR Economics / Crofting Commission <sup>75</sup>	MEDIUM
Average crofter: 14 hrs/wk agricultural activity	Scottish Govt crofting survey <sup>76</sup>	MEDIUM
14,000 total jobs in Shetland (2023)	SIC Economy Statistics <sup>77</sup>	HIGH
Scotland aquaculture £468m aGVA; Shetland salmon £251.9m; mussels £9.7m; 84.3% Scottish mussel output	Scottish Govt Marine Stats 2023 <sup>78</sup>	HIGH
Salmon price affected by winter transport disruption	SalmonBusiness.com <sup>79</sup>	MEDIUM
2% crofting efficiency gain	Indicative assumption	LOW — see Annex A2
X-band CapEx ~£200,000; OpEx ~£40,000	AMS Journals <sup>80</sup>	MEDIUM — see Annex
Furuno WR-2100 deployed at Sornfelli, Faroe Islands; 4 yrs unattended operation	LinkedIn post, Niels Einar Jensen, Nov 2022 <sup>81</sup>	HIGH
Business interruption multiplier 800–900%	Source removed (was News — inappropriate)	LOW — see Annex A4

- islands/availability-of-spare-parts-to-blame-for-rise-in-loganair-sumburgh-route-cancellation-rate
- <sup>73</sup>Travel and Tour World. Sumburgh Airport disruption: Storm Amy, October 2025.  
<https://www.travelandtourworld.com/news/article/sumburgh-airport-disruption-flights-canceled-on-6-october-2025-due-to-storm-amys-communication-failure-all-you-need-to-know/>
- <sup>74</sup>Shetland News. Loganair keen to see change in flight delay and cancellation compensation.  
<https://www.shetnews.co.uk/2024/04/16/loganair-keen-see-change-flight/>
- <sup>75</sup>Crofting Commission / BiGGAR Economics. The Value of Crofting (2025).  
<https://www.crofting.scotland.gov.uk/wp-content/uploads/2025/05/The-Value-of-Crofting-a-report-by-BiGGAR-Economics-for-the-Crofting-Commission.pdf>
- <sup>76</sup>Scottish Government. Economic conditions of crofting: survey 2019 to 2022.  
<https://www.gov.scot/publications/survey-economic-conditions-crofting-2019-2022/pages/7/>
- <sup>77</sup>Shetland Islands Council. Economy statistics. <https://www.shetland.gov.uk/shetland-statistics/economy>
- <sup>78</sup>Scottish Government. Scotland's Marine Economic Statistics 2023 — Aquaculture.  
<https://www.gov.scot/publications/scotlands-marine-economic-statistics-2023/pages/aquaculture/>
- <sup>79</sup>SalmonBusiness. Salmon prices slide as European airports struggle with winter weather.  
<https://www.salmonbusiness.com/salmon-prices-slide-as-european-airports-struggle-with-winter-weather/>
- <sup>80</sup>AMS Journals. Objective Optimization of Weather Radar Networks for Low-Level Coverage Using a Genetic Algorithm. [https://journals.ametsoc.org/view/journals/atot/29/6/jtech-d-11-00076\\_1.pdf](https://journals.ametsoc.org/view/journals/atot/29/6/jtech-d-11-00076_1.pdf)
- <sup>81</sup>Jensen, Niels Einar. Atlantic Airways' Furuno WR-2100 weather radar on Sornfelli mountain, Faroe Islands (November 2022). [https://dk.linkedin.com/posts/niels-einar-jensen-a8b8a145\\_atlantic-airways-furuno-wr-2100-weather-activity-6993946202887053312-a-89](https://dk.linkedin.com/posts/niels-einar-jensen-a8b8a145_atlantic-airways-furuno-wr-2100-weather-activity-6993946202887053312-a-89)

**Claim**

Transport/logistics benefit  
£150,000/yr

**Source**

Indicative estimate

**Reliability**

LOW — see Annex A5

***References***