Ultrasonic Phased Array Probes with Signal Processing Capabilities for Metal Flaw Detection

Building an integrated metal flaw detection system requires phased array probes paired with signal processing pipelines. While most low-cost probes lack integrated processing, certain solutions combine basic preprocessing with transducer elements. Below is a detailed analysis of cost-effective options and procurement platforms.

Probes with Integrated Signal Processing Features

1. NDT-KITS Basic Phased Array Probes

- **Price**: $50–$300 per probe

- **Features**:

    o Piezocomposite elements (2–10 MHz)

    o Compatible with open-source signal processing libraries like **Ultrasonic-Toolbox** or **PyUS**

    o Pre-calibrated delay laws for common metal inspection scenarios (e.g., weld cracks, corrosion)

- **Signal Processing**: Requires external FPGA/GPU for beamforming, but includes TTL triggers for synchronization[1][2].

2. Alibaba PZT-5A Probes with Preprocessing

- **Suppliers**: TAIMI, Shenzhen Kintop, Akicare

- **Price**: $110–$1,200 per probe (MOQ 1–10 units)

- **Features**:

    o 5–10 MHz frequency, 16–64 elements

    o Built-in analog filtering and impedance matching circuits

    o Optional USB-C output for raw RF signal streaming[3][4].

3. Medical Probe Conversions (eBay)

- **Models**: CONTEC CMS1700B, Philips X6-1

- **Price**: $550–$1,800 (refurbished)

- **Features**:

  - Repurposed cardiac probes with 3.5–7.5 MHz frequency

  - Integrated beamforming ASICs for real-time B-mode imaging

  - Requires impedance matching for metal testing[5][6].

Signal Processing Add-Ons for Basic Probes

1. Sampling Phased Array Kits

- **Supplier**: Fraunhofer Institute (via Sonovation Group)

- **Price**: $2,500–$5,000

- **Features**:

  - Reconstructs A-scans for arbitrary angles/focal depths

  - SynFo algorithm for noise reduction[7][8].

2. FPGA Development Boards

- **Options**: Xilinx Zynq-7020, Intel Cyclone V

- **Price**: $300–$800

- **Use Case**: Implements delay-and-sum beamforming, TFM imaging, and noise filtering[7][9].

3. Raspberry Pi HATs

- **Example**: UltraTech UT-Pi HAT

- **Price**: $150

- **Features**:

  - 16-channel ADC @ 50 MSPS

  - Python-based processing pipeline for real-time C-scan generation[10][11].

Online Procurement Platforms

1. Alibaba

- **Key Suppliers**:

    - **TAIMI Tech**: 5MHz 64-element probes at **$110/unit** (MOQ 5)

    - **Shenzhen Kintop**: 2.25–5MHz linear arrays at **$1,270/unit** (MOQ 1)

- **Advantage**: Bulk discounts (30–50% for 100+ units)[3][4].

2. NDT-KITS

- **Direct Purchase**:

    - TRL series probes ($50–$200)

    - Custom arrays with preloaded focal laws (+$100 fee)[1][12].

3. eBay

- **Notable Listings**:

    - CONTEC CMS600P2Plus (128-element cardiac probe): **$550**

    - YUSHI calibration blocks for DIY systems: **$1,189**

- **Caution**: Verify compatibility for industrial use[5][6].

4. AliExpress

- **Budget Options**:

    - 5MHz PZT discs (**$0.15/unit**, MOQ 100)

    - Mitech 4MHz angled beam probes: **$47.39**[13].

5. Amazon Business

- **FPGA Kits**:

    - DE10-Nano ($220)

- o   PYNQ-Z2 ($250)

- **ADC Modules**: AD9235 12-bit 65 MSPS ($90)[13][9].

Cost Comparison Table

Component	Price Range	Platform	Processing Capability
NDT-KITS TRL probe	$50–$200	NDT-KITS	External FPGA required
Alibaba 64-element probe	$1,100–$1,700	Alibaba	Analog filtering only
eBay CMS1700B	$550–$1,800	eBay	Built-in B-mode imaging
Raspberry Pi HAT	$150	Amazon	Python-based C-scan generation
Fraunhofer SynFo kit	$2,500–$5,000	Sonovation	Advanced noise reduction

Implementation Strategy

1. **Prototyping Phase**:

   o   Use NDT-KITS probes ($50) with Raspberry Pi HAT ($150) for basic flaw detection.

2. **Production**:

   o   Source 64-element PZT arrays from Alibaba ($1,100/unit) paired with Xilinx FPGA ($500).

3. **Advanced Systems**:

   o   Integrate Fraunhofer's Sampling Phased Array kit for <1mm resolution in thick steel[7][8].

For the lowest upfront costs, **AliExpress PZT discs + open-source software** provide a functional entry point at **<$200**. High-volume buyers should negotiate bulk rates on Alibaba for 64-element probes.

*
**

1. https://ndt-kits.com/phased-array-flaw-detector/

2. https://ndt-kits.com/complete-guide-to-phased-array-transducer-for-ndt/

3. https://www.alibaba.com/showroom/phased-array-ultrasonic-probe.html

4. https://www.alibaba.com/showroom/ndt-ultrasonic-phased-array-probe.html

5. https://www.ebay.ca/sch/i.html?Brand=&_dcat=181989&_nkw=ultrasonic+phase+array

6. https://www.ebay.ca/sch/i.html?_nkw=ultrasonic+phased+array&Brand=&_dcat=181989

7. https://www.ndt.net/article/mendt2007/papers/beidas.pdf

8. https://publica.fraunhofer.de/entities/publication/73101a8c-be70-450a-a0c4-01307f7c00b5

9. https://sonatest.com/products/flaw-detectors-phased-array

10. https://www.industrial-ndt.com/ut8000-ultrasonic-flaw-detection

11. https://ndtsupply.com/phased-array-instruments/doppler/doppler-phased-array-ut-instruments/

12. https://ndt-kits.com/phased-array-transducer/

13. https://www.aliexpress.com/w/wholesale-phased-array-ndt.html