1. INTRODUCTION
A novel composite cross-arm for overhead lines has been developed. The cross-arm consists of four insulating members, end fittings, field grading devices and a nose connection for the attachment of the conductor. Following the installation of four prototype cross-arms on a decommissioned line in the Scottish Highlands, a 400 kV live trial is taking place in a coastal location of northern Scotland (Fig. 1).

2. PURPOSE OF THE TRIAL
To observe the electrical behaviour of the composite cross-arm and correlate its performance to the environmental conditions.

3. THE SITE
- Substation on the east coast of Scotland.
- A small lattice tower accommodates two cross-arms installed at an orientation of 90° from each other (Fig. 2).
- An 8 m long 400 kV conductor connects the high voltage ends of the cross-arms.
- A 50 kVA transformer energises the cross-arms at 231 kV phase-to-ground.

4. PROTECTION SYSTEM
A fast, reliable and sensitive protection system was designed specifically for the trial with the following fault level requirements:
- 415 V phase-to-phase: 3031 A
- 415 V phase-to-ground: 935 A
- 415 V phase-to-phase-to-ground: 3333 A
- 231 kV phase-to-ground: 1351 A

The protection system employs the following schemes:
- **Overcurrent protection** to protect against winding faults in the transformer.
- **Inrush protection** to protect the system from voltage dips resulting from high magnetising inrush currents.
- **Undervoltage protection** to complement the overcurrent protection.
- **Differential protection** to detect phase-to-ground faults.

5. CONCLUSION
The analysis of the results from this facility combined with electrical FEA (Fig. 8) will enhance the understanding of the performance of the composite cross-arm in preparation for deployment on a live network.