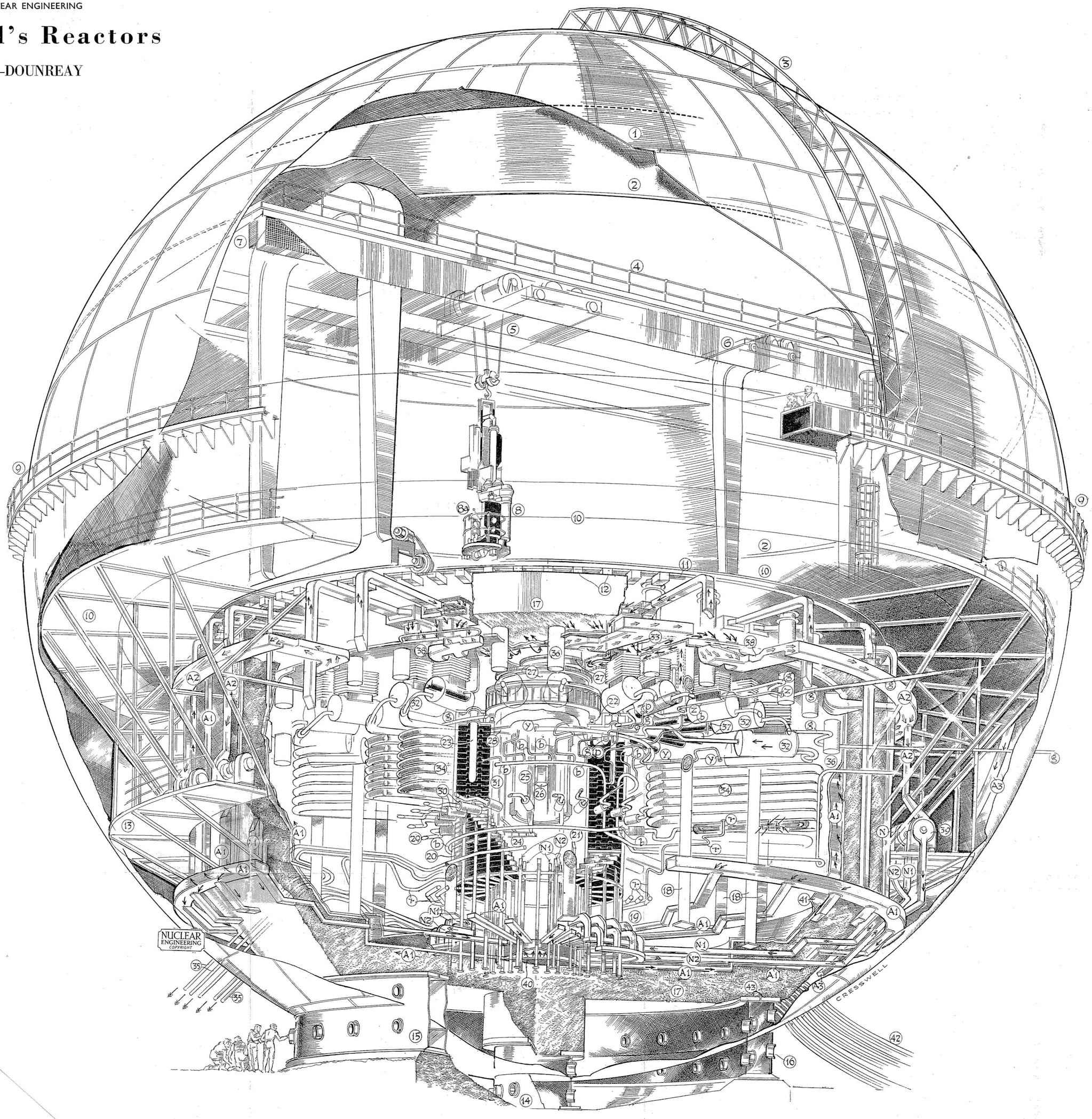
The World's Reactors

No. 12—DOUNREAY



KEY

1. Steel sphere
2. Acoustic blanket
3. Revolving catwalk
4. Goliath crane
5. 25 ton crab
6. 7½ ton crab
7. Bus bars and crane control cables
8. Charge and discharge machine
8a. Charge and discharge control
9. Exterior Catwalk (wind girder)
10. False floor
11. Goliath crane rail
12. Goliath crane rail sleepers
13. Fan gallery
14. Inner skirt
15. Outer skirt
16. Crawl holes
17. Reactor vault
18. Reactor vault roof supports
19. Vessel support
20. Graphite (shield)
21. Reactor vessel
22. Vessel support rollers
23. Instrument tubes and mortuary
24. Control arm
25. Uranium blanket
26. Core
27. Eccentric shield plugs
28. Sodium in
29. Sodium out
30. Nitrogen blanket buffer
31. Control rod guide
32. Electro-magnetic pump
33. Access to E.M.P. windings
34. Primary heat exchanger
35. To secondary heat exchanger
36. Cold trap
37. Expansion tank
38. Warm air collectors
39. Air pumps
40. Central air header
41. Cooling air lagging (internal vault)
42. Electric cables out

r. Secondary Na collecting ring(s) and outlet
y. Secondary Na circuit in
b. Thermo-syphon and warming-up circuits
g. Secondary thermo-syphon circuit
z. Warming-up circuit
p. Na to expansion tank(s)
A1. Lower ring main (cool air delivery)
A2. Upper ring main (warm air extraction)
A3. Air conditioning
N. Nitrogen circuits

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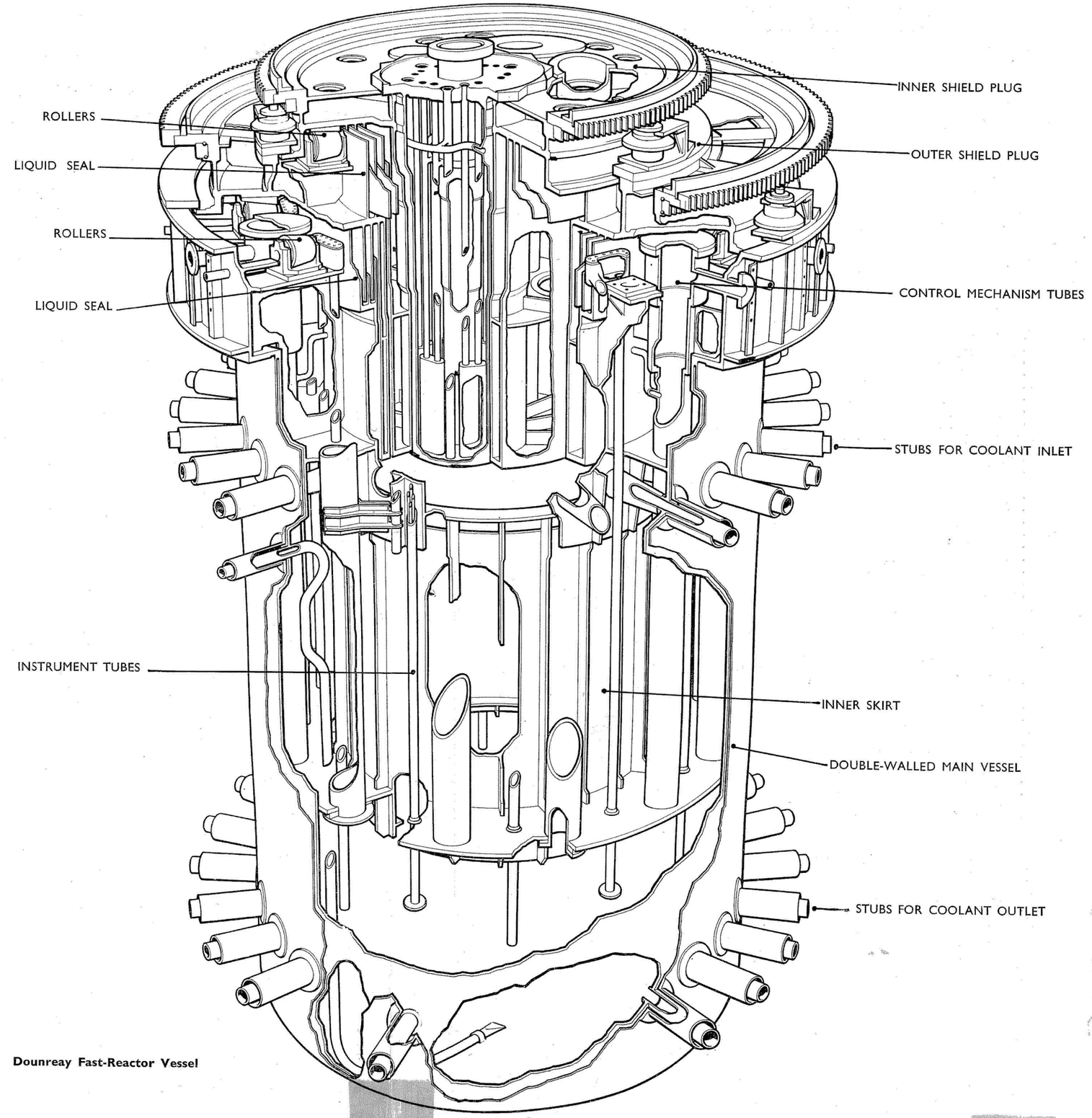
No. 12—DOUNREAY

TYPE:	Fast, heterogeneous.
PURPOSE:	Power breeder reactor experiment.
LOCATION:	Dounreay, Caithness, Scotland.
OPERATION:	Scheduled for April 1, 1958.
RATING:	60 MW (heat), 15 MW (electrical).
FUEL:	Uranium; plutonium in 1963 (say). Effective enrichment: variable, ~40%. Elements: finned tubular form, niobium clad. Length: 3 ft, central 21 in. only enriched U.
CORE:	Hexagonal prism: 21 in. × 21 in. Number of elements: ~350. Reactor tank: stainless steel double walled 20 ft × 14 ft overall dia., pressurized to 50 p.s.i.
BLANKET:	Natural U. Elements: cylindrical, stainless steel clad 8 ft × 1¼ in. dia. Number of elements: ~2,000. Overall size: 8 ft × 6 ft dia. Radial thickness: 2 ft. Axial thickness over core: 7 in. Total uranium investment: 65 tons.
CONTROL:	Groups of core elements, located at hexagon corners raised or lowered vertically. 12 in number. Safety rods: B_{10} rods which fall vertically into centre of control groups. 3 in number.
PRIMARY COOLANT:	70/30 NaK (later Na). Freezing point: 50°C. Flow downwards through core and blanket. Inlet temp. ~200°C. Outlet temp. ~350°C. 24 primary circuits through concentric heat exchangers. Total flow: 10,000 gal/min.
SECONDARY COOLANT:	70/30 NaK (later Na). Flow counter to primary. Inlet temp. ~200°C. Outlet temp. ~300°C. Secondary heat exchangers: NaK/Water. Present number 6, ultimately 12.
LIQUID METAL PUMPS:	Electro-magnetic, flat linear induction type. Pressure at 400 gal/min: 16 p.s.i. Power: 120 kW for 4 pumps.
TERTIARY COOLANT:	Water. Steam conditions: 150 p.s.i., 518°F. Alternative dumping to sea water condensers. Maximum sea water flow 50 Mgal/d.
SHIELDING:	Borated graphite: 4 ft radial thickness. Concrete: 5 ft radial thickness. Vault: 90 ft dia. × 45 ft high.
CONTAINMENT:	Steel sphere: 135 ft dia. Surface area: 1½ acres, weight: 1,500 tons. Plate thickness: 1 in. to 1⅞ in. Specification: to Lloyds P403 and Coltuf 28. Design pressure: +18 p.s.i.g. to −3 p.s.i.g.



Dounreay Fast-Reactor Vessel