

Starbird had turned down the offer to second Corner and Roberts to work at Los Alamos and Livermore, and had suggested joint working groups instead.

The Washington visit was successful and, at the end of February, four crates of drawings and papers were handed over by the AEC to British staff in Washington; samples of non-nuclear materials were to be provided shortly, and no problems were expected with bulk supplies. A bid for non-nuclear components for *Red Snow* (the Anglicized version of the United States Mark 28) had been favourably received. A second bilateral agreement was in an advanced stage of drafting.⁴³ A 'stock-take' meeting would be held in mid-April 1959, to develop the present exchanges and widen the field, and to study the proposal for joint working groups.

Pike and Schofield, visiting Los Alamos and Livermore in February 1959 to discuss weapon physics questions, returned with interesting information on 'mechanical safing', and calculations on the effects of varying the composition and thickness of the case of *Red Snow*, which confirmed the proposed British variations. The main American advantage, they considered, was in mechanical analysis and computer support. They noted that both the American laboratories had done calculations on the *Grapple Z Flagpole* shot, and had predicted substantially the same fusion and fission yields as had Corner's staff.

Anglicization

Before turning to the first stock-take, we comment briefly on the problems of turning a United States warhead design, Mark 28, into a British warhead, *Red Snow*. It was by no means the case – as is sometimes suggested – that, once given the American engineering drawings and specifications, it was a simple and relatively unskilled matter to produce 'Chinese copies'.

For one thing British engineers, as we saw, had to work to much stricter tolerances than their American counterparts because of the constraints of small-scale production. Then, too, American manufacturing techniques were sometimes unsuitable for British use. British materials had to be used wherever possible, and the specifications would often differ from United States specifications; they might perhaps be superior – for example, for high explosive components – or not. British manufacturing equipment had to be employed, and even extremely small variations between different dies, moulds, presses, and so on, could have significant effects on a product as unforgiving as a nuclear weapon.

Besides all these factors there were other problems, such as finding alternatives for materials not available from British sources; modifying engineering designs which might not comply with British standards of safety and compatibility; and meeting British service specifications, different from and sometimes more stringent than United States specifications. So there was a great deal of

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work to be done before the drawings for a Mark 28 warhead could materialize as a British *Red Snow*. Completion of the first production weapons was expected in March 1960, if all went well and according to plan. By the time of the first stock-take in mid-April 1959, the early stages of the *Red Snow* programme were under way, and there had been a flood of transatlantic visits on many aspects of nuclear weapons collaboration as well as practical production questions about *Red Snow*.

The balance of advantage in the exchanges was necessarily in Britain's favour but they were not entirely one-sided. In some areas, notably electronics and high explosives, the British were equal or perhaps even superior, and in many areas they had valuable ideas to contribute, as the American scientists, and notably Teller, appreciated. One of Aldermaston's aspirations was to identify a particular field in which the Americans had done little work, so that the British scientists could cultivate it to good effect themselves. On some topics they had performed much more work by means of minor experiments. (Teller thought that sometimes the Americans had not done enough work before going to full-scale testing.)

The first 'stock-take' – April 1959

The tasks of the first stock-take were to look back to survey and evaluate what had been done so far, both on specific weapons and on more general scientific collaboration; and then to look ahead to future collaboration and the widening of its scope. This general review meeting, the first of many, was held in London on 13–14 April 1959, less than nine months after the bilateral agreement of August 1958. Sessions were chaired by Brundrett, Loper, Libby and Penney and they covered an impressively wide range of topics, reviewing collaboration to date, examining operational requirements, and considering future exchanges. They discussed the nuclear materials agreement (then in preparation); problems of safety in storage and handling of weapons; co-operation on any future tests; scientific exchanges; 'clean bombs'; and the civil uses of nuclear explosions (Project *Plowshare*). They listed over 20 subjects for exchange of information by visits or reports; these included diagnostic methods and interpretation, radioflash, health physics, mechanical safing, interpretation of yield measurement data and physical metallurgy of plutonium. They agreed to set up 15 joint study groups and joint working groups, to deal with *inter alia* anti-missile defence systems, a 500–600 lb 1-megaton warhead, external neutron sources, vulnerability, safety of high explosives, compatibility of materials, and underground and outer space testing.

The JOWOG idea – a scheme which continues to this day – had been put forward earlier by the Americans, as we saw, as an alternative to British proposals for staff exchanges or secondments. The April 1959 stock-take agreed

JOWOG: JOINT WORKING
GROUP. x 15 qty.
WE 177? 1MT x 600 lb.