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JAMES L. TUCK 1974

Curriculum Vitae.

BORN.	Manchester, England.	9th January, 1910
EDUCATED.	Manchester Central Grammer School.	
	Victoria U. of Manchester.	BSc.(Hons.),1932, MSc. 1934
	Oxford.	M.A.
FELLOWSHIPS.	Salter Research Fellow., U. of Oxford.	1937-39
	I.C.I. Research Fellow., U. of Oxford.	1946-49
	American Physical Society.	1952-
	Guggenheim.	1962-63
	American Association for the Advancement of Science	1970-
POSITIONS.	Scientific Advisor. Prime Minister's Private Office. Office of the War Cabinet.	1939-44
	Principal Scientific Officer. British Mission, Manhattan Project. (Los Alamos.)	1943-46
	Supervisor of Advanced Studies, Clarendon Laboratory Oxford.	1946-49
	Research Associate, U. of Chicago.	1949-50
	Staff Member, Theoretical Physics Division. Los Alamos Scientific Laboratory	1950-53
	Associate Division Leader, Physics Division. Los Alamos Scientific Laboratory.	1956-73
	Delegate, U.N. Atoms for Peace Conference, Geneva.	1958.
	Walker-Ames Distinguished Professor, U. of Washington.	1974.
HONOURS.	Order of the British Empire.	1945.
PUBLICATIONS.	61 Papers, mostly Physics, theoretical and experimental, including 1 in Mathematics., 2 in Physical Chemistry, 3 Books (with other authors.), 40 Unpublished papers, (classified.)	
EDITORIAL BOARDS.	Physics of Fluids.	1955-58
	Journal of Applied Physics.	1955-58
	I.A.E.A. (Plasma Physics.)	1958-73

SCIENTIFIC ACHIEVEMENTS.

Munroe (Cavity Charge) Effect, (with G.I. Taylor.)	1943.
Explosive Lens. (with S. Neddermeyer, J. von Neumann.)	1944.
Regenerative Cyclotron Beam Deflector. (with L. Teng.)	1949.
DD. DT. Thermonuclear Cross-sections. (with Arnold, Phillips, Sawyer, Stovall.)	1951.

Pioneer Research in Controlled Fusion, 1946, and again from 1951- including: Z. Pinch, Q. Pinch, Entropy Trapping, Picket Fence, First Laboratory Thermonuclear Reaction.

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Biography.

James L. Tuck took the Matriculation and Higher School Certificate with sufficient distinction, (1928) to be able to attend the University of Manchester on Scholarships at that time of grave trade depression. The subjects for his B.Sc. (Honours) were Physics, Mathematics, and Chemistry. He then majored in Physical Chemistry first with Fairbrother, and later, with the distinguished physical chemist and philosopher, M. Polanyi, newly arrived refugee from the Hitler Terror.

His Ph.D. subject was on Reaction Kinetics of alkyl halides in liquid sulphur dioxide by a radioactive tracer method. The research was successful and some reaction constants were published. Before completing the Ph.D. requirements by submitting a thesis he joined the late Leo Szilard at the Clarendon Laboratory Oxford, to work with him on the Accellerator theory and later an electron accellerator. War pressures soon swept away any chances of completing the thesis at that time. Szilard, foreseeing the outbreak of war with Hitler, fled to the U.S., and shortly thereafter, when the head of the department, Lindemann joined his friend Churchill, first in the Admiralty and later as Prime Minister, Tuck went as his sole scientific advisor.

After three years of highly placed but distasteful administration, Tuck managed to make a crucial laboratory flash x ray experiment to determine the mechanism of the then militarily important armour piercing property of certain explosive-liner configurations. This was being studied widely in the U.K. and the U.S. The experiment was highly successful and together with G.I. Taylor, led to the complete elucidation of the Munroe (cavity Charge) effect, a little ahead of a similar effort in the U.S..(The Germans had, unknown to the Allies, already solved it by identical experimental procedure.) In 1944 he was awarded the O.B.E. for this contribution.

At that time, the research on the ultimate assembly process (implosion) for the atomic bomb was encountering grave problems at Los Alamos and Tuck, becoming known for this outstanding experiment, was asked by Los Alamos scientists, through Churchill, to join them which he did in early 1944. There he made a significant contribution

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to the first implosion weapon by devising an explosive lens. The Patent, never made public, bears the names Tuck, Neddermeyer, and von Neumann.

After attending the Trinity Test (Alamorgordo) and running a large diagnosis team at Bikini he returned to Los Alamos to attempt to produce a laboratory thermonuclear reaction having been stimulated by the thermonuclear lectures of Fermi. Advising the U. of Manchester that the writing of the thesis was at last underway, he was notified that the statute of limitations on presenting a thesis had run out.

Lord Cherwell back to the Clarendon Laboratory soon became insistent on his return and Tuck, leaving the research to others, returned to Oxford in the autumn of 1946 to direct the getting into operation of an ingenious but ill conceived Betatron, and supervise some graduate students, as well as to advise H.M. government on atomic weapon research.

E. Teller in 1949 was assembling a team to take up the problem of making a hydrogen bomb, and he invited Tuck to emigrate and return to Los Alamos. Tuck accepted on the condition that he spend one intermediate year at the U. of Chicago with Fermi, Anderson, and Marshall on the large cyclotron then being built. No way of extracting beams with any efficiency was then known, and Tuck, working with Teng as a graduate student, came up with a theory for extracting the beam by parametric exitation of the radial orbit oscillation. In the meantime, the year was up, and in spite of very tempting offers to stay with tenure at the U. of Chicago, Tuck returned as planned to Teller and Los Alamos. A deflector built by Crewe at Liverpool and found to work exactly as predicted. It is in universal use for large cyclotrons.

The DD and DT cross-sections at the low energies appropriate to thermonuclear application were not at that time at all well known, and with considerable urging from Fermi, Tuck assembled a team to measure them. The experiment was successful and very important to subsequent weapon planning. The results were withheld from publication for security reasons for some time. Tuck had been holding

classes on thermonuclear theory and at the urging of the team, now that their work was done, proposed a laboratory thermonuclear experiment (1951) Perhapsatron, based on the toroidal Z pinch which was funded by the Laboratory. About a year later, controlled nuclear research became a top priority subject in the A.E.C. at the urging of the then Chairman, Admiral Strauss and the first money to be allocated happened to be for Tuck, and was diverted from Project Lincoln, in the Hood Laboratory. The coincidence of names prompted the well-known cover name "Project Sherwood".

Tuck's main contribution to controlled fusion research is the concept of pulsed high densities-Z Pinch, Θ Pinch, Picket Fence as compared with the lower density requiring much longer plasma confinement times of approaches such as Stellarator, Mirror Machine, and Tokamak.

The first thermonuclear action to be obtained in the laboratory was in the Los Alamos Scylla Θ pinch in 1957 but not confirmed by experiment until 1961. By 1972 the Los Alamos controlled fusion programme, running at $4 million per annum seemed due to pass to the quasi developmental scale. In 1972, Tuck relinquished direction of this work (in favour of F.L. Ribe) and in 1973 retired from the laboratory, retaining a consultant association with the programme. The Los Alamos Θ pinch has expanded (currently $10 million per annum), and about to expand further, being one of the most promising (in Tuck's opinion the most promising) approaches to fusion power.

Tuck has lectured widely, having given invited lectures at Universities and Institutes in the U.S., U.K., U.S.S.R., Australia, Canada, France, Germany, Austria, Italy, Afghanistan and Eire. While still keeping in touch with controlled fusion research, since retirement he has developed free ranging scientific interests and has lectured on: The energy problem, ball lightning, and magnetic bird navigation. For April 1974, he was appointed Walker-Ames Distinguished Professor at the University of Washington and teaches a course in the Spring quarter on the energy problem. In August 1974, he lectures at an International School, University of Sidney, Australia.