INTER-OFFICE MEMORANDUM

September 28, 1944

To: J. R. Oppenheimer

From: C. S. Smith

Subject: Notes on a meeting held Thursday, September 28, to discuss carbide program.

Present at the meeting were: Bacher, Balke, Bethe, Birch, Bradbury, Frisch, Kennedy, Kistiakowsky, McMillan, Oppenheimer, Parsons, Peirels, Smith, Weiskopf.

The meeting was called for the purpose of further evaluation of the position of carbides in both gun and implosion methods, and particularly to assign proper priorities to the various research and production jobs being handled by Group C-7. The situation had been outlined in my memos of September 21 to C. C. Balke and September 25 to you.

Nuclear properties, recovery difficulties, and hydrodynamics, particularly spalling, all seem to point to carbide as a preferable material to tuballoy for implosion, and it was agreed that high priority should be given now to obtaining carbide spheres for test and to assure supply of full scale spheres when needed. Unfortunately, because of the diverse requirements of the various methods of study of collapse, and because of the uncertainty of the theoretical design of duplex tampers,* no agreement could be reached on a small number of sphere sizes that would satisfy all concerned, though it was apparent that future requirements will be for thinner walls than have hitherto been considered by Group C-7. It was also brought out that there as yet is no actual experience in the making of large spheres (particularly thin walled ones) and at least six weeks will be needed for research on methods before a realistic production schedule could be established.

Balke presented a detailed schedule of present outstanding jobs, attached hereto. These delivery dates are premised on completion of electrical connections of furnaces by October 5 (which is quite probable) and on the obtaining of additional personnel for the graphite shop (which is by no means certain and well may cause a break down of the program). The dates given for gun target work seem to the writer to be realistic and capable of being met. The dates on tube and sphere production assume rapid development of technique and no unexpected set backs.

There are already available 90 hemispheres 1.5 in. diam., 1/16 in. wall awaiting grinding. Even though these are not of exactly ideal size for 1½ in. scale shots on present designs, they are near enough to desired thickness to be usable for X-ray studies, as full thickness models, and as inner portion of 6 in. diam. duplex carbide-aluminum tampers for studies at P Site. To obtain basic information on behavior of material compared with steel and other substances, Bradbury urgently needs tubes

* Present designs approximate an aluminum sphere of O.D. to I.D. = 2 to 1 lined with a tungsten carbide sphere of O.D. to I.D. = 6 to 5 or a steel sphere of O.D. to I.D. = 7 to 5 lined with tungsten carbide O.D. to I.D. = 21 to 20.

for examination by both multi-exposure and pyramid camera shots. The size at present on order (3" x $\frac{1}{4}$" wall) are too thick for proper scaling of duplex tamper, but will be used because of the lack of a technique at the moment for making very thin tubes. A critical evaluation of all outstanding orders and production facilities produced the following agreed plan of action:

1. Present $1\frac{1}{2}$" x 1/16" spheres are to be used for X-ray shots, partly bare and partly with 3" aluminum tamper. (P Site)

2. There will be no other immediate orders for spheres, but

3. Group C-7 will work on highest priority toward the development of methods of forming spheres of large diameter and thinner walls than have heretofore been mentioned.*

4. All tube orders except 3" x $\frac{1}{4}$" wall are cancelled.

The following schedule, revised considerably from that in my letter to you dated September 25, was agreed upon by all present:

Order	Present Urgency	For Group No.	Job
1	X	X-1	Production of WC tubes, 3" x $\frac{1}{4}$" wall
2	X	G	Development of methods of large WC sphere manufacture
3	A	O-1	Production of WC 20 mm gun targets (3, 6, and 9% Co)
4	B	O-1	Production of 20 mm ductile tamper-anvils from WC - 25% Cu**
5	B	O-1	Production of 3" gun targets and anvils
6	B	G-3	Research on heavy non-conductive materials
7	C	G-3	Production of hemispheres from above
8	C	O-1	Production of 6.5" gun targets.

** This composition was selected at a meeting of representatives of C-7 and O-1 on September 25. No further research on ductile compositions is to be done until ordnance tests show it to be necessary.

In concluding, Dr. Oppenheimer emphasized that as much theoretical information and practical information as possible should be gathered in the next six weeks, and a further meeting then held to review the situation and probably to place orders for spheres, both for trial and full sized gadgets, the design of which should be more definitely determined by that time.

* As a result of discussion with Oppenheimer and Mitchell following the meeting, it has been decided to investigate immediately the possibilities of outside procurement of such shapes, as a hedge against unforeseen difficulties occurring.

Appendix A. Schedule of Carbide Program

		Gun Group	Implosion Group
	20 mm. Gun		
1.	6 assemblies 3% Co)		
2.	" " 6)	October 15	
3.	" " 9)		
4.	12 anvils 9)		
5.	12 projectiles 9)		October 15
6.	45 assemblies / month (?)	November 1	
7.	45 anvils ?)		
8.	45 projectiles ?)		November 1
9.	12 anvils 25% Cu)		
10.	12 projectiles " ")		October 15
	3" Gun		
11.	6 assemblies 9%	November 15	
12.	12 anvils 9)		
13.	12 projectiles 9)	October 15	
14.	12 anvils 25% Cu)		
15.	12 projectiles " ")		November 15
	6" Gun		
16.	10 assemblies 6%)		
17.	10 anvils 6)	1 by December 1	
18.	10 projectiles 6)		
19.	anvil 25% Cu)		
20.	projectile 25% Cu)		?
	Tubes		
21.	15 $2\frac{1}{2}$ x 3 x 8 9%)		
*22.	15 $1\frac{1}{4}$ x $1\frac{1}{2}$ x 8 9%)		November 15†
	Hemisphere		
*23.	30 $1\frac{1}{4}$ x $1\frac{1}{2}$ 9%		October 25
24.	30 1 3/8 x $1\frac{1}{2}$ 9%		Done
*25.	20 $2\frac{1}{2}$ x 3 9%		November 1 (?)
26.	Prepare 10.7" O.D.		December 1 (?)
	Miscellaneous°		
27.	12 mortars 9%	October 10	
28.	12 pestles 9%	Done	
29.	2 2" diam. 9%	November 1	
30.	2 $2\frac{1}{2}$" sq. 9%	November 1	

* These items cancelled at 9/28/44 meeting.
† By use of hot pressing a few 3" diam. tubes will be available by October 20.
° These miscellaneous jobs will not be allowed to interfere with others. There will be some additional work on high priority, making dies for hot pressing tuballoy and 25.