

Annex A Resolving the Retained Scud-Variant Missile Question

Introduction

The data in this Annex are complementary to and in support of the material found in the Delivery Systems Report and as such should be referenced only in conjunction with that Report. Items in this Annex address specific topics that are presented in the Report but include greater detail or additional data, and provide more information to support the contentions and arguments in the main text.

1.1 Scud Missile Material Balance

Documentation recovered by ISG appears to be an Iraqi attempt to account for its Scud missiles. This material reportedly was never disclosed to the UN.

The documentation includes the serial numbers for all 819 Scud missiles Iraq received from the Soviet Union between 1972 and 1988, contract numbers, and the disposition of these missiles broken down by

serial number. Also included are two figures: the first entitled “Inventory Account of Used Rockets Provided by Russia (Declaration)” represents the Scud missile account as given to the UN; the second figure entitled “Inventory Account of Used Rockets Provided by Russia (Facts)” is, according to the engineer, the most accurate accounting for Iraq’s Scud missiles. *The numbers in this second figure vary from the numbers Iraq disclosed in its 2002 Currently Accurate Full, and Complete Declaration (CAFCD) to the UN, and the explanation for the discrepancy in the numbers is provided in these documents. According to the source of this information, these documents represent the full story on Scud missile material balance.* This material was most likely prepared to support a presentation at the Technical Evaluation Meetings (TEMs) held in Baghdad in early 1998.

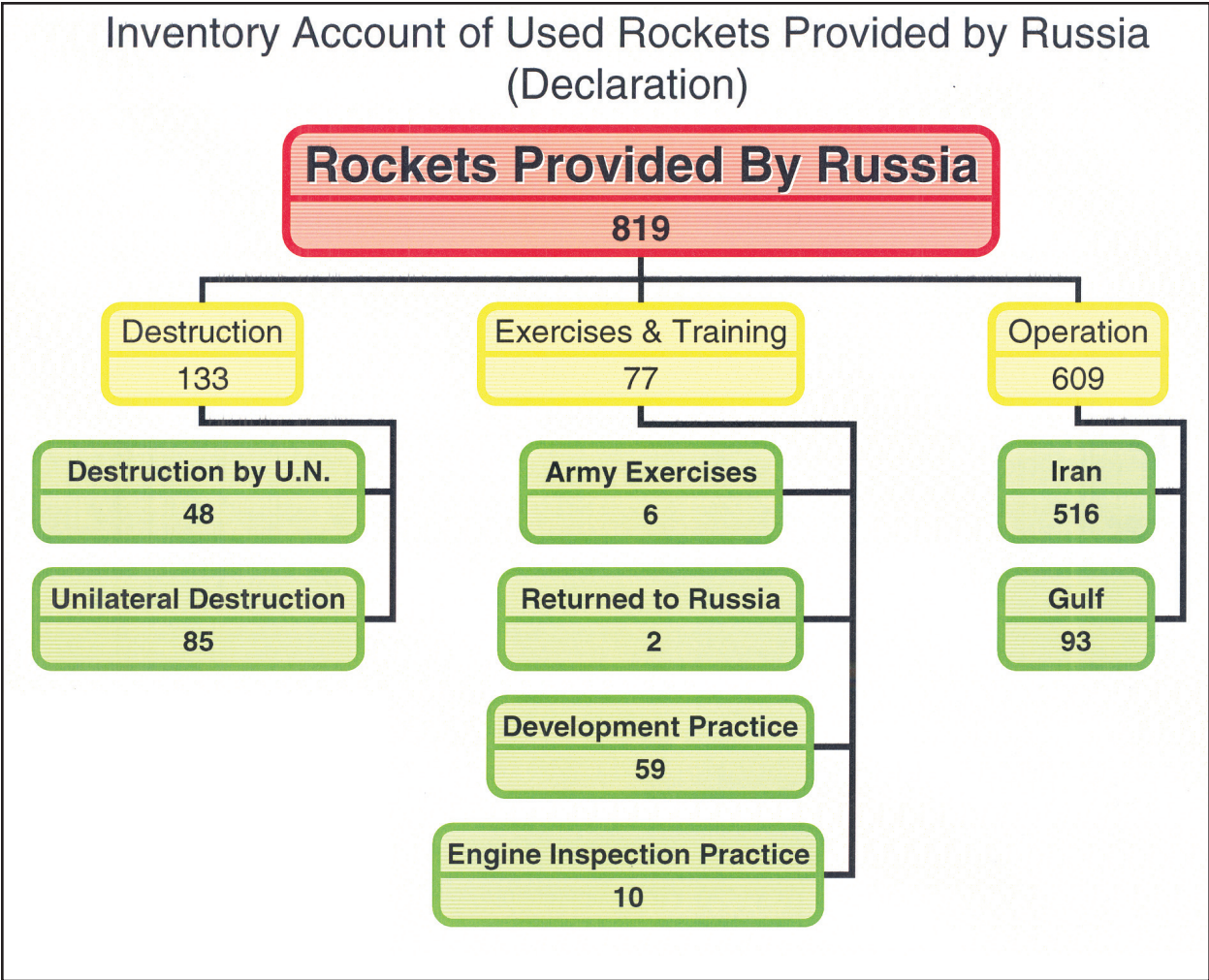


Figure 1. Inventory account of used rockets provided by Russia (declaration).

Available data suggest that Iraq's declaration of its unilateral destruction to the UN was assembled from eyewitness accounts rather than by matching up serial numbers. The Regime officials who participated in this effort supposedly interviewed more than 100 army personnel and other individuals who saw or claimed to have seen the disposition of the Scud missiles at some time. The method in which this information was derived was susceptible to error and, as such, should likely not have been forwarded to the UN as the official position.

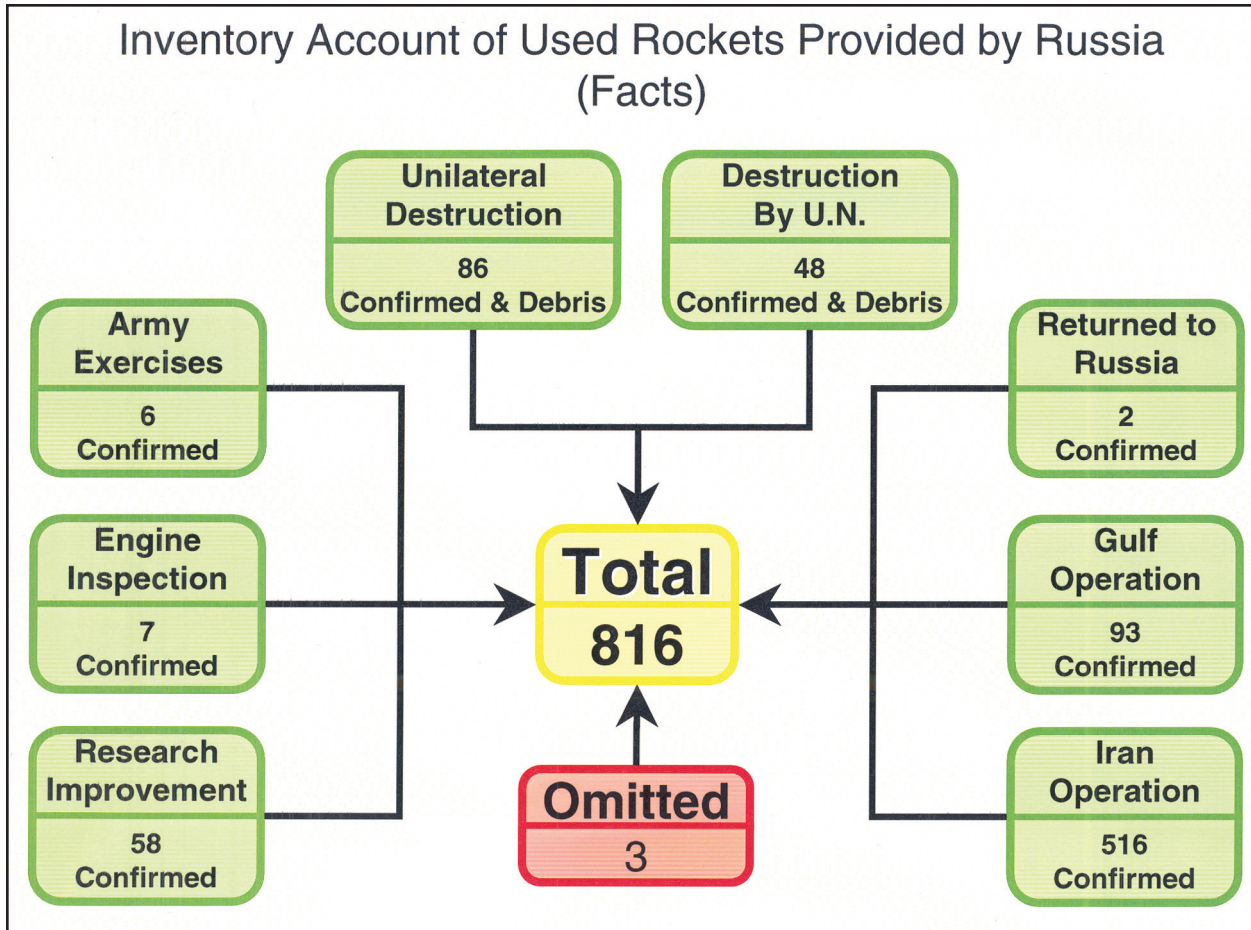


Figure 2. Inventory account of used rockets provided by Russia (facts).

Figure 2 reportedly contains Iraq's most accurate accounting for its Scud missiles. The figures in the chart are supported by the serial numbers contained in some of the other documents. The total number of missiles listed in the accounting is 816 vice 819, and an explanation was attempted, shown in the following inset.

The 3 Missing Scud Missiles

ISG derived the following information from recovered documents. This explanation was part of the overall effort to provide the most accurate accounting for Scud missiles, which the UN has reportedly not seen.

- **Engine for Missile Serial Number 853667.** *Engine serial number 85366, was used to replace engine 878426 in a flight test on 28 December 1990. According to the source's diary, remnants of engine 878426 appeared in debris of Iraq's unilaterally destroyed missiles, and tests of these remnants indicated that the engine had never been fired. Engine 878426 had been given to Project 144/2 for use in an Al Husayn, but, confusingly, the diary records that the engine was also used in the December test. 878426 had in fact been unilaterally destroyed, which is why forensic tests of the remnants showed that the engine had never been fired.*
- **Engine for Missile Serial Number 853648.** *The warhead for the engine with serial number 853648 appeared under serial number 8507101 in 1992 as part of the unilaterally destroyed debris, but, when the debris was rechecked in 1996, they were unable to locate this item again and was therefore considered unaccounted for.*
- **Engine for Missile Serial Number 866417.** *In 1992 among the remnants of the unilaterally destroyed material, a nozzle was encountered, which had an illegible serial number. The number read 8-2-16. The number was thought to be 852016 or 8552216; however, missiles with these serial numbers were never delivered to Iraq. As with the previous engine, this nozzle was not found among the debris when it was rechecked in 1996. A document recovered from Project 144/2 noted that engine 866417 was present for modification for the Al Husayn.*

ISG assesses that the accounting for missiles 853648 and 866417 is still incomplete.

Below is the breakdown for all 819 SCUD-B missiles according to the year of delivery and serial number. This information is reflected in Figure 2.

Year of Delivery-1974		
1	742504	Training
2	742509	Iran-Iraq War
3	742516	Iran-Iraq War
4	742519	Iran-Iraq War
5	742524	Training
6	742527	Iran-Iraq War
7	742530	Iran-Iraq War
8	742532	Iran-Iraq War
9	742536	Iran-Iraq War
10	742540	Iran-Iraq War
11	742543	Training
12	742547	Iran-Iraq War
13	742552	Iran-Iraq War
14	742559	Iran-Iraq War
15	742562	Iran-Iraq War
16	742565	Iran-Iraq War
17	742568	Training
18	742570	Iran-Iraq War
19	742571	Iran-Iraq War
20	742577	Training
21	742581	Training
22	742587	Iran-Iraq War
23	742591	Iran-Iraq War
24	742595	Iran-Iraq War
25	742598	Iran-Iraq War
26	742602	Iran-Iraq War
27	742606	Iran-Iraq War
28	742614	Iran-Iraq War
29	742618	Iran-Iraq War
30	742620	Iran-Iraq War
31	742626	Iran-Iraq War
32	742629	Iran-Iraq War
33	742634	Iran-Iraq War
34	742638	Iran-Iraq War
35	742645	Iran-Iraq War
36	742650	Returned
37	742655	Iran-Iraq War
38	742657	Iran-Iraq War
39	742673	Iran-Iraq War

40	742675	Iran-Iraq War
41	742679	Iran-Iraq War
42	742684	Iran-Iraq War
43	742689	Iran-Iraq War
44	742693	Returned
45	742699	Iran-Iraq War

Year of Delivery-1978		
46	784018	Iran-Iraq War
47	784020	Iran-Iraq War
48	784023	Iran-Iraq War
49	784026	Iran-Iraq War
50	784029	Iran-Iraq War
51	784031	Iran-Iraq War
52	784034	Iran-Iraq War
53	784037	Iran-Iraq War
54	784040	Iran-Iraq War
55	784045	Iran-Iraq War
56	784048	Iran-Iraq War
57	784053	Iran-Iraq War
58	784056	Iran-Iraq War
59	784059	Iran-Iraq War
60	784064	Iran-Iraq War
61	784067	Iran-Iraq War
62	784093	Iran-Iraq War
63	784103	Iran-Iraq War
64	784106	Iran-Iraq War
65	784110	Iran-Iraq War
66	784111	Iran-Iraq War
67	784113	Iran-Iraq War
68	784117	Iran-Iraq War
69	784119	Iran-Iraq War
70	784121	Iran-Iraq War
71	784124	Iran-Iraq War
72	784127	Iran-Iraq War
73	784130	Iran-Iraq War
74	784133	Iran-Iraq War
75	784136	Iran-Iraq War
76	784139	Iran-Iraq War
77	784142	Iran-Iraq War
78	784144	Iran-Iraq War
79	784147	Iran-Iraq War
80	784150	Iran-Iraq War
81	784155	Iran-Iraq War

82	784158	Iran-Iraq War
83	784161	Iran-Iraq War
84	784166	Iran-Iraq War
85	784169	Iran-Iraq War
86	784174	Iran-Iraq War
87	784180	Iran-Iraq War

Year of Delivery-1979		
88	794532	Iran-Iraq War
89	794535	Iran-Iraq War
90	794537	Iran-Iraq War
91	794539	Iran-Iraq War
92	794541	Iran-Iraq War
93	794544	Iran-Iraq War
94	794548	Iran-Iraq War
95	794551	Iran-Iraq War
96	794556	Iran-Iraq War
97	794559	Iran-Iraq War
98	794564	Iran-Iraq War
99	794569	Iran-Iraq War
100	794573	Iran-Iraq War
101	794576	Iran-Iraq War
102	794578	Iran-Iraq War
103	794581	Iran-Iraq War
104	794590	Iran-Iraq War
105	794592	Iran-Iraq War
106	794599	Iran-Iraq War
107	794602	Iran-Iraq War
108	794612	Iran-Iraq War
109	794614	Iran-Iraq War
110	794617	Iran-Iraq War
111	794621	Iran-Iraq War
112	794624	Iran-Iraq War
113	794628	Iran-Iraq War
114	794634	Iran-Iraq War
115	794636	Iran-Iraq War

Year of Delivery-1982		
116	827615	Iran-Iraq War
117	827618	Iran-Iraq War
118	827621	Iran-Iraq War
119	827624	Iran-Iraq War
120	827627	Iran-Iraq War
121	827632	Iran-Iraq War

122	827637	Iran-Iraq War
123	827640	Iran-Iraq War
124	827643	Iran-Iraq War
125	827645	Iran-Iraq War
126	827648	Iran-Iraq War
127	827653	Iran-Iraq War
128	827656	Iran-Iraq War
129	827660	Iran-Iraq War
130	827663	Iran-Iraq War
131	827668	Iran-Iraq War
132	827671	Iran-Iraq War
133	827676	Iran-Iraq War
134	827679	Iran-Iraq War
135	827682	Iran-Iraq War
136	827684	Iran-Iraq War
137	827688	Iran-Iraq War
138	827691	Iran-Iraq War
139	827694	Iran-Iraq War
140	827697	Iran-Iraq War
141	827702	Iran-Iraq War
142	827703	Iran-Iraq War
143	827705	Iran-Iraq War
144	827706	Iran-Iraq War
145	827708	Iran-Iraq War

Year of Delivery-1983		
146	838648	Iran-Iraq War
147	838650	Iran-Iraq War
148	838653	Iran-Iraq War
149	838656	Iran-Iraq War
150	838658	Iran-Iraq War
151	838661	Iran-Iraq War
152	838664	Iran-Iraq War
153	838666	Iran-Iraq War
154	838669	Iran-Iraq War
155	838671	Iran-Iraq War
156	838673	Iran-Iraq War
157	838676	Iran-Iraq War
158	838679	Iran-Iraq War
159	838682	Iran-Iraq War
160	838686	Iran-Iraq War
161	838693	Iran-Iraq War
162	838695	Iran-Iraq War
163	838706	Iran-Iraq War

164	838710	Iran-Iraq War
165	838713	Iran-Iraq War
166	838716	Iran-Iraq War
167	838721	Iran-Iraq War
168	838724	Iran-Iraq War
169	838730	Iran-Iraq War
170	838733	Iran-Iraq War
171	838993	Iran-Iraq War
172	838996	Iran-Iraq War
173	838997	Iran-Iraq War
174	838999	Iran-Iraq War
175	839021	Iran-Iraq War
176	839024	Iran-Iraq War
177	839027	Iran-Iraq War
178	839033	Iran-Iraq War
179	839036	Iran-Iraq War
180	839039	Iran-Iraq War
181	839042	Iran-Iraq War
182	839045	Iran-Iraq War
183	839048	Iran-Iraq War
184	839051	Iran-Iraq War
185	839054	Iran-Iraq War
186	839057	Iran-Iraq War
187	839060	Iran-Iraq War
188	839065	Iran-Iraq War
189	839068	Iran-Iraq War
190	839073	Iran-Iraq War

Year of Delivery-1984		
191	841101	Iran-Iraq War
192	841104	Iran-Iraq War
193	841107	Iran-Iraq War
194	841110	Iran-Iraq War
195	841112	Iran-Iraq War
196	841118	Iran-Iraq War
197	841123	Iran-Iraq War
198	841126	Iran-Iraq War
199	841129	Iran-Iraq War
200	841131	Iran-Iraq War
201	841134	Iran-Iraq War
202	841137	Iran-Iraq War
203	841140	Iran-Iraq War
204	841143	Iran-Iraq War
205	841146	Iran-Iraq War
206	841149	Iran-Iraq War

207	841152	Iran-Iraq War
208	841155	Iran-Iraq War
209	841158	Iran-Iraq War
210	841161	Iran-Iraq War
211	841164	Iran-Iraq War
212	841166	Iran-Iraq War
213	841169	Iran-Iraq War
214	841202	Iran-Iraq War
215	841214	Iran-Iraq War
216	841220	Iran-Iraq War
217	841225	Iran-Iraq War
218	841228	Iran-Iraq War
219	841233	Iran-Iraq War
220	841238	Iran-Iraq War
221	841245	Iran-Iraq War
222	841250	Iran-Iraq War
223	841253	Iran-Iraq War
224	841342	Iran-Iraq War
225	831347	Iran-Iraq War
226	841354	Iran-Iraq War
227	841357	Iran-Iraq War
228	841360	Iran-Iraq War
229	841363	Iran-Iraq War
230	841370	Iran-Iraq War
231	841373	Iran-Iraq War
232	841376	Iran-Iraq War
233	841379	Iran-Iraq War
234	841384	Iran-Iraq War
235	841388	Iran-Iraq War
236	841389	Iran-Iraq War
237	841392	Iran-Iraq War
238	841394	Iran-Iraq War
239	841395	Iran-Iraq War
240	841398	Iran-Iraq War
241	841414	Iran-Iraq War
242	841417	Iran-Iraq War
243	841420	Iran-Iraq War
244	841423	Iran-Iraq War
245	841426	Iran-Iraq War
246	841429	Iran-Iraq War
247	841432	Iran-Iraq War
248	841435	Iran-Iraq War
249	841438	Iran-Iraq War
250	841441	Iran-Iraq War
251	841444	Iran-Iraq War

252	841447	Iran-Iraq War
253	841450	Iran-Iraq War
254	841453	Iran-Iraq War
255	841456	Iran-Iraq War
256	841459	Iran-Iraq War
257	841462	Iran-Iraq War
258	841465	Iran-Iraq War
259	841468	Iran-Iraq War
260	841471	Iran-Iraq War
261	841474	Iran-Iraq War
262	841477	Iran-Iraq War
263	841482	Iran-Iraq War
264	841485	Iran-Iraq War
265	841489	Iran-Iraq War
266	841494	Iran-Iraq War
267	841592	Iran-Iraq War
268	841598	Iran-Iraq War
269	841602	Iran-Iraq War
270	841605	Iran-Iraq War
271	841608	Iran-Iraq War
272	841616	Iran-Iraq War
273	841621	Iran-Iraq War
274	841624	Test for dev. missile
275	841630	Iran-Iraq War
276	841636	Iran-Iraq War
277	841642	Iran-Iraq War
278	841645	Iran-Iraq War
279	841648	Iran-Iraq War
280	841651	Iran-Iraq War
281	841654	Iran-Iraq War
282	841658	Iran-Iraq War
283	841661	Iran-Iraq War
284	841666	Iran-Iraq War
285	841669	Iran-Iraq War
286	841672	Iran-Iraq War
287	841683	Iran-Iraq War
288	841686	Iran-Iraq War
289	841691	Iran-Iraq War
290	841693	Iran-Iraq War
291	841854	Iran-Iraq War
292	841857	Iran-Iraq War
293	841860	Iran-Iraq War
294	841862	Iran-Iraq War
295	841865	Iran-Iraq War
296	841870	Iran-Iraq War

297	841877	Test for dev. missile
298	841888	Iran-Iraq War
299	841891	Iran-Iraq War
300	841896	Iran-Iraq War
301	841899	Iran-Iraq War
302	841901	Iran-Iraq War
303	841911	Iran-Iraq War
304	841916	Iran-Iraq War
305	841919	Iran-Iraq War
306	841922	Iran-Iraq War
307	841925	Iran-Iraq War
308	841928	Iran-Iraq War
309	841931	Iran-Iraq War
310	841935	Iran-Iraq War
311	841942	Iran-Iraq War
312	841945	Iran-Iraq War
313	841949	Iran-Iraq War
314	841952	Iran-Iraq War
315	841959	Iran-Iraq War
316	841964	Iran-Iraq War
317	841967	Iran-Iraq War
318	841972	Iran-Iraq War
319	841978	Iran-Iraq War
320	841983	Iran-Iraq War
321	841986	Iran-Iraq War
322	841989	Iran-Iraq War
323	841992	Iran-Iraq War
324	841995	Iran-Iraq War
325	841998	Iran-Iraq War

Year of Delivery-1985		
326	853203	Iran-Iraq War
327	853208	Test for dev. missile
328	853215	Unilaterally destroyed
329	853222	UNSCOM destroyed
330	853225	Iran-Iraq War
331	853233	Iran-Iraq War
332	853238	UNSCOM destroyed
333	853242	Iran-Iraq War
334	853249	Iran-Iraq War
335	853252	Iran-Iraq War
336	853255	Iran-Iraq War
337	853259	Desert Storm
338	853261	Iran-Iraq War

339	853265	Iran-Iraq War
340	853268	Test for dev. missile
341	853271	Unilaterally destroyed
342	853272	Iran-Iraq War
343	853275	Desert Storm
344	853341	UNSCOM destroyed
345	853344	Desert Storm
346	853347	Iran-Iraq War
347	853350	UNSCOM destroyed
348	853354	UNSCOM destroyed
349	853357	UNSCOM destroyed
350	853363	Desert Storm
351	853367	Unilaterally destroyed
352	853370	Iran-Iraq War
353	853374	Desert Storm
354	853379	Iran-Iraq War
355	853382	UNSCOM destroyed
356	853387	Test for dev. missile
357	853390	Desert Storm
358	853392	Desert Storm
359	853399	Unilaterally destroyed
360	853402	Iran-Iraq War
361	853405	Iran-Iraq War
362	853409	Test for dev. missile
363	853411	Iran-Iraq War
364	853413	Iran-Iraq War
365	853417	Test for dev. missile
366	853421	Test for dev. missile
367	853423	Iran-Iraq War
368	853426	UNSCOM destroyed
369	853428	Iran-Iraq War
370	853434	Test for dev. missile
371	853440	Iran-Iraq War
372	853443	Iran-Iraq War
373	853446	Test for dev. missile
374	853448	Iran-Iraq War
375	853449	UNSCOM destroyed
376	853451	Test for dev. missile
377	853453	Iran-Iraq War
378	853458	Iran-Iraq War
379	853462	Test for dev. missile
380	853469	Unilaterally destroyed
381	853473	Iran-Iraq War
382	853478	Unilaterally destroyed
383	853481	Iran-Iraq War

384	853484	UNSCOM destroyed
385	853489	Iran-Iraq War
386	853491	Test for dev. missile
387	853494	Engine test
388	853497	Unilaterally destroyed
389	853501	Unilaterally destroyed
390	853503	Desert Storm
391	853507	Desert Storm
392	853510	Desert Storm
393	853512	Test for dev. missile
394	853514	Desert Storm
395	853518	Unilaterally destroyed
396	853520	Unilaterally destroyed
397	853523	Desert Storm
398	853525	Desert Storm
399	853528	Unilaterally destroyed
400	853530	Unilaterally destroyed
401	853534	Unilaterally destroyed
402	853538	Unilaterally destroyed
403	853541	Test for dev. missile
404	853546	Unilaterally destroyed
405	853553	Desert Storm
406	853557	UNSCOM destroyed
407	853561	UNSCOM destroyed
408	853565	Desert Storm
409	853573	Unilaterally destroyed
410	853575	Test for dev. missile
411	853581	UNSCOM destroyed
412	853587	Unilaterally destroyed
413	853591	Unilaterally destroyed
414	853595	Unilaterally destroyed
415	853596	Unilaterally destroyed
416	853598	Desert Storm
417	853602	Desert Storm
418	853604	Test for dev. missile
419	853606	Unilaterally destroyed
420	853608	Desert Storm
421	853611	Test for dev. missile
422	853613	Unilaterally destroyed
423	853616	Test for dev. missile
424	853622	Desert Storm
425	853626	Unilaterally destroyed
426	853633	Unilaterally destroyed
427	853636	Test for dev. missile
428	853640	Unilaterally destroyed

429	853643	UNSCOM destroyed
430	853645	Desert Storm
431	853648	**See insert
432	853651	Unilaterally destroyed
433	853655	Desert Storm
434	853659	Unilaterally destroyed
435	853663	Desert Storm
436	853667	**See insert
437	853676	Unilaterally destroyed
438	853679	Desert Storm
439	853683	Unilaterally destroyed
440	853685	UNSCOM destroyed
441	853689	Unilaterally destroyed

Year of Delivery-1986		
442	863692	Iran-Iraq War
443	863694	Unilaterally destroyed
444	863697	Iran-Iraq War
445	863699	Iran-Iraq War
446	863701	Iran-Iraq War
447	863702	Iran-Iraq War
448	863703	Iran-Iraq War
449	863707	Test for dev. missile
450	863708	Unilaterally destroyed
451	863710	Iran-Iraq War
452	863711	Iran-Iraq War
453	863715	Iran-Iraq War
454	863716	Iran-Iraq War
455	863719	Iran-Iraq War
456	863721	Iran-Iraq War
457	863723	Iran-Iraq War
458	863724	Iran-Iraq War
459	863726	Iran-Iraq War
460	863729	UNSCOM destroyed
461	863730	Iran-Iraq War
462	863736	Iran-Iraq War
463	863739	Iran-Iraq War
464	863743	Iran-Iraq War
465	863751	Iran-Iraq War
466	863752	Iran-Iraq War
467	863755	Unilaterally destroyed
468	863756	Iran-Iraq War
469	863762	Iran-Iraq War
470	863764	Iran-Iraq War
471	863772	Iran-Iraq War

472	863778	Iran-Iraq War
473	863780	Unilaterally destroyed
474	866131	Unilaterally destroyed
475	866134	Iran-Iraq War
476	866137	Iran-Iraq War
477	866139	Iran-Iraq War
478	866140	Iran-Iraq War
479	866141	Iran-Iraq War
480	866146	Iran-Iraq War
481	866149	Iran-Iraq War
482	866151	Test for dev. missile
483	866156	Iran-Iraq War
484	866158	Iran-Iraq War
485	866161	Iran-Iraq War
486	866163	Desert Storm
487	866169	Iran-Iraq War
488	866175	Iran-Iraq War
489	866187	Iran-Iraq War
490	866193	Iran-Iraq War
491	866197	Iran-Iraq War
492	866203	Iran-Iraq War
493	866205	Iran-Iraq War
494	866209	Test for dev. missile
495	866212	Test for dev. missile
496	866215	Desert Storm
497	866217	Iran-Iraq War
498	866219	Unilaterally destroyed
499	866221	Iran-Iraq War
500	866224	Iran-Iraq War
501	866227	Unilaterally destroyed
502	866229	Iran-Iraq War
503	866231	UNSCOM destroyed
504	866232	Test for dev. missile
505	866235	Test for dev. missile
506	866237	Iran-Iraq War
507	866242	Unilaterally destroyed
508	866247	Iran-Iraq War
509	866250	Iran-Iraq War
510	866252	Iran-Iraq War
511	866256	Unilaterally destroyed
512	866260	Iran-Iraq War
513	866264	Iran-Iraq War
514	866269	Iran-Iraq War
515	866270	Unilaterally destroyed
516	866274	Iran-Iraq War

517	866277	Unilaterally destroyed
518	866280	Iran-Iraq War
519	866288	Iran-Iraq War
520	866293	Iran-Iraq War
521	866302	Iran-Iraq War
522	866304	UNSCOM destroyed
523	866309	Iran-Iraq War
524	866311	Iran-Iraq War
525	866313	Iran-Iraq War
526	866314	Test for dev. missile
527	866318	Iran-Iraq War
528	866320	Iran-Iraq War
529	866322	Iran-Iraq War
530	866325	Iran-Iraq War
531	866328	Desert Storm
532	866331	Iran-Iraq War
533	866333	Iran-Iraq War
534	866337	Iran-Iraq War
535	866340	Iran-Iraq War
536	866341	Iran-Iraq War
537	866345	Test for dev. missile
538	866348	UNSCOM destroyed
539	866353	Desert Storm
540	866357	Desert Storm
541	866359	Desert Storm
542	866363	Desert Storm
543	866366	UNSCOM destroyed
544	866368	Desert Storm
545	866373	Unilaterally destroyed
546	866405	UNSCOM destroyed
547	866406	Desert Storm
548	866412	Iran-Iraq War
549	866417	**See insert
550	866423	Unilaterally destroyed
551	866427	Desert Storm
552	866432	UNSCOM destroyed
553	866434	Iran-Iraq War
554	866442	Iran-Iraq War
555	866444	Iran-Iraq War
556	866449	Unilaterally destroyed
557	866454	Desert Storm
558	866458	Iran-Iraq War
559	866460	UNSCOM destroyed
560	866467	Unilaterally destroyed
561	866469	Iran-Iraq War

562	866470	UNSCOM destroyed
563	866471	Unilaterally destroyed
564	866474	Unilaterally destroyed
565	866476	Iran-Iraq War
566	866477	Unilaterally destroyed
567	866481	Iran-Iraq War
568	866484	UNSCOM destroyed
569	866487	Desert Storm
570	866490	Desert Storm
571	866504	Desert Storm
572	866507	Engine test
573	866508	Unilaterally destroyed
574	866513	Test for dev. missile
575	866516	Desert Storm
576	866519	Desert Storm
577	866524	Test for dev. missile
578	866527	Unilaterally destroyed
579	866530	Desert Storm
580	866533	Desert Storm
581	866535	Desert Storm
582	866539	Desert Storm
583	866543	Unilaterally destroyed
584	866544	Desert Storm
585	866547	Unilaterally destroyed
586	866550	Desert Storm
587	866552	Unilaterally destroyed
588	866557	Test for dev. missile
589	866564	Unilaterally destroyed
590	866570	Unilaterally destroyed
591	866573	UNSCOM destroyed
592	866585	Test for dev. missile
593	866590	Desert Storm
594	866593	Test for dev. missile
595	866595	Iran-Iraq War
596	866597	Desert Storm
597	866598	Iran-Iraq War
598	866599	Test for dev. missile
599	866602	Desert Storm
600	866605	Unilaterally destroyed
601	866614	UNSCOM destroyed
602	866620	Test for dev. missile
603	866628	UNSCOM destroyed
604	866634	Iran-Iraq War
605	866641	Test for dev. missile
606	866649	Desert Storm

607	866654	Iran-Iraq War
608	866658	Desert Storm
609	866664	Desert Storm
610	866667	UNSCOM destroyed
611	866669	UNSCOM destroyed
612	866674	UNSCOM destroyed
613	866677	Iran-Iraq War
614	866679	Desert Storm
615	866682	Desert Storm
616	866684	Desert Storm
617	866686	Iran-Iraq War
618	866688	Iran-Iraq War
619	866689	Desert Storm
620	866691	UNSCOM destroyed
621	866692	Desert Storm
622	866693	Desert Storm
623	866694	Unilaterally destroyed
624	866695	Unilaterally destroyed
625	866697	Unilaterally destroyed
626	866698	Desert Storm

Year of Delivery-1987		
627	876704	Unilaterally destroyed
628	876711	Unilaterally destroyed
629	876716	Desert Storm
630	876723	UNSCOM destroyed
631	876726	Unilaterally destroyed
632	876734	Desert Storm
633	876739	Desert Storm
634	876743	UNSCOM destroyed
635	876746	Desert Storm
636	876754	Desert Storm
637	876758	Test for dev. missile
638	876762	Unilaterally destroyed
639	876766	Engine test
640	876768	Desert Storm
641	876771	Unilaterally destroyed
642	876773	Desert Storm
643	876776	UNSCOM destroyed
644	876778	Desert Storm
645	876782	Engine test
646	876784	Desert Storm
647	876786	UNSCOM destroyed
648	876789	Unilaterally destroyed
649	876790	Unilaterally destroyed

650	876792	Test for dev. missile
651	876794	Desert Storm
652	876795	Test for dev. missile
653	876797	Engine test
654	876798	Desert Storm
655	876799	Test for dev. missile
656	878303	Test for dev. missile
657	878306	UNSCOM destroyed
658	878312	Test for dev. missile
659	878315	Desert Storm
660	878318	Desert Storm
661	878321	Test for dev. missile
662	878324	Unilaterally destroyed
663	878327	Test for dev. missile
664	878329	Test for dev. missile
665	878333	Test for dev. missile
666	878336	UNSCOM destroyed
667	878338	Unilaterally destroyed
668	878341	Desert Storm
669	878343	Desert Storm
670	878346	Test for dev. missile
671	878349	UNSCOM destroyed
672	878351	UNSCOM destroyed
673	878354	UNSCOM destroyed
674	878357	Test for dev. missile
675	878361	Desert Storm
676	878363	Unilaterally destroyed
677	878368	Test for dev. missile
678	878371	UNSCOM destroyed
679	878374	Desert Storm
680	878379	Desert Storm
681	878382	Unilaterally destroyed
682	878386	Desert Storm
683	878392	Desert Storm
684	878396	Test for dev. missile
685	878401	Desert Storm
686	878405	Desert Storm
687	878409	Test for dev. missile
688	878414	Unilaterally destroyed
689	878416	Test for dev. missile
690	878419	Desert Storm
691	878423	Desert Storm
692	878426	Unilaterally destroyed
693	878430	Unilaterally destroyed
694	878434	Test for dev. missile

695	878435	Desert Storm
696	878439	Desert Storm
697	878442	Test for dev. missile
698	878445	Engine test
699	878453	Unilaterally destroyed
700	878456	Unilaterally destroyed
701	878463	Desert Storm
702	878466	Iran-Iraq War
703	878470	Iran-Iraq War
704	878473	Iran-Iraq War
705	878476	Iran-Iraq War
706	878484	Unilaterally destroyed
707	878485	Iran-Iraq War
708	878488	Iran-Iraq War
709	878491	Iran-Iraq War
710	878494	Iran-Iraq War
711	878497	Iran-Iraq War
712	878499	Iran-Iraq War
713	878502	Iran-Iraq War
714	878504	Iran-Iraq War
715	878507	Iran-Iraq War
716	878511	Iran-Iraq War
717	878513	Unilaterally destroyed
718	878517	Iran-Iraq War
719	878520	Iran-Iraq War
720	878528	Iran-Iraq War
721	878531	Iran-Iraq War
722	878537	Iran-Iraq War
723	878544	Unilaterally destroyed
724	878547	Iran-Iraq War
725	878552	Iran-Iraq War
726	878559	Iran-Iraq War
727	878562	Iran-Iraq War
728	878567	Iran-Iraq War
729	878569	Iran-Iraq War
730	878572	UNSCOM destroyed
731	878575	Iran-Iraq War
732	878577	Iran-Iraq War
733	878581	Iran-Iraq War
734	878583	Test for dev. missile
735	878589	Iran-Iraq War
736	878590	Iran-Iraq War
737	878593	Iran-Iraq War
738	878595	Iran-Iraq War
739	878596	Iran-Iraq War

740	878597	Iran-Iraq War
741	878599	Iran-Iraq War
742	878601	Iran-Iraq War
743	878608	Iran-Iraq War
744	878610	Iran-Iraq War
745	878615	Iran-Iraq War
746	878619	Iran-Iraq War
747	878622	Iran-Iraq War
748	878625	Iran-Iraq War
749	878627	Iran-Iraq War
750	878629	Iran-Iraq War
751	878632	Iran-Iraq War
752	878635	Unilaterally destroyed
753	878640	Iran-Iraq War
754	878642	Iran-Iraq War
755	878648	Iran-Iraq War
756	878651	Iran-Iraq War
757	878653	Iran-Iraq War
758	878656	Iran-Iraq War
759	878658	UNSCOM destroyed
760	878660	Test for dev. missile
761	878663	Iran-Iraq War
762	878666	Iran-Iraq War
763	878671	Iran-Iraq War
764	878673	Iran-Iraq War
765	878678	Unilaterally destroyed
766	878682	Iran-Iraq War
767	878685	Iran-Iraq War
768	878687	Test for dev. missile
769	878691	Desert Storm
770	878694	Test for dev. missile
771	878696	Desert Storm
772	878704	Iran-Iraq War
773	878707	Iran-Iraq War
774	878711	Iran-Iraq War
775	878716	Iran-Iraq War
776	878720	Iran-Iraq War
777	878723	Iran-Iraq War
778	878726	Iran-Iraq War
779	878731	Iran-Iraq War
780	878734	Iran-Iraq War
781	878737	Unilaterally destroyed
782	878739	Engine test
783	878744	Unilaterally destroyed
784	878747	Unilaterally destroyed

785	878750	Unilaterally destroyed
786	878752	Iran-Iraq War
787	878755	Unilaterally destroyed
788	878759	Iran-Iraq War
789	878762	Unilaterally destroyed
790	878764	UNSCOM destroyed
791	878767	Iran-Iraq War
792	878770	UNSCOM destroyed
793	878772	UNSCOM destroyed
794	878775	UNSCOM destroyed
795	878779	Iran-Iraq War
796	878809	Iran-Iraq War
797	878811	Iran-Iraq War
798	878817	Iran-Iraq War
799	878822	Desert Storm
800	878825	Iran-Iraq War
801	878829	Iran-Iraq War
802	878833	Iran-Iraq War
803	878836	Iran-Iraq War
804	878840	Iran-Iraq War
805	878845	Desert Storm
806	878850	Iran-Iraq War
807	878858	Iran-Iraq War
808	878861	Iran-Iraq War
809	878866	Desert Storm
810	878869	Desert Storm
811	878873	Desert Storm
812	878877	Iran-Iraq War
813	878878	Iran-Iraq War
814	878880	Iran-Iraq War
815	878883	Desert Storm
816	878886	Iran-Iraq War
817	878887	Iran-Iraq War
818	878890	Iran-Iraq War
819	878891	Iran-Iraq War

1.2 Scud Warhead Material Balance

ISG has collected an official National Monitoring Directorate (NMD) document, dated 12 December 1997, on the expenditure of Scud warheads imported from the Soviet Union, which differs from the figures provided in the 1996 Full, Final, and Complete Disclosure (FFCD). These FFCD data are also repeated in the 2002 CAFCD. The NMD document is most likely part of that organization's effort to reconcile the material for imported Scud warheads. Although unable to verify information, ISG judges that this is a factual accounting for the 819 Scud warheads Iraq imported from the Soviet Union.

As with the data in for missile consumption (Section 1.1), this material was most likely prepared to support a presentation at the Warhead Technical Evaluation Meeting (TEM) held in Baghdad between the 1st and 6th February 1998.

Following the acceptance of UNSCR 687, Iraq was forced to destroy its remaining inventory of Scud missiles, warheads, and related equipment. Iraq had imported 819 warheads from the Soviet Union and had succeeded in producing warheads indigenously. During the period of warhead destruction, the distinc-

tion between the imported warheads and the indigenously produced warheads became unclear, and thus a full and accurate accounting for the destruction of imported and indigenously produced Scud warheads has never been reconciled.

- According to the NMD accounting (Tables 1 & 2), Iraq fired 87 imported warheads and six indigenously produced warheads (presumably concrete warheads for the Al Hijarah missiles) during the 1991 Gulf War. In the 1996 FFCD and the CAFCD, Iraq declared that it had fired 88 imported warheads and 5 indigenously produced Al Hijarah warheads. This leaves a discrepancy of one imported warhead.
- In the 1996 FFCD and the CAFCD, the Iraqis declared that they unilaterally destroyed 119 imported warheads. This NMD document shows only 118 had been destroyed.
- The disagreement between the numbers provided in the 1996 FFCD and the CAFCD, and this NMD document for the “special” CBW warheads destroyed by the Chemical Destruction Group, (CDG), is the largest. During this destruction of warheads, an accurate accounting for the number of imported versus indigenously produced warheads was never achieved.

Table 1

Accounting for Imported Soviet Scud Warheads (819 total)

		1996 FFCD & 2002 CAFCD
Returned to USSR	2	2
Fired during Iran-Iraq War	516	516
Test fired	57	57
Fired during 1991 Gulf War	87	88
Unilaterally destroyed	118	119
Destroyed under UN supervision	17	17
Special Warheads destroyed by CDG	22	19
Used in analysis	---	1
Total	819	819

This is a comparison of the figures derived from the NMD document and the 2002 CAFCD.

Table 2

Warheads Used by Purpose and Year

Year	Document		Warheads Exhausted	Remarks
	#	Date		
1. Warheads used against Iran				
1980	2	20 Nov 1980	53	No indication to the number of warheads or code numbers
1981	5	21 Nov 1980	16	No indication to the number of warheads or code numbers
	7	03 Mar 1981	1	No warhead number or code. Launch failed and will be used for reverse-engineering
	8	07 Apr 1981	5	
	10	24 June 1981	3	
	13	27 Nov 1981	2	
	15	18 Dec 1981	2	
1982	3	04 May 1982	2	
	4	07 Jul 1982	8	
	7	21 Sept 1982	11	
	8	11 Sept 1982	3	
	10	19 Dec 1982	2	
1983	3	02 Feb 1983	4	
	9	19 May 1983	7	
	12	17 Aug 1983	2	
	13	08 Oct 1983	4	
	15	01 Nov 1983	10	
	16	18 Nov 1983	4	
	18	22 Dec 1983	5	
	19	30 Dec 1983	1	
1984	8	22 Feb 1984	15	
	9	05 Mar 1984	11	
	14	15 June 1984	9	
	21	06 Oct 1984	18	
1985	10	21 Mar 1985	54	
	11	03 Apr 1985	9	
	12	15 Apr 1985	13	
	16	03 May 1985	2	
	18	09 June 1985	4	
	22	14 June 1985	11	
1987	2	19 Jan 1987	27	
	7	27 Mar 1987	9	
1988	18	19 May 1988	189	
Total			516	
Year	Document		Warheads Exhausted	Remarks
	#	Date		
2. Warheads Launched During the 1991 Gulf War				
1991	1	08 June 1991	87	No documents mention the [serial] numbers of the warheads. 93 total were launched, of which 6 were Iraqi made
	2	08 June 1991		
Total			87	

3. Warheads Launched in Training, Flight Tests, and Mineral Analysis				
1977	6	Oct 1977	6	No warheads [serial] numbers mentioned in documents
1985	29	09 Aug 1985	1	No warheads [serial] numbers mentioned in documents
1987	16	04 May 1987	2	No warheads [serial] numbers mentioned in documents
	19	07 Aug 1987	1	No warheads [serial] numbers mentioned in documents
	25	05 Oct 1987	3	
	26	09 Oct 1987	1	
	27	18 Oct 1987	1	
	28	23 Nov 1987	2	
1988	1	02 Jan 1988	2	
	2	06 Jan 1988	1	Used for metal analysis
	16	15 June 1988	7	
	17	07 July 1988	3	
	19	03 Sept 1988	2	
	25	20 Nov 1988	3	
	26	02 Dec 1988	3	
1989	1	24 Feb 1989	2	
	3	07 July 1989	1	
	4	24 Aug 1989	1	
1990	1	07 Jan 1990	4	
	3	18 Apr 1990	1	No definition if warhead is Iraqi or Russian—suspect latter
	5	18 Apr 1990	1	
	11	09 May 1990	1	
Year	Document		Warheads Exhausted	Remarks
	#	Date		
	12	09 July 1990	1	
	10	28 June 1990	1	No code or indication about the warhead
	21	02 Dec 1990	3	
	*	26 Dec 1990	1	* 2 nd Division Orders doesn't reflect warhead code
	*	26 Dec 1990	2	* 2 nd Division Orders doesn't reflect warhead code
Total			57	
4. Warheads Destroyed by UNSCOM				
1991	5	31 July 1991	17	
5. Special Warheads Destroyed by UNSCOM /CDG at Al Muthanna (Sept 1992 and April 1993)				
1992/3	**	Sept 92/Apr 93	22	**Verification certificate for the warhead destruction by UNSCOM in Sept 1992 and April 1993. Warheads were not indicated at the time but were later by both UNSCOM and Iraq. Now with UNSCOM (Bahrain)
6. Conventional Warheads Destroyed by Iraq in 1991 (Unilateral)				
1991	10	21 July 1991	118	
	13	22 Oct 1991		
7. Conventional Warheads Returned to Russia				
1980	3	03 April 1980	2	
Overall Total			819	

Official NMD document with the expenditure of 819 imported Scud warheads.

This page intentionally left blank.

Annex B Liquid-Propellant Missile Developments

2.1 Al Samud Program

In 1993, Iraq began developing liquid-propellant ballistic missiles. The program began as the Ababil-100 liquid-propellant missile program, which later became known as the Al Samud. This missile was based on SA-2 and Scud technology and manufacturing techniques; it was monitored closely by the UN. Research and development continued until 2001 when the program was terminated and replaced by the Al Samud II.

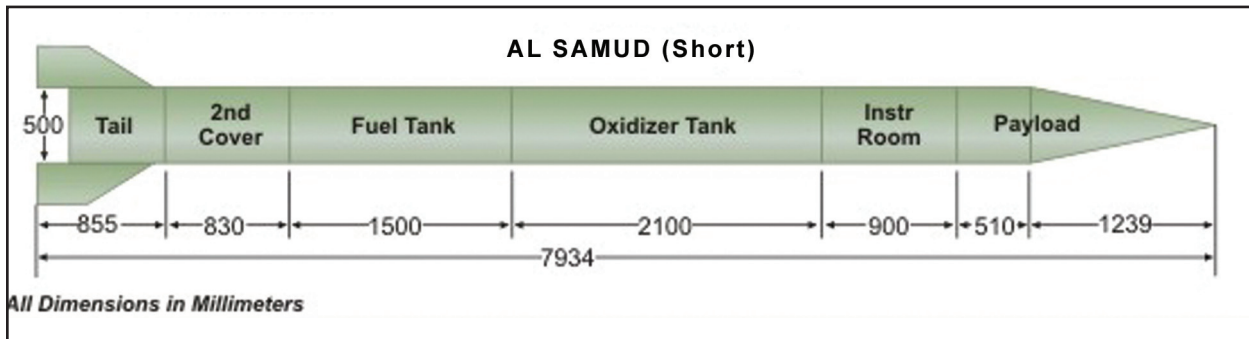


Figure 3. Al Samud short diagram.

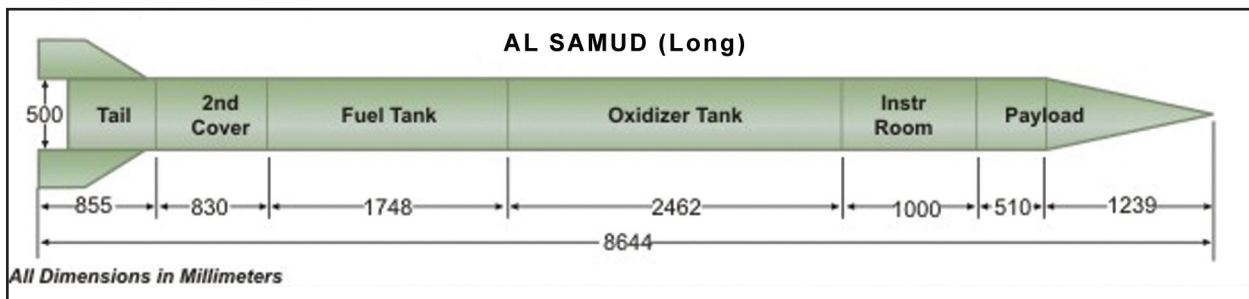


Figure 4. Al Samud long diagram.

Table 3

Original Al Samud Parameters

Subsystem	Parameter	Characteristic	Units	Data	Notes
Missile	Overall	Length	m	7.6	
		Diameter	mm	500	
		Lift-off mass	kg	1,500	Approximate figure
		Inert mass	kg	340	+/- 30kg
Warhead	Mass	Total	kg	270	
		Explosive	kg	160	60% TNT, 30% RDX, 10% Al
	Length	Overall	m	1.68	
		Cylindrical	m	0.23	
		Conical	m	1.45	
	Material	Wall	mm	3	Carbon steel
	Propulsion	Engine	Thrust	t	3.5
Burning time			s	68*	Nominal
			s	+2*	Contingency
Tanks		Ullage volume	%	5	Up to 8%
		Ox, length, overall	m	2.600	Domes each 0.335 high
		Ox, length, parallel	m	1.930	
		Fuel, length, overall	m	1.691	Domes each 0.335 high
		Fuel, length, parallel	m	1.021	
		Thickness	mm	2	Aluminum
Propellant		Oxidizer	-----	AK-20K	
		Oxidizer flow rate	kg/s	11.5*	
		Total mass	kg	724*	Usable, for 63s burning time
		Fuel	-----	TG-02	
		Fuel flow rate	kg/s	3.5*	
	Total mass	kg	220*	Usable, for 63s burning time	
Air supply	Air bottle	Diameter	mm	300	Spherical, one only
		Pressure	bar	300-360	

*Parameters are known to be inconsistent.

2.2 Al Samud Static Test Data

#	Date		Fuel			Oxidizer			Filling Site	Notes (residual fuel, oxidizer)
	Filled	Fired	Type	Source	Vol. (l)	Type	Source	Vol. (l)		
01	00.10.96	00.10.96	TG-02	Bat. 76	210	AK-20K	Bat. 76	360	Bat. 76	IZZ chamber & injector head
02	14.04.97	00.04.97	TG-02	Bat. 76	210	AK-20K	Bat. 76	360	Bat. 76	Structural test of missile
03	00.08.97	00.08.97	TG-02	Bat. 76	210	AK-20K	Bat. 76	360	Bat. 76	Structural test of missile
04	10.04.98	15.04.98	TG-02	Bat. 76	210	AK-20K	Bat. 76	360	Bat. 76	
05	20.04.98	22.04.98	TG-02	Bat. 76	210	AK-20K	Bat. 76	360	Bat. 76	
06	00.06.99	07.06.99	TG-02	Bat. 76	210	AK-20K	Bat. 76	360	Bat. 76	Check IZZ engine
07	00.07.99	00.07.99	TG-02	Bat. 76	210	AK-20K	Bat. 76	360	Bat. 76	Check IZZ engine
08	21.07.99	22.07.99	TG-02	Bat. 76	210	AK-20K	Bat. 76	360		
09	06.08.99	07.08.99	TG-02	Bat. 76	210	AK-20K	Bat. 76	360	Bat. 76	Check IZZ purge system
10	22.11.99	23.11.99	TG-02	Bat. 76	210	AK-20K	Bat. 76	360	Bat. 76	Check telemetry
11	04.12.99	05.12.99	TG-02	Bat. 76	210	AK-20K	Bat. 76	360	Bat. 76	Check telemetry
12	13.07.00	15.07.00	TG-02	Karamah	210	AK-20K	Karamah	360	Bat. 76	
13	05.08.00	08.08.00	TG-02	Karamah	242.5	AK-20K	Karamah	402.5	Bat. 76	(10, 41)
14	06.09.00	07.09.00	AZ-11	China	267	AK-20K	USSR	463	Bat. 76	Tb 61s, (2, 2.5)
15	11.10.00	12.10.00	AZ-11	?	267	AK-20K	USSR	430	Bat. 76	IZZ regulator, tb 69s (2.5, 2)
16	16.10.00	17.10.00	TG-02	USSR	267	AK-20K	USSR	431.5	Bat. 76	Tb 61s
17	17.03.01	18.03.01	AZ-11		266	AK-20K	USSR	428	Bat. 76	Repeat of 16
18	03.04.01	03.04.01	TG-02	USSR	275	AK-20K	USSR	442	Bat. 76	IZZ turbo-pump
19	25.04.01	26.04.01	TG-02	USSR	285	AK-20K	USSR	460	Bat. 76	IZZ vanes [TVC]
20	11.06.01	12.06.01	TG-02	USSR	271	AK-20K	USSR	451	Bat. 76	Tb 58s, original engine
21	16.10.01	17.10.01	TG-02	USSR	216	AK-20K	USSR	357	Bat. 76	IZZ turbo-pump, tb 49s, (22, 8)
22	28.11.01	29.11.01	AZ-11	?	191	AK-20K	USSR	352	Bat. 76	Tb 45s, (10, 40)
23	16.02.02	17.01.02	AZ-11	?	190	AK-20K	Al Qa'qa'a	350	IAH	Tb 49s, (8, 19)
24	01.04.02	02.04.02	TG-02	USSR	210	AK-35K	Ibn-Sina'	350	Bat. 76	Test effects of AK-35K

AI Samud Flight Tests						
	Date Launched	ZTime	Range (km)	Date Filled	TG-02 (liters)	AK-20K (liters)
1	24-Oct-1997	unk	92		210	360
2	20-Feb-1998	1323	93		210	360
3	21-Feb-1998	1000	0		210	360
4	22-Feb-1998	unk	0		210	360
5	30-Mar-1998	unk	15			
6	1-May-1998		15km		210	360
7	1-Jun-1998		Failed		210	360
8	4-Aug-1998	600	0			
9	11-Aug-1998	940	71.8			
10	20-Oct-1998	715	0			
11	20-Oct-1998	1250	0			
12	1-May-1999	unk	n/a	30-Apr-99	210	360
13	10-May-1999	unk	20			
14	30-Aug-1999		n/a		210	360
15	5-Sep-1999	415	n/a			
16	23-Dec-1999		Failed		210	360
17	28-Dec-1999	1315	55	28-Dec-99	210	360
18	17-Feb-2000	938	72	15-Feb-99	210	360
19	12-Mar-2000	1315	90	11-Mar-99	210	360
20	25-Apr-2000	1201	70	24-Apr-00	212	365
21	23-May-2000	1030	100	22-May-00	212	365
22	1-Sep-2000	606	0			
23	26-Oct-2000	unk	n/a			
24	13-Nov-2000		n/a	11-Nov-00	281	453
25	20-Nov-2000	1215	151	20-Nov-00	279	452
26	12-Dec-2000	830	50	10-Dec-00	286	461

Figure 5. AI Samud flight tests (1997-2000).

AI Samud Flight Tests						
	Date Launched	ZTime	Range (km)	Date Filled	TG-02	AK-20K
27	13-Jan-2001	802	120	11-Jan-01	286	463
28	14-Jan-2001	1039	n/a			
29	21-Jan-2001	1125	Failed	20-Jan-01	278	452
30	12-Feb-2001	907	56	8-Feb-01	278	452
31	16-Feb-2001	846	150	16-Feb-01	279	450
32	20-Mar-2001	842	150	20-Mar-01	279	452
33	28-Mar-2001		30km	27-Mar-01	279	452
34	28-May-2001	unk	Failed	25-May-01	280	460
35	28-May-2001		87km	25-May-01	280	460
36	28-May-2001		90km	26-May-01	280	460
37	29-May-2001		85km	29-May-01	240	355
38	11-Jul-2001	314	88	11-Jul-01	230	376
39	12-Jul-2001	340	Failed	12-Jul-01	230	376
40	17-Jul-2001		n/a	15-Jul-01	230	376
41	20-Aug-2001	359	n/a	19-Aug-01	230	376
42	20-Aug-2001		85km	19-Aug-01	230	375
43	20-Aug-2001		45km	19-Aug-01	217	357
44	24-Sep-2001		n/a	23-Sep-01	217	355
45	24-Sep-2001		n/a			
46	26-Sep-2001		74km	26-Sep-01	217	358

Figure 6. AI Samud flight tests (2001).

2.4 Al Samud II Static Test Data

Table 5

Static Tests Supporting the Al Samud II

#	Date		Fuel			Oxidizer			Filling Site	Notes (residual fuel, oxidizer) (in liters)
	Filled	Fired	Type	Source	Vol. (l)	Type	Source	Vol. (l)		
01	31.07.01	01.08.01	TG-02	AK-20K	347	AK-20K	USSR	557	Bat. 76	Tb 74s, (15, 12)
02	07.03.02	08.03.02	AZ-11		370	AK-20K	Qa'qa'a	597	IAH	Tb 85s, (14, 18)
03	26.03.02	27.03.02	TG-02	Raya	364	AK-20K	Qa'qa'a	601	IAH	Tb 75s, (33, 10)
04	07.04.02	08.04.02	TG-02	Raya	386	AK-20K	Raya	605	IAH	Stabilizer test (70, 35)
05	15.05.02	16.05.02	TG-02	Raya	371	AK-20K	Qa'qa'a	603	IAH	T-pump test, tb 30, leak!
06	01.07.02	01.07.02	TG-02	Raya	375.5	AK-22K	Qa'qa'a	612	IAH	IZZ chamber, (66, 15)
07	08.07.02	08.07.02	TG-02	Raya	375	AK-20K	Qa'qa'a	?	IAH	Failed, oxidizer pipe leak
08	16.07.02	16.07.02	TG-02	Raya	370.9	AK-20K	Qa'qa'a	609	IAH	IZZ vanes, orig engine - Fail
09	31.07.02	01.08.02	TG-02	Raya	371	AK-20K	Qa'qa'a	609	IAH	Tb 81s, IZZ vanes (36, 2)
10	07.08.02	07.08.02	TG-02	Raya	370	AK-20K	Qa'qa'a	607	IAH	IZZ gas generator
11	29.08.02	30.08.02	TG-02	Raya	370	AK-20K	Qa'qa'a	614	IAH	IZZ chamber, ok
12	05.09.02	06.09.02	TG-02	Raya	375	AK-20K	Qa'qa'a	614	IAH	Engine burnt - Fail
13	09.11.02	n/a	TG-02	Raya	372	AK-20K	Qa'qa'a	598	IAH	IZZ t-pump, (13, 20) OK
14	16.11.02	16.11.02	TG-02	Raya	372	AK-20K	Qa'qa'a	598	IAH	IZZ t-pump (37, 36)
15	24.11.02	25.11.02	TG-02	Raya	370	AK-20K	Qa'qa'a	605	IAH	IZZ engine, tb20s,(436 ox) F
16	04.12.02	05.12.02	TG-02	Raya	368	AK-20K	Qa'qa'a	601	IAH	Tb 78s, (3, 12) OK
17	02.01.03	02.01.03	TG-02	Raya	368	AK-20K	Qa'qa'a	601	IAH	Orig engine, IZZ vanes (25, 27)
18	11.01.03	12.01.03	TG-02	Karamah	369	AK-20K	Raya	606	Taji	IZZ engine, (15, 55) OK
19	26.01.03	27.01.03	TG-02	Karamah	365	AK-20K	Qa'qa'a	602	IAH	IZZ engine, (0, 48.5) OK
20	03.02.03	04.02.03	TG-02	Karamah	368	AK-20K	Qa'qa'a	605	A Ghraib	Tb 81s, IZZ vanes (28, 26.5)
21	22.02.03	23.02.03	TG-02	Karamah	366	AK-20K	Qa'qa'a	605	A Ghraib	New TVC vane material

This page intentionally left blank.

2.5 Al Samud II Flight Test Data

Al Samud II Flight Tests										
	Date Launched	ZTime	Range (km)	Date Filled	TG-02 (litres)	AK-20K (liters)	Propellant Temp	Temp of Air	Wind Speed (m/s)	Wind Direction
1	24-Aug-2001		n/a	23-Aug-01	344	555				
2	26-Sep-2001	1332	154	25-Sep-01	357	613.5	28°C	22°C	10	246°
3	11-Oct-2001	unk	142	9-Oct-01	612	381	28°C	20°C	14	169°
4	6-Nov-2001	unk	Failed	4-Nov-01	376	611.5				
5	7-Nov-2001	630	154.2	6-Nov-01	375	604.5	22°C	28°C	21	306°
6	29-Dec-2001	unk	33	27-Dec-01	369 ®	600 (Q)				
7	9-Jan-2002	949	155.9	7-Jan-02	370 ®	600 (Q)	15°C	20°C	6	206°
8	10-Jan-2002	unk	140	8-Jan-02	367 ®	596 (Q)	11°C	15°C	7	212°
9	31-Jan-2002	1229	171	30-Jan-02	367 ®	600.5(Q)	12°C	15°C	12	122°
10	14-Mar-2002	unk	180.5	12-Mar-02	370 ®	598 ®	24°C	20°C	12	202°
11	11-Apr-2002	unk	164	11-Mar-02	370 ®	604 ®	n/a	n/a	n/a	n/a
12	10-May-2002	unk	183	8-May-02	398*	632	n/a	n/a	n/a	n/a
13	6-Jun-2002	unk	145	5-Jun-02	386 ®	636 ®	30°C	25°C	15	208°
14	17-Jun-2002	307	156.6	16-Jun-02	387 ®	632 ®	31°C	9°C	10	192°
15	18-Jun-2002	312	136.7				31°C	10°C	12	226°
16	18-Jul-2002	354	153	17-Jul-02	376 ®	612 (Q)	37°C	31°C	12	311°
17	18-Jul-2002	unk	n/a							
18	23-Jul-2002	256	152.2	n/a	376 ®	620 (Q)	n/a	n/a	n/a	n/a
19	25-Aug-2002	345	174	n/a	375(K)	607 (Q)				
20	25-Aug-2002	unk	163	n/a	375(K)	614 (Q)				
21	30-Oct-2002	604	124	24-Aug-02	375(K)	612 (Q)				
22	30-Oct-2002	812	25	24-Aug-02	375(K)	612 (Q)				
23	16-Nov-2002	unk	166	14-Nov-02	374(K)	612 (Q)				

Figure 7. Al Samud II flight tests.

Al Samud II Flight Tests (continued)		
	Lateral Deviation	Source Comments and Deviations
1		"Result n/a. & Filled at Battery 76"
2	1°-Left	"Filled at Battery 76, Flight date 25-Sep-2001 & Range 145km"
3	0.5°-Left	"Filled at Battery 76"
4		"Failed on the pad. & Filled at Bat. 76"
5	1.76°-Left	"Filled at Battery 76 & Range 154km"
6		"Filled at Ibn al Haytham & Range 35km"
7	2°-Right	"Missile # 020214 & Range 154km"
8	10°-Right	"Missile # 010203"
9	0.68°-Left	"Range 170km"
10	3.07°-Left	"Range 181km" & "9th Al Samud 2 luanch"
11	n/a	"Range 165km"
12	1°-Left	**Used AZ-11 & Filled at Ibn al Haytham" & "Range 184km"
13	3.67°-Left	
14	1.63°-Right	"Result n/a"
15	2.06°-Right	
16	0.75°-Left	"Missile #63"
17		
18	0.14°-Left	"83s burning time, Missile #66 & Range 152km"
19		"174km (vs 125 theoretical), Missile #67 & 80s burn time"
20		"163km (vs 100 theoretical), Missile#68, & 82.4s burn time"
21		"Missile #69" & "Range 75km"
22		"Missile #70" & "Range 24km"
23		"Result n/a"

Figure 7. Al Samud II flight tests (continued).

2.6 Al Samud II Missile Material Balance

Materials Balance

To determine the likely number of missiles that could potentially remain in an inventory, the technique of materials balance can be employed. This involves the collection of data associated with all aspects of the production and consumption of the missiles concerned. The production numbers may be gleaned from the factory producing the hardware or where the missiles are integrated or even loaded with propellants. Consumption numbers can be derived from tests, either static or flight, deliveries to the armed forces or those withdrawn due to damage or other causes.

If a materials balance of complete missiles cannot be accomplished, an equivalent might be derived from the many subsystems that make up the complete missile—such as warheads, engines, or even propellants. This latter approach has been used in an attempt to account for both Scud and Al Samud II missile inventories.

ISG believes that a complete material balance for the Al Samud II missile may not be possible due to various factors. Documentary data indicating the total number of missiles produced have not been recovered by ISG and the disposition of the missiles is unknown. However, a very good estimate of the total number produced can be achieved based on the knowledge that the Iraqis had a production rate goal of 10 per month, according to an official in Iraq's missile program. This rate varied month to month due to availability of parts. The missile began production in late 2001 with the first 10 being delivered to the Army in December 2001. ***Assuming these production figures were maintained between December 2001 and December 2002, ISG believes a likely total of 130 Al Samud II missiles may have been produced during this period.*** According to a former senior official at Al Karamah, Iraq produced approximately 20 missiles during the first quarter of 2003. Another source claimed that, after UNMOVIC inspectors departed the country in March 2003, Iraq was able to assemble about 4 Al Samud missiles from remain-

ing parts, which had been placed in mobile trucks to avoid destruction. ***These 24, in addition to the 130 previously mentioned, yield a total of 150 Al Samud II missiles produced.***

According to multiple sources, Iraq expended up to 27 missiles during experimental tests (flight and static tests). Beginning 1 March 2003, UNMOVIC began a destruction program, which accounted for 72 missiles destroyed. ISG have obtained information given in Table 6, which shows serial numbers associated with 62 of the 72 missiles destroyed. However, the dates of destruction do not appear to correlate to those dates provided by the UNMOVIC spokesman during the period of destruction. According to reporting, Iraq launched five Al Samud II missiles during OIF. Table 7 details some of the additional al Samud subsystems destroyed under UNMOVIC supervision. Coalition forces may have been responsible for the destruction and recovery of up to 15 missiles based on available data. According to a foreign government service, two Al Samud II missiles were taken to Iran. ISG has not been able to confirm this claim. ***Taking these figures into account, ISG has developed possible scenarios for material balance for the Al Samud II missile given in Table 6***

Table 6**Al Samud II Missiles Destroyed Under UNMOVIC Supervision in 2003**

Date	Serial No.	Date	Serial No.	Date	Serial No.
03 Mar 03	020279	06 Mar 03	020294 TE	11 Mar 03	020233
03 Mar 03	020272	06 Mar 03	020297 TE	11 Mar 03	020283
03 Mar 03	020228	06 Mar 03	020302 TE	11 Mar 03	020232
03 Mar 03	020226	07 Mar 03	010206 TL	12 Mar 03	020237
03 Mar 03	020236	07 Mar 03	020310 TL	12 Mar 03	020236
03 Mar 03	020229	07 Mar 03	020308 TL	12 Mar 03	020292
04 Mar 03	020296	08 Mar 03	020280	13 Mar 03	020314
04 Mar 03	020295	08 Mar 03	020288	13 Mar 03	020313
04 Mar 03	020286	08 Mar 03	020287	13 Mar 03	020316
05 Mar 03	020217 TE	08 Mar 03	020306	14 Mar 03	020311
05 Mar 03	010227 TE	08 Mar 03	020209	14 Mar 03	020312
05 Mar 03	020264 TE	08 Mar 03	020303	14 Mar 03	020299
05 Mar 03	020284 TE	09 Mar 03	020285	14 Mar 03	020315
05 Mar 03	020277	09 Mar 03	020282	15 Mar 03	020235
05 Mar 03	020278	09 Mar 03	020281	15 Mar 03	020234
05 Mar 03	020273	09 Mar 03	020304 TE	15 Mar 03	020290
05 Mar 03	020274	09 Mar 03	020291 TL	16 Mar 03	020220
05 Mar 03	020293	09 Mar 03	020289 TL	16 Mar 03	020242
06 Mar 03	020222	10 Mar 03	020225	17 Mar 03	020240
06 Mar 03	020227	10 Mar 03	020224	17 Mar 03	020221
06 Mar 03	020275	10 Mar 03	020298		

No.	Engine Serial No.	Fuel Tank Serial No.	Oxidizer Serial No.	Tail Serial No.	Warhead Serial No.
1	57013	FU-125	Ox-115	109	130
2	56820	FU-132	Ox-120	118	133
3	89834	FU-113	Ox-127	121	134
4	88240	FU-123	Ox-102	120	135
5	50413	FU-115	Ox-126	102	136
6	57007	FU-129	Ox-132	111	122
7	82439	FU-117	Ox-121	112	124
8	57918	FU-111	Ox-124	113	120
9	82551	FU-134	Ox-123	119	121
10	27736	FU-114	Ox-125	126	115
11	31414	FU-121	Ox-118	117	132
12	53005	FU-130	Ox-140	124	131
13	53401	FU-138	Ox-135	126	128
14	82626	FU-142	Ox-138	128	118
15	54115	FU-139	Ox-136	131	116
16	82414	FU-140	Ox-129	123	119
17	89720	FU-145	Ox-122	132	126
18	55404	FU-116	Ox-131	130	113
19	51725	FU-133	Ox-117	127	117
20	54108	FU-135	Ox-128	125	103
21	80120	FU-127	Ox-130		114
22	89925	FU-126	Ox-133		
23	113741	FU-128	Ox-134		
24	52916	FU-103	Ox-141		
25	55017		Ox-092		
26	54418		Ox-104		

Table 7

Additional Al Samud II Subsystems Destroyed Under UNMOVIC Supervision

	Worst Case	Likely Case	Best Case
Missiles Produced	150	130	121
Used in tests	22	25	27
Destroyed under UNMOVIC	72	72	72
Launched during OIF	5	5	5
Damaged/Captured/to Iran	15	15	17
Unaccounted for	36	13	0

Table 8

ISG Assessment of Al Samud II Missile Accountability

The Liquid Fuels Committee (LFC)

Until April 1998, both the Air Defense and the Naval Defense and the Naval Defense forces had supplied Al Karamah with whatever propellant was required for testing on an ad hoc basis. Both felt unable to continue this relationship as it was adversely affecting their own propellant stocks. On hearing this news, Staff Lt. Gen. Muzahim Sa'b al-Hasan Muhammad Al Nasir called a meeting of representatives from the Military Industrialization Commission (MIC), the Army (Surface-to-Surface Missile [SSM] Command), Air Defense Forces, Al Karamah, and the Naval Defense Forces. The armed forces could satisfy their own propellant requirements but, for Al Karamah's new development program, there was none available. Thus, arrangements had to be made to satisfy this need whilst maintaining stock availability to the other armed services. To do this, a committee called the LFC was set up by the MIC in 1998 to manage and coordinate the requirements of all

liquid-propellant research, production, and supply (regeneration, manufacture, or importation) to the various users.

There were three goals of the LFC:

1. Now - To ensure the continued supply for current requirements of TG-02 and AK-20K
2. Near Term - The production of AZ-11 and AK-27P
3. Far Term - The production of Hydrazine, Unsymmetrical Di-Methyl Hydrazine (UDMH), Nitrogen Tetroxide, and Hydrogen Peroxide

By the time of Operation Iraqi Freedom (OIF), objective 1 was achieved, some movement was in progress toward objective 2, and most of the candidate propellants in objective 3 were at least being researched.

The LFC consisted of the following personnel:

Name	From, Position	Notes
Dr. Muzhir [Modher] Sadiq Saba' Khamis Al-Tamimi	Al Karamah, DG	Chairman
Jasim Muhammad Salman al-Tamimi	Al Karamah	Deputy Chairman
Dr. Yusif 'Ulwan Hammadi Al 'Ithawi	Ibn-Sina', DG	
Dr. Hikmat Na'im Al Jalu	Ibn-Sina', former DG	
Dr. Thabit Jasim	Ibn-Sina', former DG	
Ghazi Faysal Najm-al-Din	Al Basil	
Dr. Zuhayr Mahmud Al Qazzaz	Al Basil	
Dr. Jalil Rahif' Akal	Al Basil	
Dr. Agil 'Awad	Al Basil	
Dr. Jasim	Al Kindi	
Fu'ad Muhammad Basim	Al Qa'qa'a	
Sami Da'ud	Sa'd Company	Al Zahrawi Center
Dr. Hamzah Yasin 'Issa	MIC Center	
Dr. Ghanim Maqbul 'Ulwan	Al Amin	

2.7 Liquid-Propellant Material Balance

Closure of the material balance for liquid propellants is extremely difficult because of the amount of regeneration due to the effects of aging on propellants. The records kept concerning regeneration do not make reference to the sources of fresh material acquired in the regeneration process. Instead, they provide only an input-output picture.

The Liquid Fuels Committee (LFC) was initiated in August of 2000 to analyze performance capabilities for various propellants, research techniques for producing candidate chemical propellants or their precursors, and study synthesis routes and manufacturing capabilities of various companies. Through studies of companies and capabilities, the LFC awarded contracts to companies to begin manufacturing. The projected production capabilities were 50 tons/yr of Di-methyl amine (DMA), 20 tons/yr of DETA, 50 tons/yr of TEA, and 50 tons/yr of xylydine. Schematics of liquid-propellant production and research are shown in Figures 8 and 9. *This production when combined with the imported quantities of propellant far surpassed the requirements of the Al Samud II program.* A schematic materiel balance of the liquid propellant used for the Al Samud II program is shown below in Figures 10 through Figure 12, with the production or sources along the top, above the total and consumption along the bottom of each table.

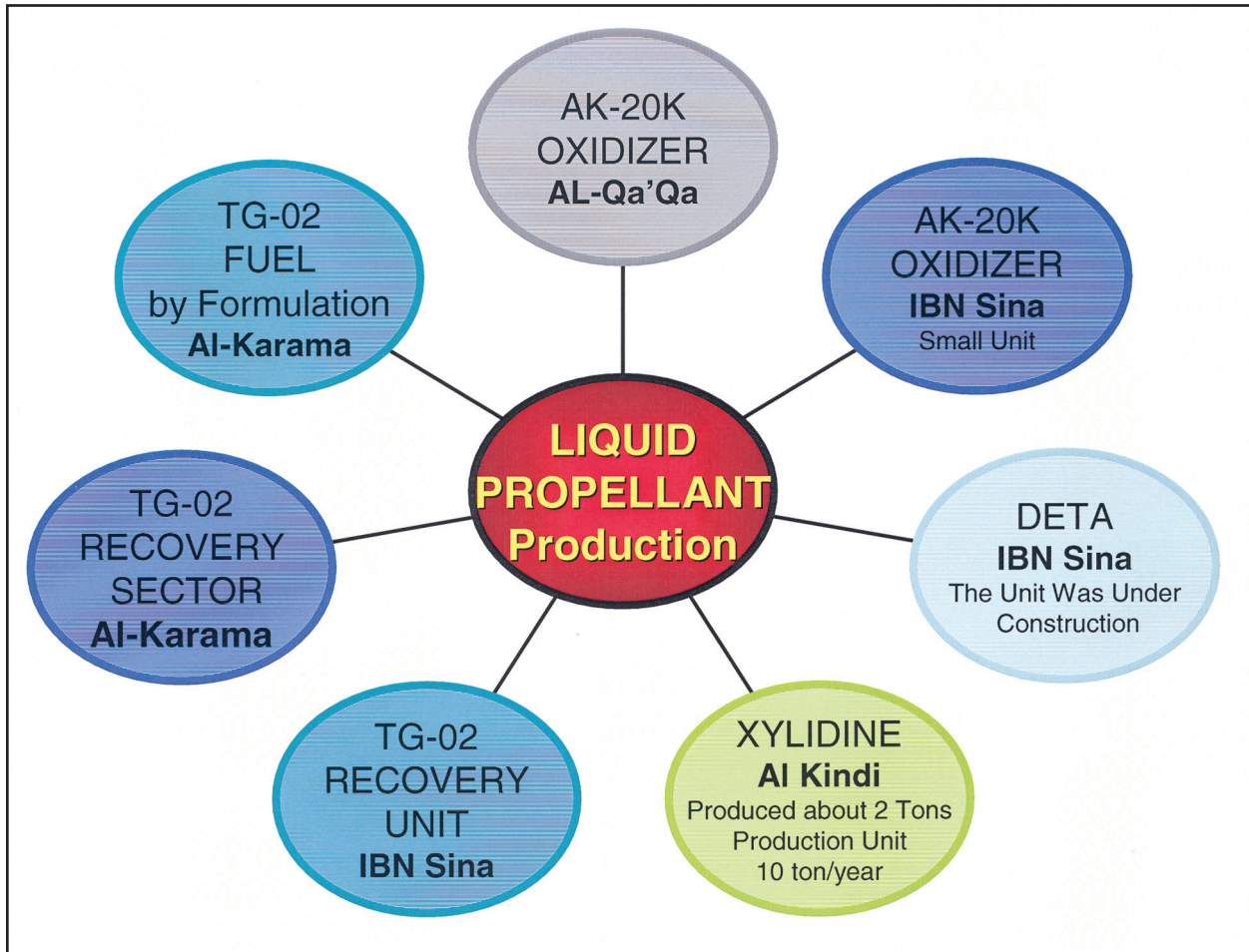


Figure 8. Liquid-propellant production.

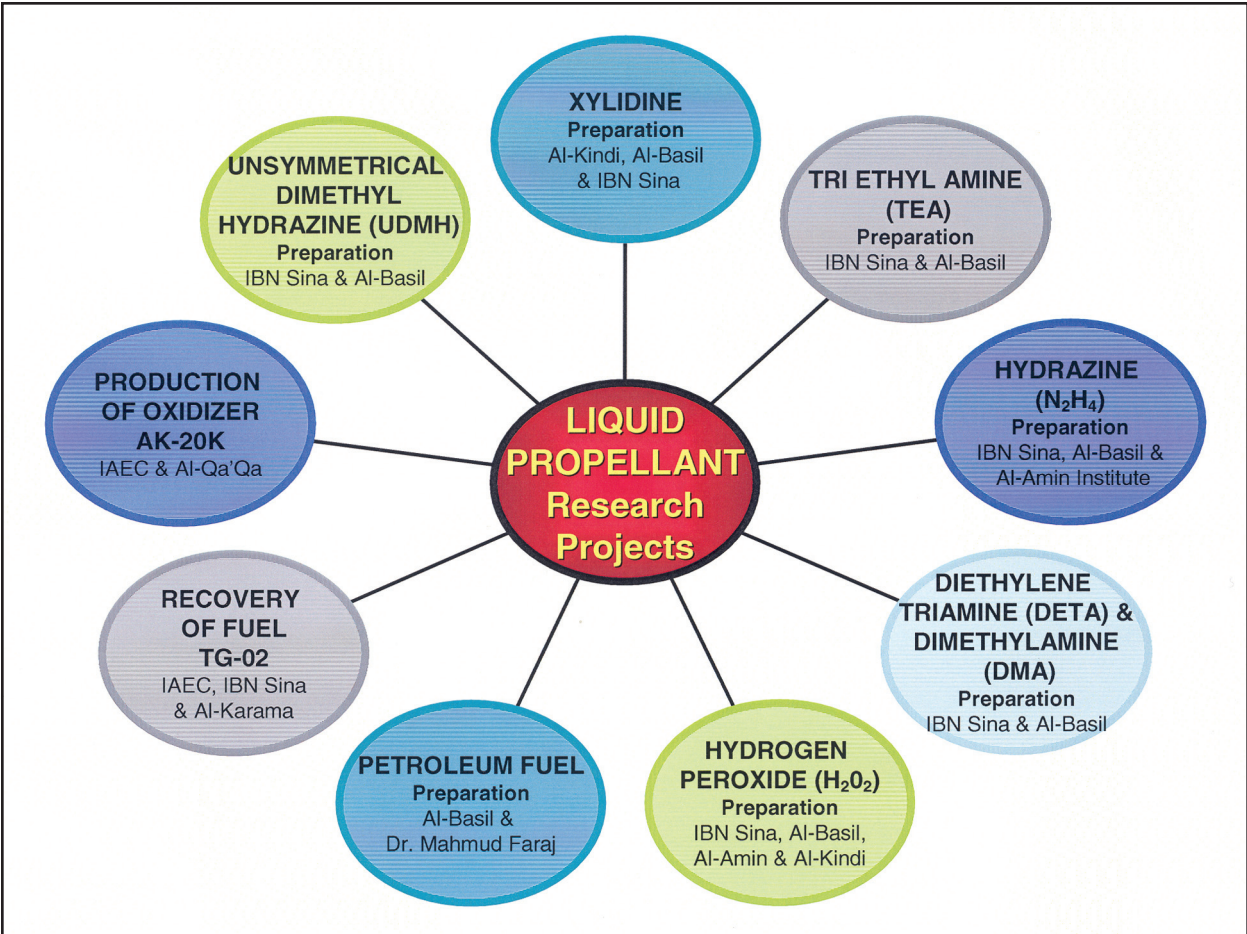
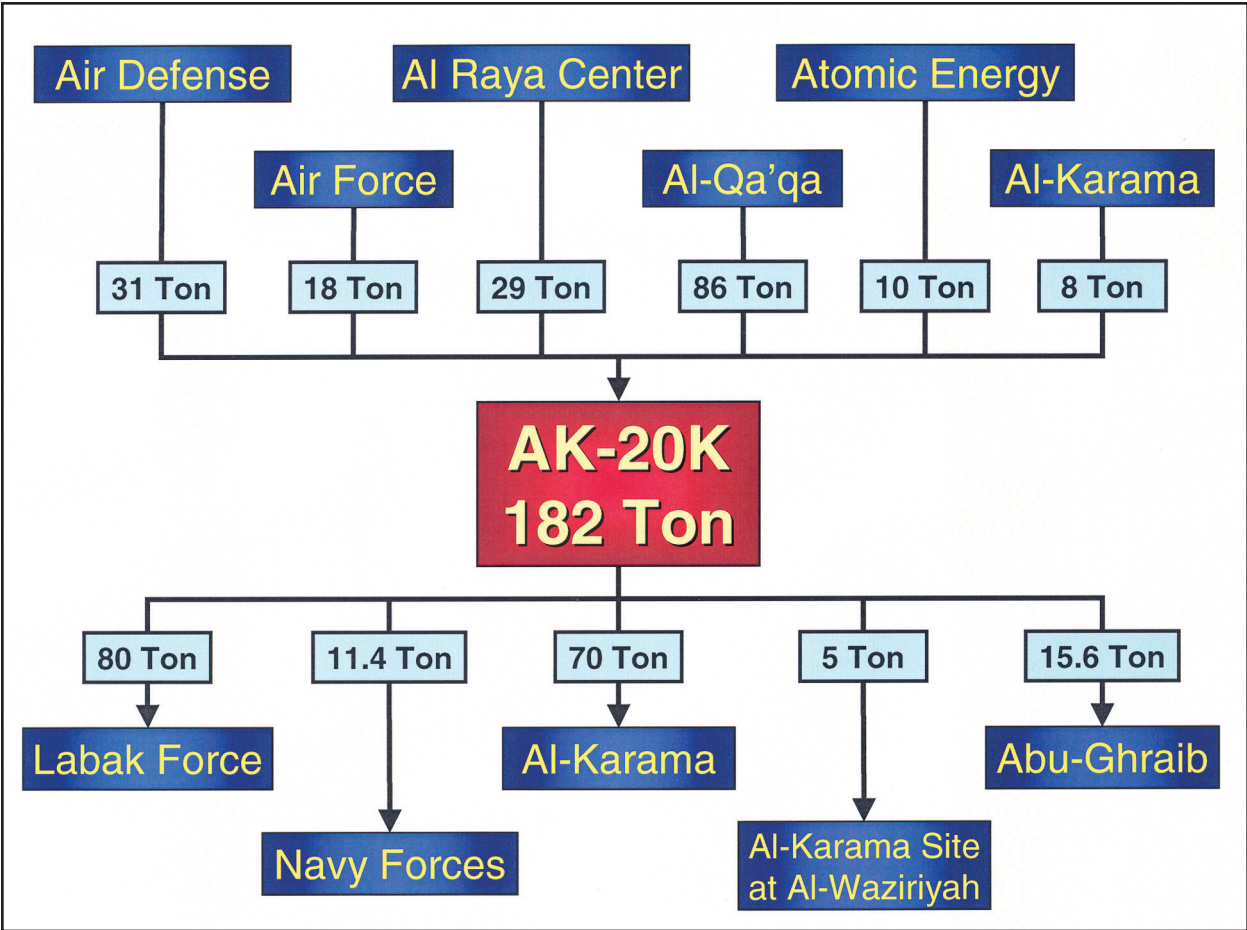


Figure 9. Liquid-propellant research.



Delivery Systems

Figure 10. Oxidizer materiel balance (1995-2003).

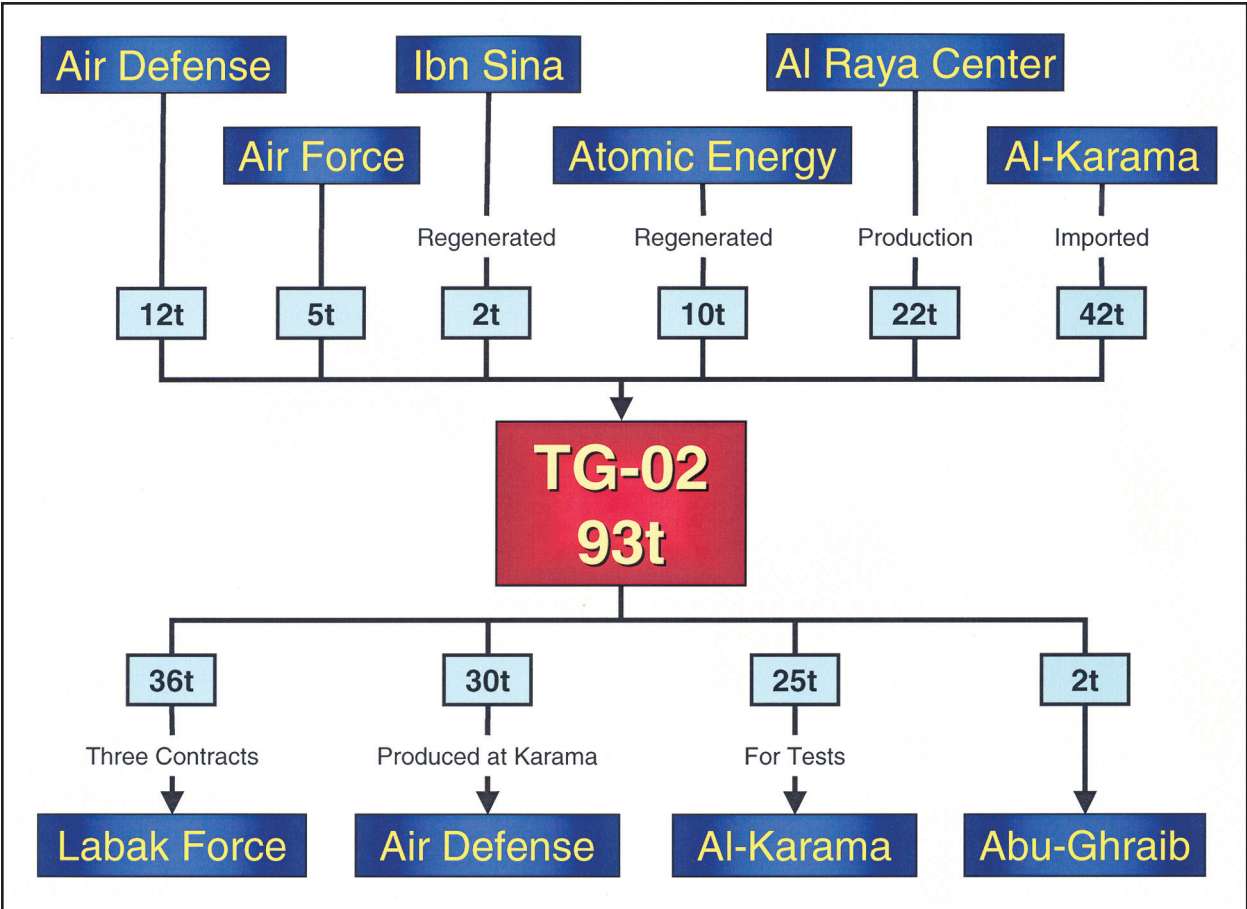


Figure 11. Fuel materiel balance (1995-2003).

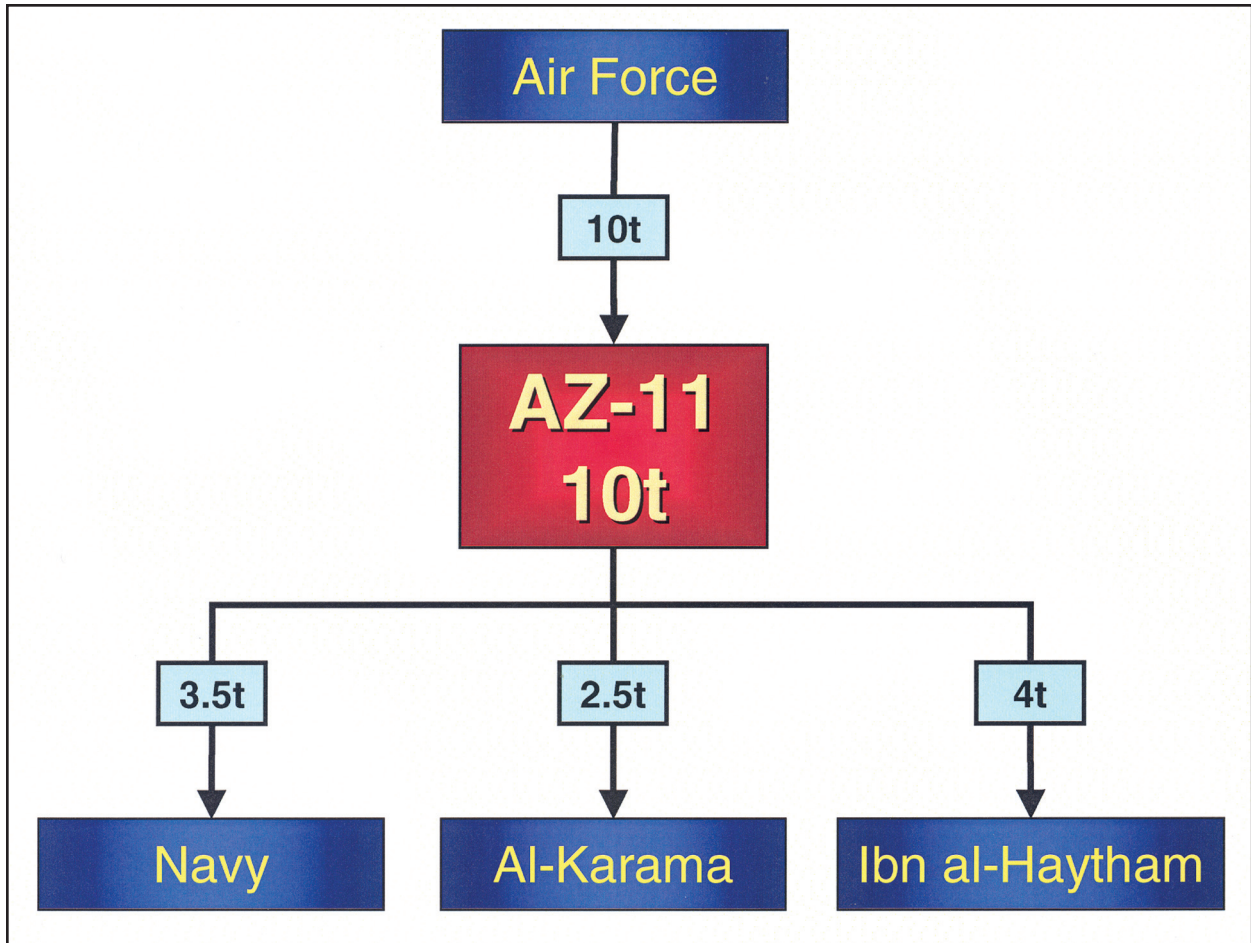


Figure 12. High-energy propellant materiel balance (1995-2003).

This page intentionally left blank.

**Annex C
Solid-Propellant
Missile Developments**

**3.1 Iraqi Composite Solid-Propellant
Composition**

The composite propellants fielded by Iraq were “conventional,” being formulations widely used throughout the industry and based on a hydroxyl-terminated poly butadiene (HTPB) binder heavily loaded with ammonium perchlorate (AP) and aluminum powder. In addition to these main chemicals, a number of other chemicals are used, such as plasticizer, burning rate modifiers and curing agents.

Table 9

The Al Fat’h and Al ‘Ubur Propellant Formulation

Compound	% by mass
Ammonium Perchlorate (AP) (200-Micron Particle Size)	35
Ammonium Perchlorate (AP) (50-80 Micron Particle Size)	35
Aluminum Powder (< 200 Micron particle Size)	14
Hydroxy Terminated Poly Butadiene (HTPB)	11-12
Diocetyl Azelate (DOZ) - or - Diocetyl Adepate (DOA)	3.5
Ferric Oxide	1
2,4-Toluene Diisocyanate (TDI)	~1
Tri[1-(2-Methyl Aziridinyl)] Phosphine Oxide (MAPO)	0.3

Of these ingredients, none are explicitly prohibited. UNSCR 715 Annex IV references chemicals subject to monitoring and verification, although the Import/Export Mechanism approved by UNSCR 1051 requires prior notification of imports. The Missile Technology Control Regime (MTCR) refers to Category II chemicals, which are subject to case by case review. Many of these chemicals are classified as “Dual Use,” meaning they may have other uses. The primary components of the Iraqi composite solid-propellant ingredients fall within these control classifications as shown in Table 10.

Table 10

The Al Fat’h and Al ‘Ubur Propellant Control Classifications

Chemical	UNSCR 715/1051	MTCR Cat II	Dual Use
Ammonium Perchlorate (AP)	Y	Y	N
Aluminum Powder	N	Y	Y
Hydroxyl Terminated Poly Butadiene (HTPB)	Y	Y	Y
Diocetyl Azelate (DOZ)	N	N	Y
Ferric Oxide (FE ₂ O ₃)	Y	Y	Y
2,4-Toluene Diisocyanate (TDI)	N	N	Y

3.2 Iraqi Composite Solid-Propellant Infrastructure

To support its solid-propellant program, Iraq constructed, rebuilt, or repaired equipment and facilities destroyed by UNSCOM or Coalition forces. The Iraqi effort was relatively successful at indigenous production, although some key materials still had to be imported. The Iraqi composite solid-propellant capabilities were centered initially in the Al Kindi General Company and the Al Rashid General Company. Due to the lack of involvement with ballistic missile developments, Al Kindi and its associated facilities will not be discussed in detail in this document.

The Al Rashid General Company (see Figure 13) controlled most if not all of the major solid-propellant missile initiatives and the related production facilities.

The Al Fat’h Company functioned primarily in a design, project management, and oversight role for the Al Fat’h missile. Headquartered in the Al ‘Amiriyah section of Baghdad, the company was founded in 1996 at Ibn-al-Haytham and moved to Al ‘Amiriyah in the late 1990’s.

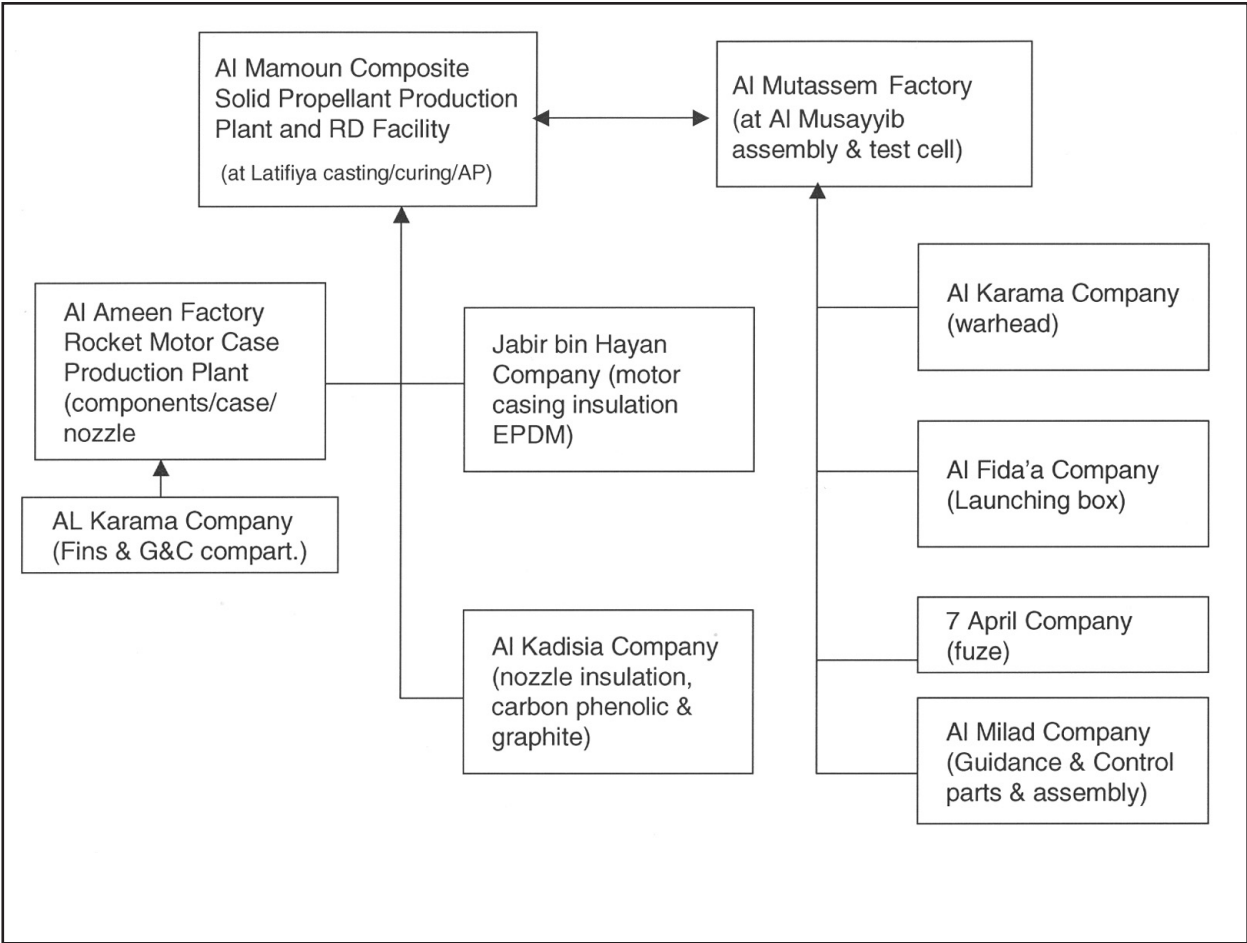


Figure 13. Al Rashid organizational structure.

Within the Al Rashid State Company, the Al Ma'mun Factory was the center of composite solid-propellant research and production. Within the complex were facilities for composite propellant mixing, casting and curing. In addition, R&D efforts in the area of composite propellants were conducted.

The Al Musayyib Solid Rocket Motor Factory at Al Mutasim contained horizontal rocket motor test cells and motor assembly buildings. All of the known Al Rashid associate solid-propellant static tests were conducted at Al Musayyib.

The Al Amin Factory and Thu-al-Fiqar [Tho-al-Fekar] Factory produced motor casings and nozzles.

3.3 Al Fat'h Missile Technical Specifications

The Al Fat'h was originally intended to be produced in two variants, guided and unguided. The missile was a solid-propellant ballistic missile weighing approximately 1,200 kg with an overall length of approximately 6.7 m and a diameter of 0.5 m for the main body and 1.4 m with the aft fin assembly. During the development of the system, large inaccuracies in the unguided variant were encountered. All the Al Fat'h missiles recovered to date are unguided. The Al Fat'h was designed to be launched from a Transporter-Erector-Launcher (TEL) based upon the Volga (SA-2) missile launcher. The composite propellants utilized in the Al Fat'h are "conventional," being a general

formulation widely used throughout the industry. The propellant is based on a Hydroxyl Terminated Poly Butadiene (HTPB) binder heavily loaded with Ammonium Perchlorate (AP) and aluminum powder. In addition to these main chemicals, a number of other chemicals are used, such as plasticizer, burning rate modifiers, and curing agents.

3.4 Al Fat'h Missile Manufacturing Difficulties

There were apparently three aspects of the Al Fat'h manufacturing process that presented the Iraqis with significant challenges. **The first was the unavailability of maraging steel sheets of sufficient size.** Maraging steel has the advantage of being easy to form in its original state, but when annealed, to provide excellent properties as far as rigidity, strength, and crack resistance. Without maraging steel, the Al Fat'h had to be constructed from 30CrMoV9 sheet steel. Forming this sheet steel into the cylindrical shapes needed for the rocket motor casing and airframe was difficult and created problems.

A second manufacturing issue in the construction of the Al Fat'h was the lack of large propellant mixing capabilities. The original 1,200-liter (300 gallon) propellant mixers acquired through the BADR-2000 program were destroyed by the UN. Although at least two of the bowls and one or both mixers were restored by Iraq, these were in turn destroyed by the Iraqis prior to the return of the UN in 2002 and hidden. Either way, the equipment was unavailable for use in the propellant mixing for the Al Fat'h rocket motor. The Al Fat'h contained approximately 830 kg of propellant. While the BADR-2000 bowls would have provided the capability of easily filling the Al Fat'h motor in a single pour, the lack of these bowls forced the Iraqis to use four or five smaller 120-liter (30 gallon) bowls. These bowls,

were then poured sequentially into the motor casing. A senior Iraqi official stated the process worked well but admitted that one out of every 10 motors exploded during motor burn. In addition, this process also eliminated the possibility of multiple simultaneous motor castings.

The final major manufacturing issue was the inability to completely indigenously manufacture the G&C system for the Al Fat'h. The Al Fat'h was intended to use a strap-down inertial guidance system. A highly accurate strap-down system with digital flight computer, coupled with an adequate canard terminal guidance system, would most likely have provided the Al Fat'h with an accuracy that met the specified 150 m CEP accuracy for the guided variant at a range of 150 km. This level of accuracy, coupled especially with the submunition warhead, would have made the Al Fat'h a more accurate and lethal tactical weapon system.

3.5 Al Fat'h Missile Program Organization

As previously mentioned, while the Al Fat'h General Company was responsible for design and program management aspects of the Al Fat'h program, the Al Rashid General Company was primarily the manufacturer. The Al Rashid General Company utilized a variety of subordinate companies and contracted sources in the manufacturing process. The general organization of Al Rashid is presented in Figure 14 below.

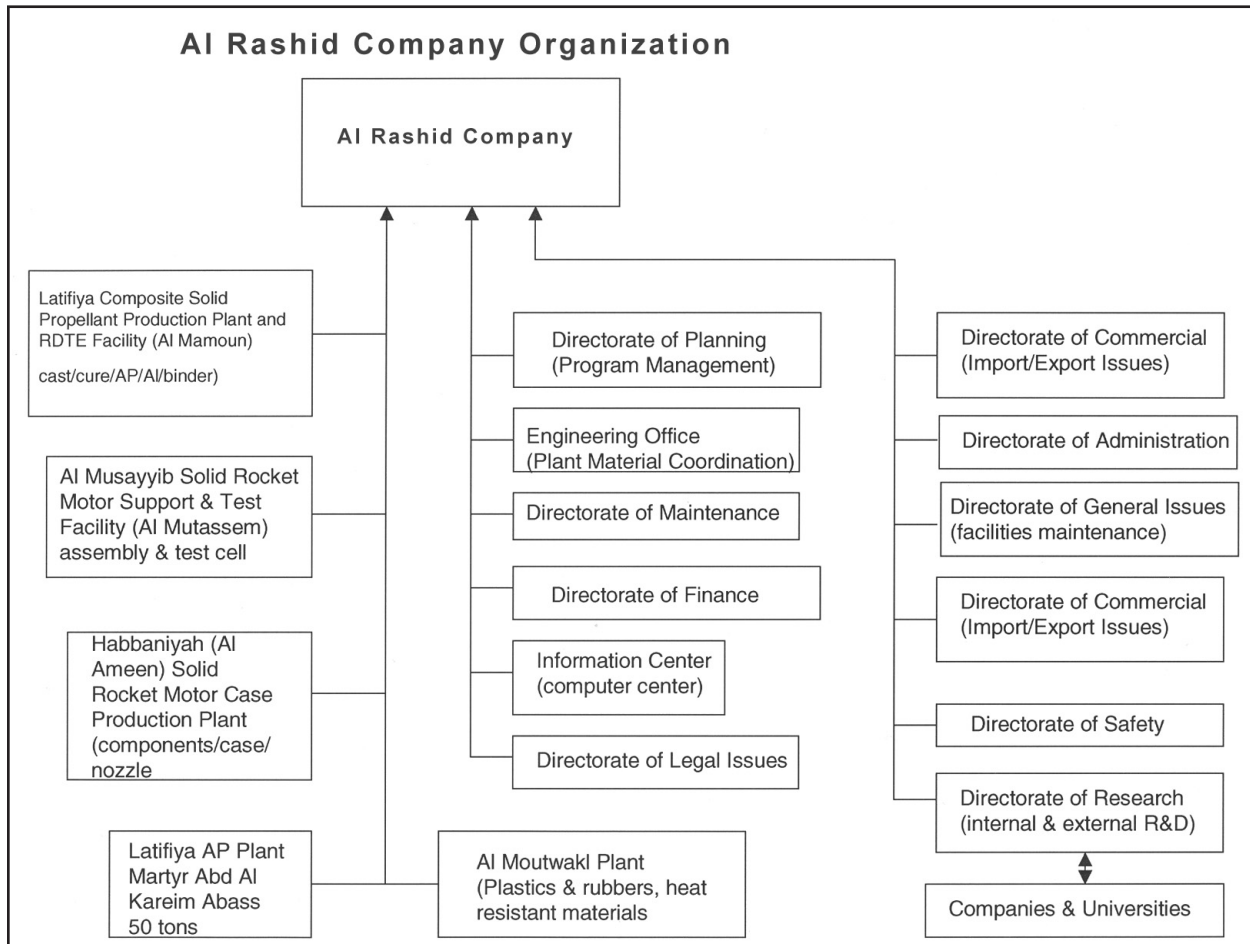


Figure 14. Al Rashid structure.

Within the Al Rashid Company, the Al Ma'mun Composite Solid-Propellant Plant at Latifiyyah was the center of composite solid-propellant research and production. Within the complex were facilities for composite propellant mixing, casting, and curing. Motors for existing systems, like the LUNA-M, were reengineered with composite propellant. Motors for new systems, like the Al Fat'h, were also assembled and inspected here. In addition, research and development efforts in the area of composite propellants were conducted at both Ma'mun and Al Kindi.

The Al Musayyib Solid Rocket Motor Support and Test Facility at Al Mutasim contained horizontal rocket motor test cells and motor assembly buildings. All of the Al Rashid associated solid-propellant static tests were conducted at Al Musayyib.

The Al Amin Solid Rocket Motor Case Production Plant at Habbaniyah produced motor casings and nozzles and undertook hydrostatic testing of the motor case. Figure 15 shows an Al-Fat'h motor nozzle.



Figure 15. Al Fat'h rocket motor nozzle.

3.6 Al Fat'h Test Launches

ISG has compiled data concerning flight tests for the Al Fat'h missile from various sources shown in Figure 16 .

Al Fat'h Flight Test Launches								
B. Count	Missile No.	Motor No.	Action	Date	Range (km)	Lateral Dev. (km)	Results	Purpose
1	F6		TEST FLT 1	9/1/2000	4	?	F	Motor Perform.
2	F8		TEST FLT 2	10/23/2000	83.4	?	S	Motor Perform.
3	F9		TEST FLT 3	11/18/2001	118??	?	S	to confirm last test (2000???)
4	F??		TEST FLT 4	3/17/2001	117.7	11.5R	S	Motor Perform.
5	F12		TEST FLT 5	3/27/2001	133	10L	S	Motor Perform.
6	F13		TEST FLT 6	4/29/2001	88	34°	F	PRELIM TEST R-40 CONTROLS
7	F14		TEST FLT 7	9/30/2001	7	n/a	F	PRELIM TEST R-40 CONTROLS
8	F17		TEST FLT 8	8/8/2001	161	13.5R	S	Rocket Perform. & Range
9	F18		TEST FLT 9	8/8/2001	6	n/a	F	1st spin mtr test
10	F19		TEST FLT 10	8/22/2001	7	n/a	F	perform. using frontal fins
11	F20		TEST FLT 11	9/6/2001	103	n/a	P.S.	perform. & range with spin motor
12	F21		TEST FLT 12	11/3/2001	90	n/a	P.S.	perform. & range with spin motor
13	F22		TEST FLT 15	12/5/2001	103	20L	S	perform. & range with spin motor
14	F23		TEST FLT 13	11/22/2001	134	13°	S	perform. & range
15	F24		TEST FLT 14	12/5/2001	160.5	13R	S	perform. & range
16	F25		TEST FLT 16	12/5/2001	???	50+	P.S.	perform. & range
17	F26		TEST FLT 17	?????	158	2.4L	S	perform. & range
18	F37	M24	TEST FLT 18	1/26/2002	151	4.2	S	perform. & range
19	F39	M24	TEST FLT 19	3/14/2002	143	?	P.S.	1ST CLUSTER WARHEAD TEST
20	F43		TEST FLT 32	11/25/2002	131	4.4L	S	approval of cluster warhead
21	F46	M55	TEST FLT 20	4/22/2002	147	8°	S	testing warhead fuze
22	F59		TEST FLT 21	9/6/2002	ukn	ukn	F	accuracy & range
23	F60		TEST FLT 22	9/6/2002	ukn	ukn	F	accuracy & range
24	F67	M71	TEST FLT 23	7/22/2002	145	8R	S	accuracy & range
25	F70		TEST FLT 27	9/30/2002	158.2	6R	S	accuracy & range
26	F74	M80	TEST FLT 26	8/24/2002	151.1	13R	S	accuracy & range & warhead
27	F75	M78	TEST FLT 24	8/18/2002	4	n/a	F	accuracy & range & warhead
28	F76	M90	TEST FLT 25	8/22/2002	145	15L	S	accuracy & range
29	F78*	M87	TEST FLT 31	8/22/2002	151.1	ukn	S	approval of rocket
30	F79		TEST FLT 28	9/30/2002	154.4	6.3R	S	accuracy & range
31	F80		TEST FLT 29	9/30/2002	114.6	n/a	F	accuracy & range
32	F84	M90	TEST FLT 30	10/28/2002	147	ukn	S	approval of rocket

Note 1: Apparent transition of date, 9 June or 6 September.

Figure 16. Iraqi accounting of Al Fat'h missile testing.

This page intentionally left blank.

Annex D People

Ra'ad and Muzhir

Beginning before the 1990s, the changes in career of two people, Maj. Gen. Ra'ad Jasim Isma'il Al Adhami and Brig. Gen. Dr. Muzhir Saba' Sadiq al-Tamimi, have been cloaked in mystique and intrigue. They have competed for supremacy on many occasions, one often replacing the other in key technical positions in the Iraqi ballistic missile program after undercutting the others efforts. Dissecting the plot tells much about the relationships within the Iraqi hierarchy and the strong family and religious ties that directly affected the outcome of the efforts to build a successful ballistic missile program.

The first clash came when Muzhir is directed by Husayn Kamil (HK) to review the Rafidiyan project (a conversion of the SA-2 surface-to-air missile to a surface-to-surface role). The report is critical and the project canceled. Ra'ad was fired, and, as a result, Muzhir took control of the responsible establishment, Al Karamah. Ra'ad spent his time fruitlessly at MIC, later supporting the National Monitoring Directorate (NMD) in its role as the Iraqi counterpart of UNSCOM.

With support from Dr Hamid Khalilal-Assawi, Ra'ad designed a 500-mm-diameter missile, which they claimed could maintain Iraq's missile liquid-propellant expertise and infrastructure whilst remaining within the 150-km-range limitation imposed by UNSCR 687. A presentation to HK was successful, and Ra'ad was reinstated as Head of Al-Karamah. Muzhir, being retained as Head of Ibn al Haytham, proposed a competitive design at a 750-mm diameter, which is soon banned by UNSCOM as being too difficult to monitor and capable of being fitted with 2 SA-2 type engines. Undaunted, Muzhir proposed a 600-mm design, which in late 1995 competed with Ra'ad's design in a design review competition. Ra'ad's design was successful, and Muzhir was forced to work on this project under Ra'ad.



Ra'ad Ismail Jasim Isma'il al-Adami (left) and Muzhir Sabah Sadiq al-Tamimi (right).

This situation did not last long as Muzhir was jailed for 25 months for allegedly importing gyros from Russia (an allegation vigorously denied). Ra'ad continued developing the Samud but could not achieve consistency or reliability.

One of Huwaysh' primary responsibilities when he became head of MIC was to successfully complete the development of the Al Samud ballistic missile. Soon after assuming control of MIC, in an attempt to fix the ballistic missile problems, Huwaysh worked to obtain Muzhir's release from jail. With Ra'ad showing little progress, Huwaysh, who had heard of Muzhir's past experience in this field, appealed to Saddam and obtained his release. Muzhir who on release, had begun working under Huwaysh at MIC, was tasked to review the Al Samud program—his report was unfavorable. After another failed test flight, Huwaysh fired Ra'ad in June 1999, replacing him with Muzhir. Ra'ad, along with Dr Hamid, was transferred to the MIC. Ra'ad spent the remainder of 1999 at MIC before Huwaysh transferred him to head up the Samarra Electronics Plant, the Salah al-Din State Company. On 15th June 2001, Huwaysh accedes to Muzhir's request to replace the 500-mm diameter Al Samud with a 760-mm design,

called the Al Samud II. The first experimental test flight of Al Samud II occurred on 18th August 2001, a surprisingly short time from go-ahead.

The first 10 Al Samud II ballistic missiles were delivered to the Iraqi Army in December 2001.

Drawing dates (August 2000) on designs for a longer range liquid-propellant ballistic missile, both 2- and 5- engine cluster types, suggest that, by OIF, Muzhir might have been well along the road to developing these systems. However, no evidence has been found by ISG that suggests that a development program was instigated.
