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# Office of Intelligence Technical Intelligence Note

TIN000108

September 13, 2002

## Iraq: Recent Aluminum Tube Procurement Efforts



### Scope Note

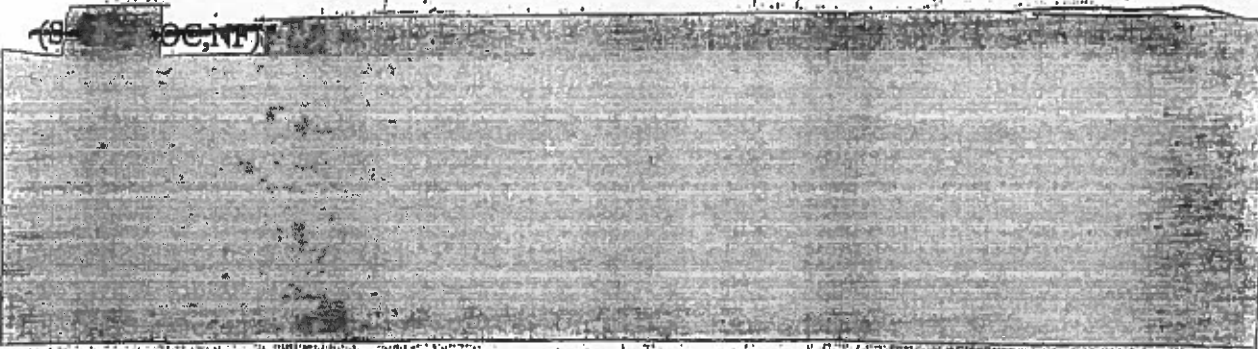
(S) ~~OC, NF~~ [Redacted] Saddam Hussein is seeking to reconstitute Iraq's nuclear weapons program. One such potential indicator is the aluminum tubes issue discussed in this paper. While we continue to assess that this acquisition effort probably is motivated by a conventional military rather than nuclear application, we judge that other indicators collectively do indicate intention to rejuvenate Iraq's nuclear weapons program.

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### Key Judgments

(S) ~~OC, NF~~ [Redacted] Iraq is continuing in its attempt to procure large numbers of seamless, 7075 T6 aluminum alloy tubes. These tubes could be modified for use as centrifuge rotors. However, technical experts at DOE and the National Laboratories believe other conventional military uses are more plausible. The tubes are very similar to those used by Iraq in the past to manufacture rocket casings, including the Nassr-81 rocket. In 1996, Iraq declared to the UN and the IAEA an in-country stockpile of over 65,000 such 7075-T6 aluminum alloy tubes. Regardless of their end use, any Iraqi inventories of such tubes (including new acquisitions) are required to be declared and subjected to UN/IAEA monitoring under the terms of existing UN Security Council resolutions.

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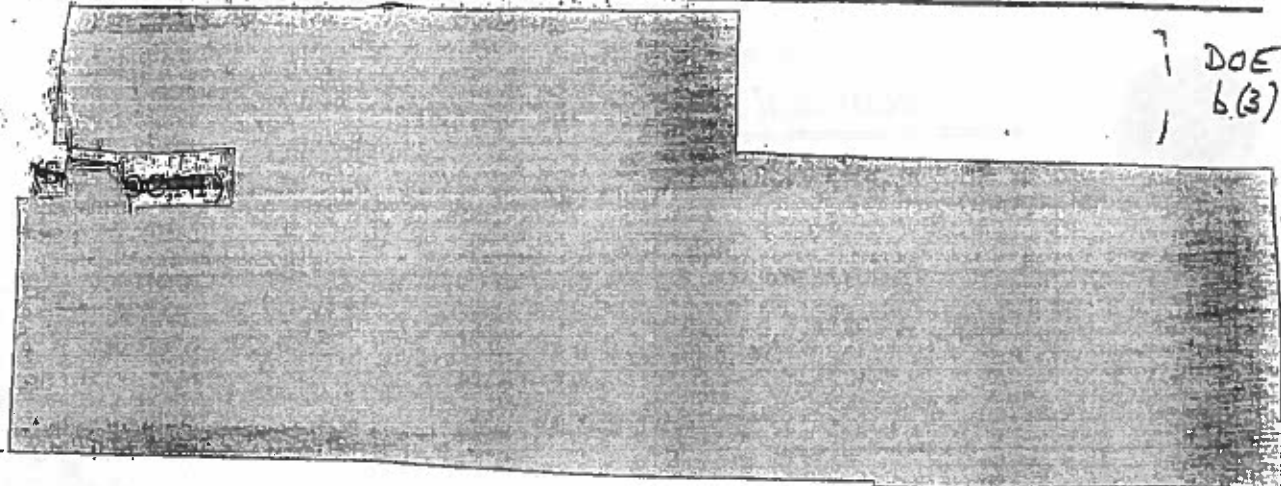
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Authors: [Redacted]  
DOE/IN POC: [Redacted]

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Comments and queries are welcome and may be addressed to DOE, Office of Intelligence

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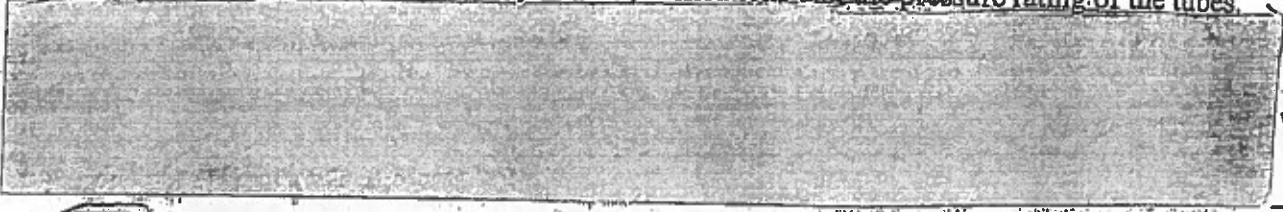
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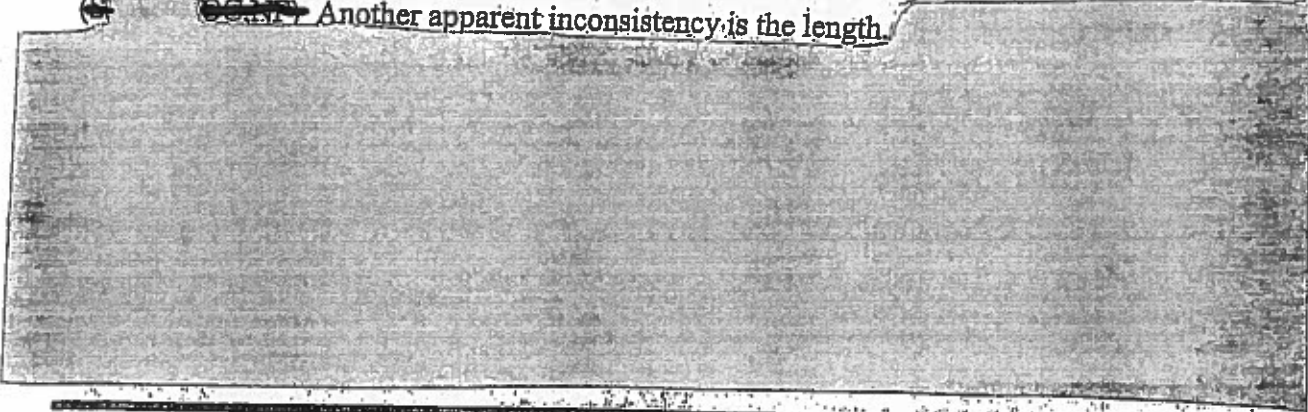
(S) ~~OC,NF~~ Our centrifuge experts note that the tubes' specifications and the number of tubes do not match what we would expect to see for centrifuge rotors as we understand them. One possibility is that Iraq could modify these tubes, or some portion of the tubes, to make centrifuge rotors. The other is that the tubes are intended for some other specialized military application. Because we observe that the characteristics of these attempted orders align more closely with a rocket motor casings application, DOE and the National Laboratories assess that this is the more likely intended end use.

(S) ~~OC,NF~~ More specifically, several technical aspects of the tubes and their handling seem inconsistent with a gas centrifuge application. First is the reported pressure-testing of the tubes. Materials intended for use in high-speed rotational equipment, such as centrifuges, would typically be subjected to a battery of tests, such as spin testing, to determine ultimate tensile strength, yield strength, metallurgical flaws, and balance. The tests conducted by Iraq have focused on the dimensional conformity to the specifications and the pressure rating of the tubes.



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(S) ~~OC,NF~~ Another apparent inconsistency is the length



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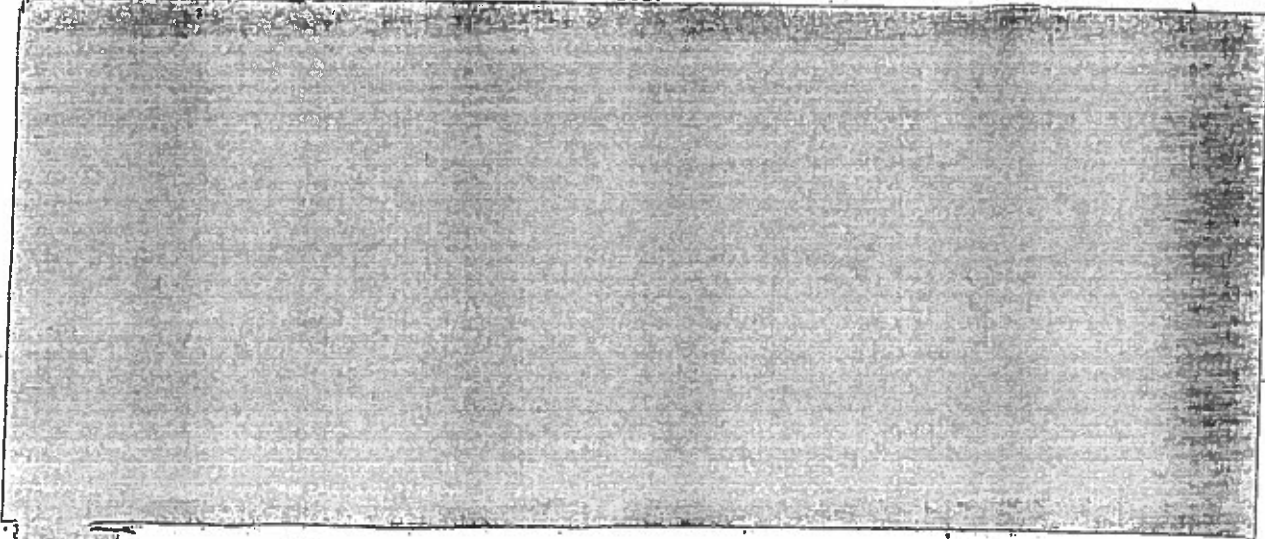
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~~(S//NF)~~ In contrast, the dimensions of the tubes are consistent with applications to rocket motors previously declared by Iraq. According to research by DOE and National Laboratory technical analysts, many conventional rocket motors are approximately 80-85 mm in outer diameter, 900 mm in length, and are composed of high-strength aluminum alloys.

- o ~~(S//NF)~~ The Nassr-81 is made at Nassr State Establishment. Iraq has manufactured large numbers of these 81-mm rockets since the 1980s. When inspected by the IAEA in 1996, the Iraqis had sixty-six thousand four hundred and thirty-seven 7075 T6 aluminum tubes with the same dimensions as the tubes originally sought by Iraq last year. IAEA inspectors reportedly reviewed this case and determined that the factory was indeed producing rockets for the Nassr-81. This 81-mm rocket was declared by Iraq in its 1996 "Full, Final, and Complete Disclosure" on missiles to the UN following the Gulf war.
- o ~~(S//NF)~~ These procurements are being conducted at a security level consistent with much of Iraq's military and industrial procurement activities, and not at a level that we would expect for WMD procurements.

~~(S//NF)~~ Furthermore, the reported pressures, stresses, and method of testing are consistent with rocket motor testing. Unlike centrifuges, which develop their stresses from the high speed of rotation, solid-fuel rocket motors develop stresses from internal pressure, and hydrostatic testing is typical for rocket motor cases.



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~~(S//NF)~~ Several other features of the latest reporting also appear to track with an intended use in solid-fuel rocket motor cases.

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- o ~~(S//NF)~~ The tube wall thickness. The tube wall's thickness does not correspond with what we would expect to see in centrifuge designs — except possibly a Beams-type centrifuge — it is too thick for the design we assess that Iraq is most likely to be pursuing today, the Zippe design.



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Although Iraq has experimented with a Beams-type design in the past, it abandoned that design in favor of the Zippe design. The significantly

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thicker tube wall substantially increases the mass of the assembled rotor, with attendant undesirable increases in the load on the bottom bearing and damping system.

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o (S) [redacted] OC,NE) *Balancing of the tubes.* The fact that Iraq appeared more interested in the pressure rating of the tubes than the ultimate balance of tubes suggests that the end use may not be a centrifuge rotor.

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o (S) [redacted] OC,NE) *Surface finish of the tubes.* Tube samples obtained purportedly were anodized on the outside rather than the inside. We assess that the requirement for anodization is not necessary — and is even problematic — for centrifuges. Bare aluminum is resistant to UF<sub>6</sub> and anodization is unnecessary for corrosion resistance, either for the aluminum rotors or for the thousands of feet of aluminum piping in a centrifuge facility. Instead, anodization would likely introduce uncertainties into the design that would need to be resolved before a centrifuge could be operated. In contrast, anodization is a standard practice in missile construction in order to preclude galling of aluminum parts as they pass each other during launch.

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