

General Disclaimer

One or more of the Following Statements may affect this Document

- This document has been reproduced from the best copy furnished by the organizational source. It is being released in the interest of making available as much information as possible.
- This document may contain data, which exceeds the sheet parameters. It was furnished in this condition by the organizational source and is the best copy available.
- This document may contain tone-on-tone or color graphs, charts and/or pictures, which have been reproduced in black and white.
- This document is paginated as submitted by the original source.
- Portions of this document are not fully legible due to the historical nature of some of the material. However, it is the best reproduction available from the original submission.

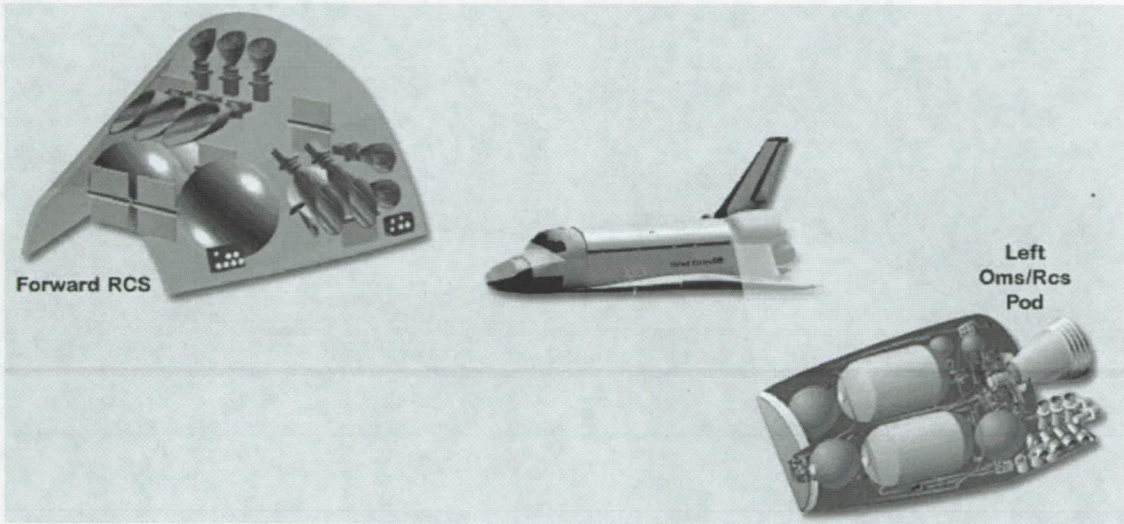
Reaction Control Systems (RCS)

Copyright © 2008 by United Space Alliance, LLC. These materials are sponsored by the National Aeronautics and Space Administration under Contract NAS9-20000 and Contract NNJ06VA01C. The U.S. Government retains a paid-up, nonexclusive, irrevocable worldwide license in such materials to reproduce, prepare, derivative works, distribute copies to the public, and perform publicly and display publicly, by or on behalf of the U.S. Government. All other rights are reserved by the copyright owner.

What is RCS?

- ❖ **Provides the thrust on the space shuttle for:**
 - **Attitude maneuvers - pitch, yaw, and roll**
 - **Small velocity changes along the orbiter axis**
- ❖ **Comprised of three systems:**
 - **Forward RCS**
 - **Aft RCS (right and left)**

Locations of RCS

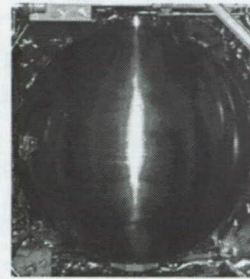


Reaction control systems are used for:

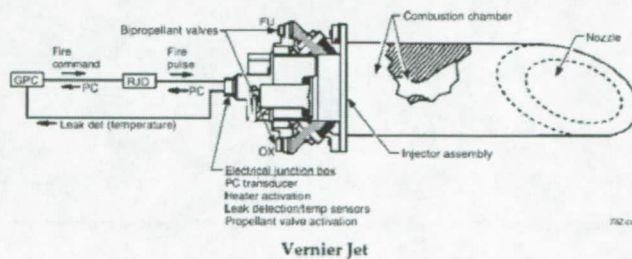
- ❖ **Attitude control during re-entry**
- ❖ **Station keeping in orbit**
- ❖ **Close maneuvering during docking procedures**
- ❖ **Control of orientation**
- ❖ **As a backup means of de-orbiting**

Each RCS System Consists of:

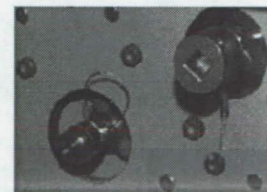
- ❖ High-pressure gaseous helium storage tanks
- ❖ Pressure regulation and relief systems
- ❖ A fuel tank (MMH)
- ❖ An oxidizer tank (N_2O_4)
- ❖ A distribution system
- ❖ Electrical heaters
- ❖ Thrusters



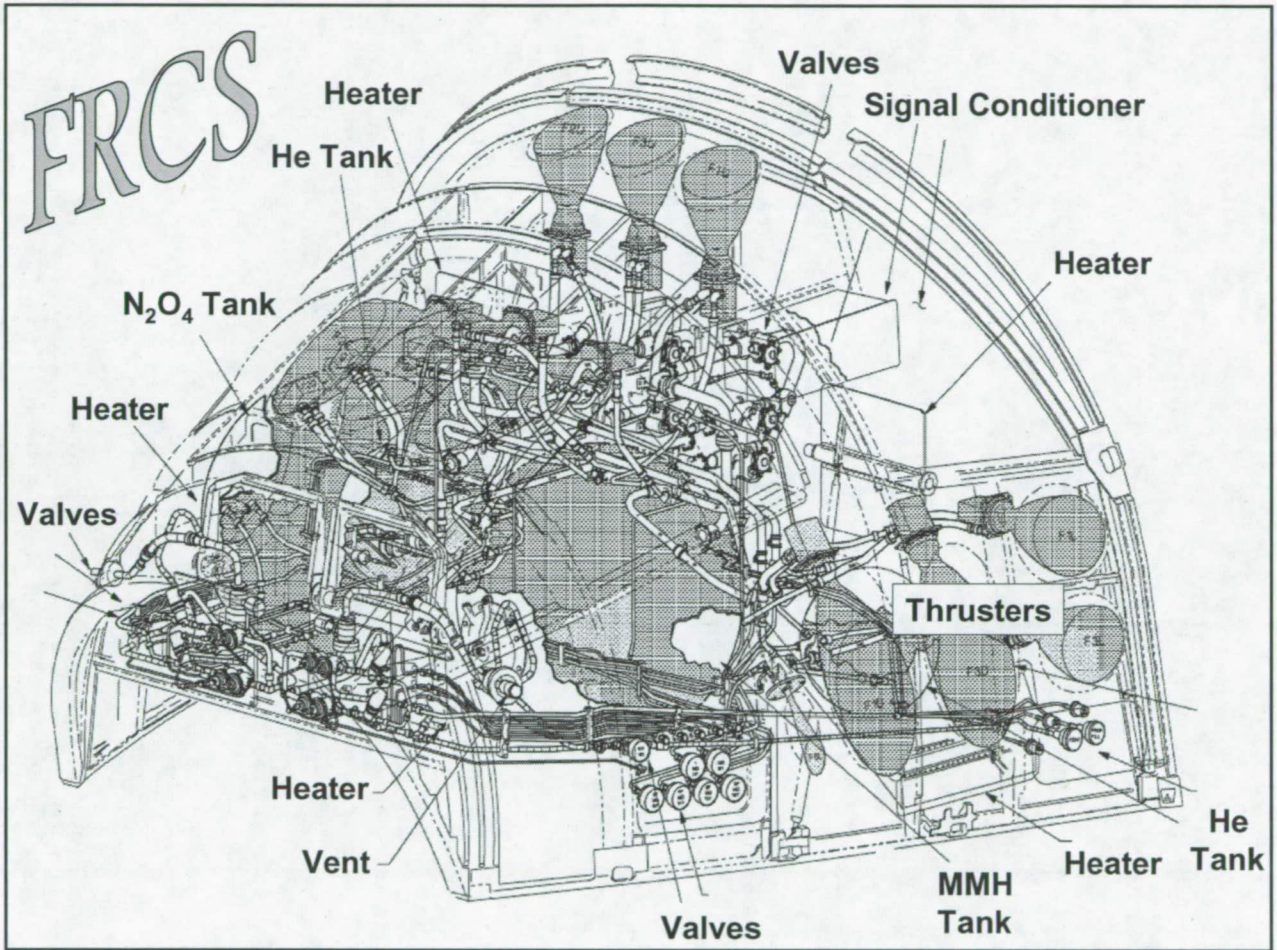
Oxidizer / Fuel Tank

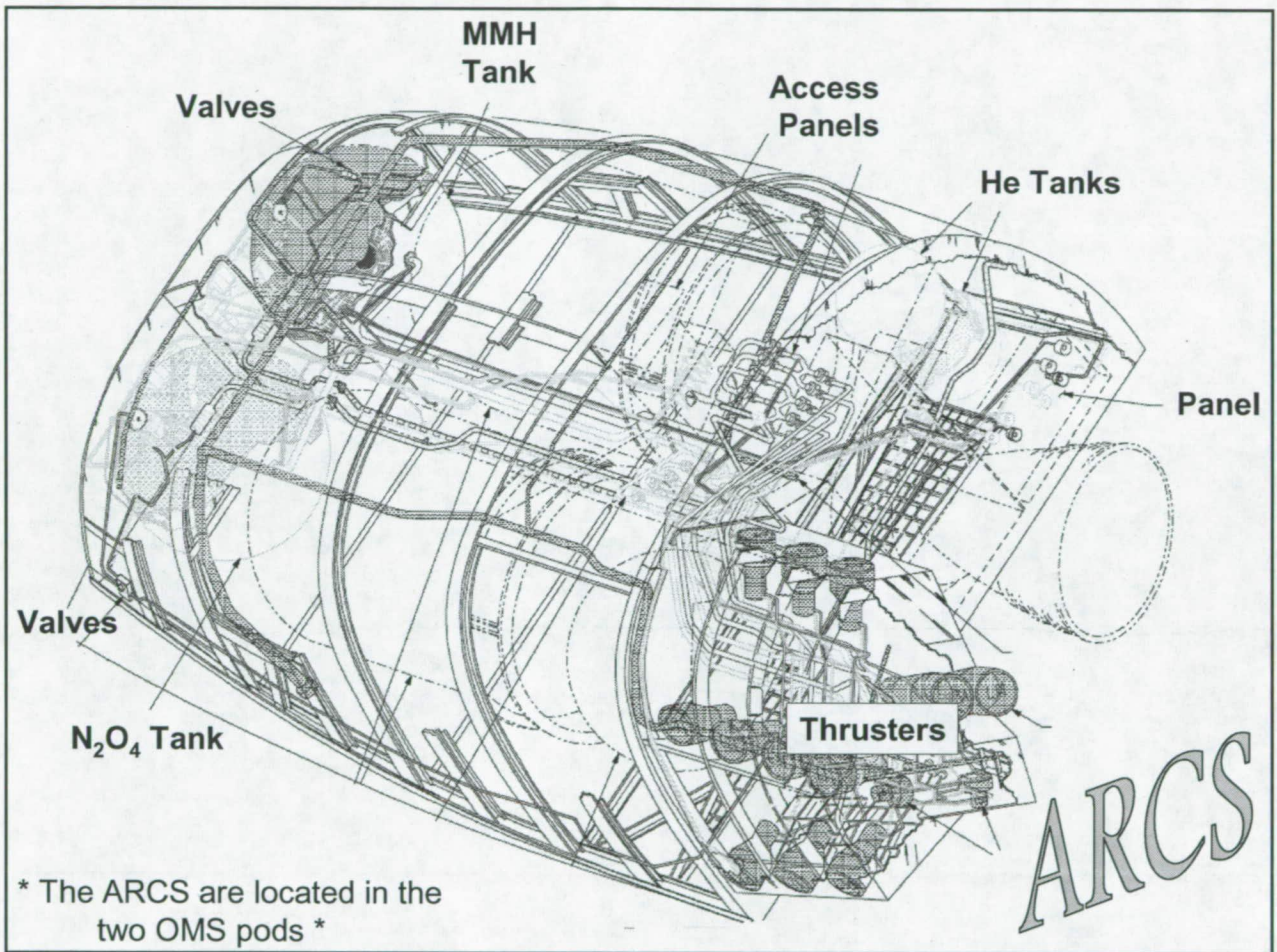


Iso Valve



Manual Valve



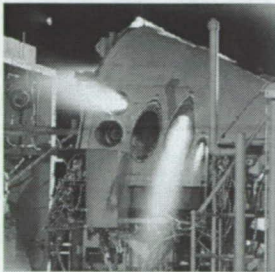


Distribution System

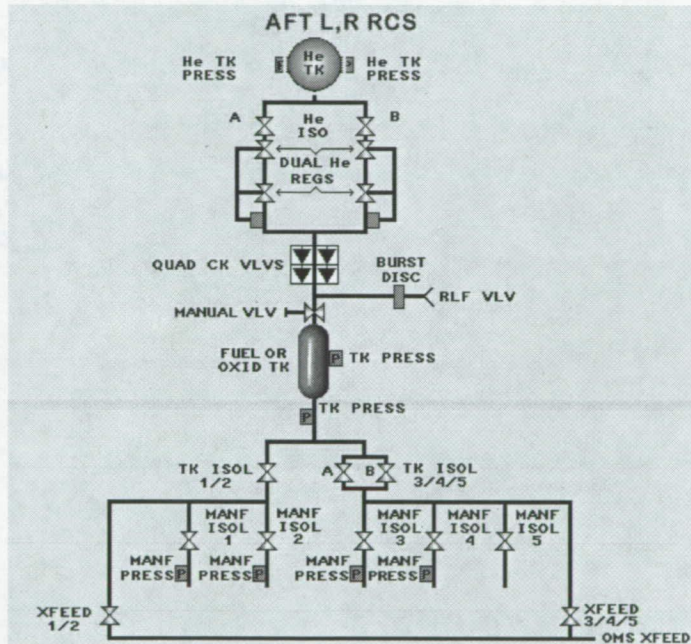
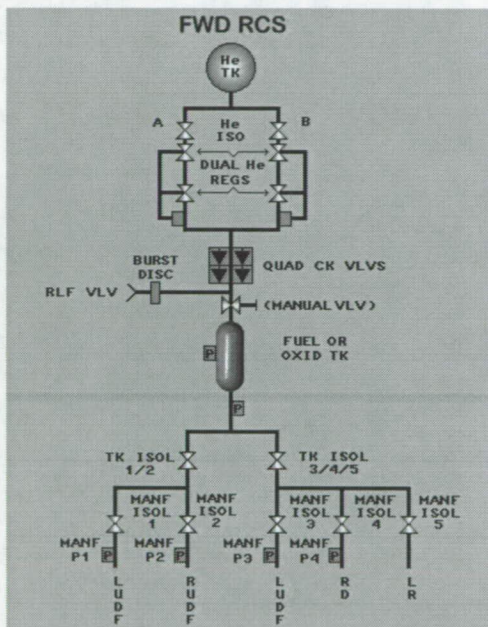
- ❖ Tank and manifold isolation valves, crossfeed valves, regulators, and distribution lines
- ❖ Valves open / close through pressure gradients
- ❖ Oxidizer and fuel are supplied under pressure to the RCS jet thrusters where they atomize, ignite, and produce a hot gas and thrust

Engine Specs

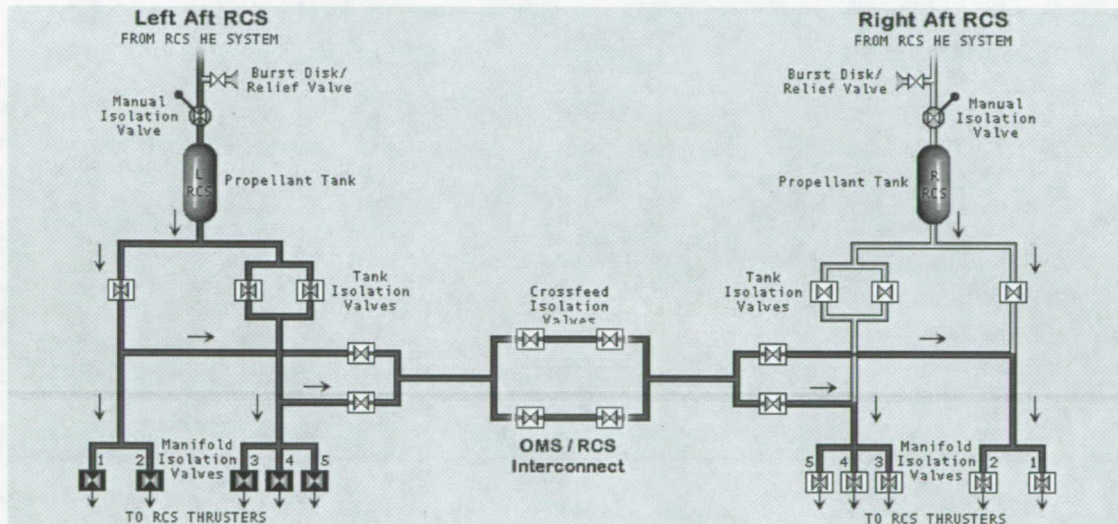
- ❖ Primary ~ 14 in FRCS and 12 in each ARCS pod
 - 870 lbs thrust each
- ❖ Vernier ~ 2 in FRCS and 2 in each ARCS pod
 - 24 lbs thrust each
- ❖ N_2O_4 to MMH ratio for each engine is 1.6 to 1



RCS Block Diagrams



RCS Block Diagrams cont.



References

- ❖ www.nasa.gov
- ❖ <http://science.ksc.nasa.gov>
- ❖ United Space Alliance

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

The public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports (0704-0188), 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.

PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS.

1. REPORT DATE (DD-MM-YYYY) 7/15/08		2. REPORT TYPE presentation UCF		3. DATES COVERED (From - To) 1996-2000	
4. TITLE AND SUBTITLE RCS				5a. CONTRACT NUMBER NNJ06VA01C	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S) Kristine Perniciaro				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) KSC				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) USA/NASA				10. SPONSORING/MONITOR'S ACRONYM(S)	
				11. SPONSORING/MONITORING REPORT NUMBER	
12. DISTRIBUTION/AVAILABILITY STATEMENT					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT This presentation explains how the reaction control system is incorporated into the shuttle and how it functions.					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT U	18. NUMBER OF PAGES 12	19b. NAME OF RESPONSIBLE PERSON Kristine Perniciaro
a. REPORT U	b. ABSTRACT U	c. THIS PAGE U			19b. TELEPHONE NUMBER (include area code) 321 861 6143