

Automated Gas Generator Disassembly FY1998 Accomplishments

The Automated Gas Generator Disassembly (AGGDIS) system is a robotic workcell which demilitarizes MC1362, MC1835 and MC3002 gas generators by disassembling them and removing the propellant and igniter. Manual disassembly of these gas generators is hazardous due to depletion of a stabilizer in the propellant; demilitarization by manual disassembly is not considered an option. Igniting the units is less hazardous than manual disassembly, but would include some potential for hazard and the resulting waste stream would be contaminated by lead and propellant residue.

As a result, the Pantex Plant and Sandia initiated a joint project in FY95 to develop a robotic workcell which automatically disassembles these gas generators. During FY98, the workcell disassembled the remaining stockpile of MC1362s, was converted for disassembly of MC1835s, and disassembled 185 MC1835 generators.

The required process steps are: remove the threaded locking ring, remove the closure disc, pour out the propellant, dislodge any remaining propellant, remove the threaded igniter, and place the igniter in a pallet. Required operations include aligning spanner and socket wrenches with components, unscrewing threaded components, pouring, and handling sensitive igniters. The workcell uses simple fixturing where appropriate; force sensing, force controlled motion, and computer vision are used to accommodate remaining variations in the process.



Figure 1: Components of an MC1362 Gas Generator.

The robot performs most of the handling processes, but cannot deliver the torque required for removal of threaded subcomponents. A powered socket, driven by a 1/3 hp electric motor via gear drive, was developed to provide up to 200 ft-lb of torque. The robot manipulates specialized wrenches which incorporate parallel jaw and vacuum grippers to grasp parts as they are removed. Motion of the robot and powered socket must be closely synchronized. A Programmable Logic Controller (PLC), in communication with the robot controller, performs this task.

The operator controls the system with a graphical push-button interface running under Windows on a PC. The PC communicates with the PLC and robot controller to direct the overall operations. The design allows control from a remote location, reducing personnel hazards. From the remote console, the operator uses two video cameras, one robot-mounted and one independent pan/tilt/zoom unit, to monitor the workcell operations. If necessary, the operator can halt or temporarily pause operations and can set a gas generator aside for further assessment. In the event of a processing error, the operator can safe the workcell by placing workpieces in temporary storage locations before entering the workcell.

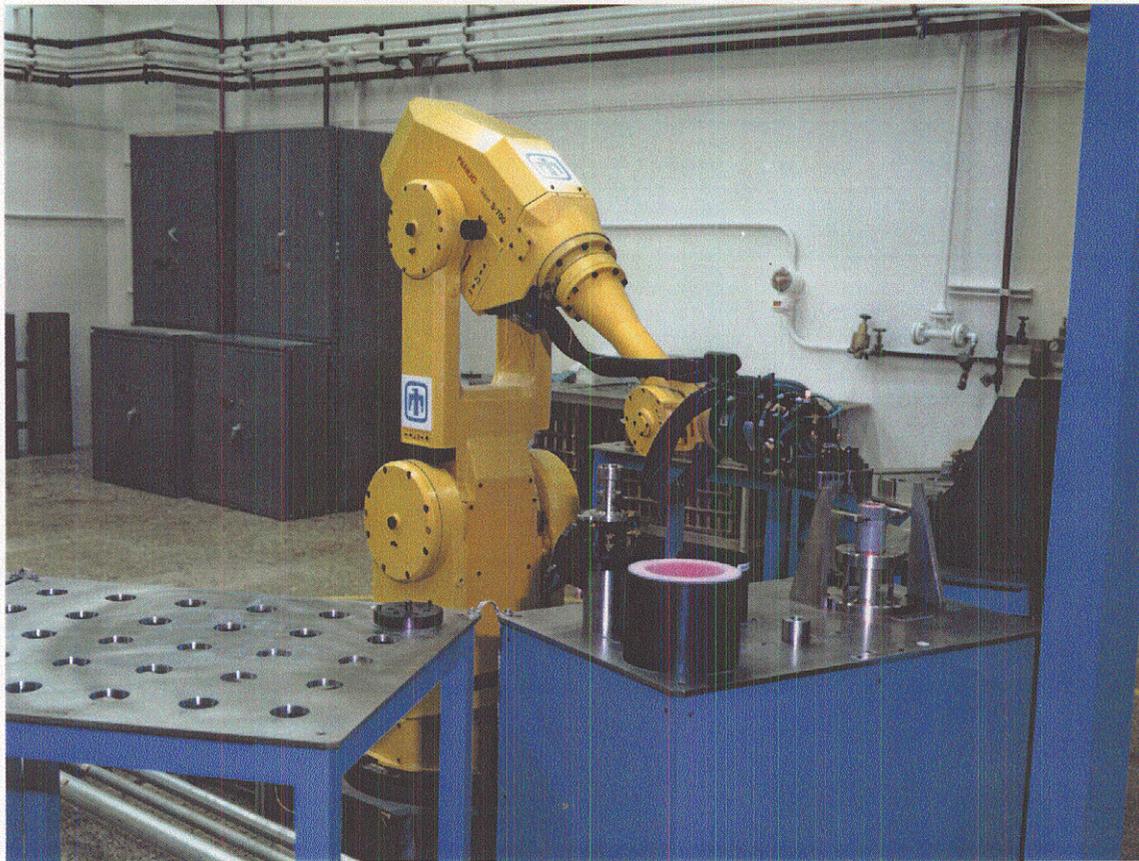


Figure 2: Workcell Overview.

AGGDIS performed its first disassembly of a live MC1362 gas generator in April 1997 at the Pantex Plant, and continued operations on these units through FY97. During FY98, the system disassembled about 800 MC1362s, completing the demilitarization of the stockpile of 1075 units without incident. One error in the system software was discovered and corrected. Before correction of the bug, the system could not always resume operations on a batch after suspension and shutdown (for example, during a lightning warning).

After completing disassembly of MC1362s, the system was converted for disassembly of MC1835s. Since these units have a larger case than the MC1362, alternative tooling had been fabricated as required during the development phase, including station tabletops and robot grippers. The MC1835 tooling is also compatible with operations on MC3002 generators. Pantex personnel swapped out the tooling, then Pantex and Sandia personnel worked together to update robot motion paths and check out the system. Since this was the first time in the project that a live MC1835 could be opened for examination, we expected some surprises. One surprise required some software modification: the igniter surfaces were in better condition, hence shinier, than those in the MC1362s. This required some modification of the computer vision routines which locate the igniter flats. The robot motion path and software updates were completed in three days. During FY98, 185 MC1835 gas generators were disassembled without incident.

For additional information, contact the Pantex Plant project leader, Jack Holy (JHOLY@pantex.com), or the Sandia project leader, Larry Ray (lpray@sandia.gov).



Figure 3: Pouring Out the Propellant.

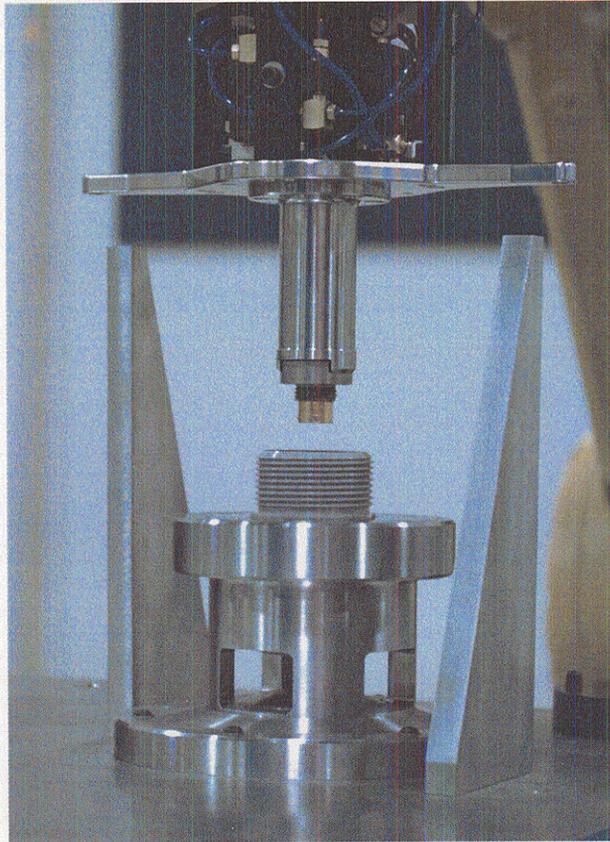


Figure 4: Removing the Igniter.