A search for solutions to generator problems

by lst Lt. David Conrad

In order for the Signal Corps to perform its mission, the communications-electronics (C-E) equipment in the field needs mobile power. For the last few years, however, there has been a growing dissatisfaction with the currently fielded power units. Therefore, it will be instructive to examine the problems which cause dissatisfaction, explore some possible solutions and discuss some steps to achieve the solutions.

First of all, let us look at power generation systems. There are four parts we must consider: the generator, which is the source of power; the power conditioner, which tailors the generator's output to meet voltage or frequency requirements; the power distribution system, which delivers the conditioned power to the load; and the environmental control systems, the heating and air-conditioning components. Though they are not generically part of a power system, the environmental control systems are the primary user of power in a C-E system and — as we shall see — could be supplied directly from a generator.

As we examine communications power requirements for the future, there is an increasing requirement based on an increase in communications for the extended battlefield. Also, we can see an increase in the vulnerability of mobile power units because of increased detection of noise and infrared signatures. Changes to meet this increased detection capability, such as the concept of distributed command posts, will increase the needs of signal units for power. So, what we can see in the future is the increasing importance of — and requirements for — mobile power. But there are problems. First, let's look at current shortcomings for our power units.

The current gasoline and diesel engine-driven generators have size and weight characteristics which handicap the tactical commander. The trailers on which the generators are mounted restrict the mobility and maneuverability of the prime mover. The generators themselves also pose a threat to a tactical unit because of the noise and infrared signatures. These signatures can be easily detected and this handicaps the performance of the communications mission.

Further, the current generators are inefficient fuel consumers and they are limited to a single fuel. In addition, as they get older and more worn, they are unable to produce the full rated output.

According to complaints from the field, design of generators now in the field has also caused problems: start-up is manual for the most part, frequent lubrication is required, engine vibration tends to shake the generator apart (component degradation), the lack of standardization makes maintenance difficult and problems with design components reduce reliability.

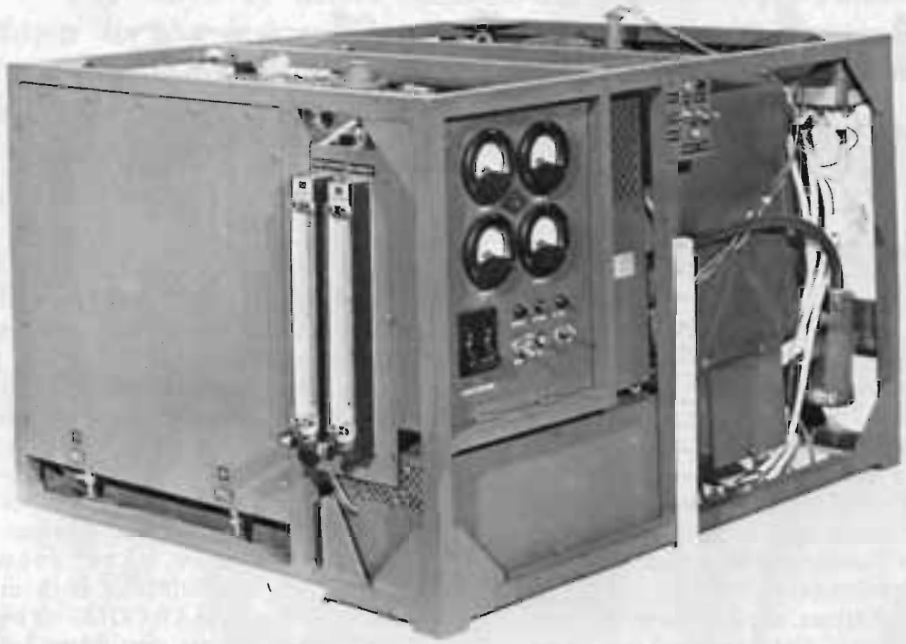
There are other problems including a shortage of quality repair parts (many of which are moving parts inside the generators and therefore complex to repair) and a maintenance staff overloaded with responsibilities. The 63B MOS, for example, is responsible for organizational level power generation equipment (200 KW or less gasoline and diesel engine-driven generators), vehicle maintenance and vehicle recovery. The 52C MOS is responsible for gas turbine generators, gas turbine equipment, and heating, air conditioning, refrigeration and high pressure air systems at all levels of maintenance. The 52D MOS is the direct support/general support level power generation mechanic (200 KW or less gasoline and diesel engine-driven generators). The overload, especially on the 63B, handicaps the tactical commander in his job of keeping all his generators operational.

Obviously our dissatisfaction with current systems of power generation is extensive and the problems complex. How then can we solve the problem?

The key is that we must establish a solid commitment aimed at solution. Thus far, efforts have been fractionalized and parochial, both in TRADOC and DARCOM. The necessary requirements documents for power generation development programs are not there, so no money is allocated for developing power generation systems. What happens is that we have been putting nickels and dimes into scattered projects or into a search for the absolutely "perfect" generator — instead of focusing on a coherent program. The result is that the new generator for the field is always a few years down the road.

In September 1980, TRADOC chartered the TRADOC System Manager for mobile electric power/environmental control equipment (TSM-Generator). The function of the TSM-Generator is to coordinate the various TRADOC schools' input and to interface with the DARCOM materiel developers. There were five goals established for the TSM-Generator: to determine the Army's needs for power; to determine what the Army has to supply power; to find short-range solutions to problems; to find long-range solutions to problems; and to determine if the solutions are affordable.

In May 1975, the Department of the Army approved the Silent Lightweight Electric Energy Program (SLEEP) Required Operational Capability (ROC) which called for the development of a new family of mobile tactical power generators with the power levels of 0.5 kilowatts (KW), 1.5



Two new technologies are currently being developed: one, the methanol fuel cell (above), uses hydrogen, produced from methanol, in an electrochemical reaction with air to produce electricity. The other, a thermoelectric generator uses the heat generated by burning any liquid fuel to produce an electric current. Both could be fielded by 1985-87. (US Army photographs)

KW, 3 KW, 5 KW and 10 KW. Currently we are examining two new technologies to fulfill the requirements of the SLEEP ROC. The first of these is the methanol fuel cell (MFC) being developed by the Mobility Equipment Research and Development Command (MERADCOM) at Fort Belvoir. The MFC uses hydrogen, produced from methanol, in an electrochemical reaction with air to produce electricity. The second technology — the thermoelectric generator (TEG) — is being developed by the Electronics Research and Development Command (ERADCOM) at Fort Monmouth. The TEG uses the heat generated by burning a fuel (any liquid fuel) to produce a temperature difference in a series of thermocouples, which produces an electric current. Both technologies could possibly be fielded by 1985-87.

Power conditioning and power distribution systems are also suffering from a lack of money for advanced development. Power conditioners have been developed which will condition for a specific voltage or frequency, but work is necessary to determine the numbers and types needed to meet all requirements. The necessary requirements documents for conditioning and distribution systems are being written, but it is unlikely that we will see anything fielded before 1988-1990.

Also being studied is the idea of getting electrical power, heating and/or air conditioning out of one package. This concept, called the Integrated Power and Environmental Control System (IPECS), uses the thermoelectric generator (TEG) as the power supplier. As a by-product, the TEG produces clean (non-toxic) hot air which can be used in cold weather to directly heat the shelter, or in hot weather to drive a heat-pump actuated air-conditioning unit to cool the shelter. This concept could lead to mounting the IPECS on the prime mover or shelter. We could recognize some savings from this development, such as a weight reduction for the prime mover since it wouldn't have to tow a generator trailer, and we would be able to eliminate the current heavy environmental control systems from the shelter and prime mover. It could also result in some fuel savings because the only power drain would be for C-E equipment which would mean a smaller size generator to power a shelter. The IPECS is being looked at for the 1986-90 time frame.

As we've already noted, maintenance on generators is hampered by an overload on the maintenance MOSs. To solve this, a change has been instituted to make the 52D MOS solely responsible for 200 KW and less engine-driven generators from organizational level through general support level. The 52B MOS would only maintain environmental systems and the 63B MOS would revert to wheel vehicle mechanic and vehicle recovery. These changes are being processed and, when approved, they will allow a commander to have mechanics dedicated solely to keeping his generators operational.

What do we do next? The people who work in combat developments depend on you, the user, providing us with input. We encourage comments, problems, suggested solutions or just questions. This input, funneled through the TSM-Generator, determines the future of our generator program.

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