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Mini-Mobile – the new generation outside broadcast vehicle

Summary

In recent years the advent of the high quality portable camera has led to the re-examination of outside broadcast vehicle design. A new requirement has developed for a small, versatile, cost effective vehicle able to make maximum use of modern portable camera techniques. The design and development of such a vehicle is followed in this article. The finished vehicle, fitted with two portable colour cameras and a full size quadruplex vtr and complete with inboard generator and full air conditioning facilities is described in detail.

Introduction

For many years the large and often luxurious mobile production unit, with its four or even six studio styled cameras, has been the heart of outside broadcasting, and mere mention of the word 'mobile' or the letters 'ob' brings into vision one of these veritable studios on wheels. Recent years however have seen the advent of the high quality portable or hand-held camera, with its technical quality equal to that of its studio counterpart, but of such small physical size and so flexible in use that it can get shots which would be impossible for a full size camera. Following logically on this capability, the first application which arises for this new generation of portable camera must be to supplement the larger cameras in the mobile production unit. Many broadcasters have found the advantages of just such an addition to their existing mobiles and are currently demanding that any new design of large ob vehicle must be suitable for operating with camera channels which have complete interchange capabilities between standard and portable camera heads.

Having established itself with directors as the ideal device for obtaining those difficult ob shots it is not long before the high-quality portable camera gets considered for further roles. Its true versatility begins to reveal itself in the way it can be applied to news and current affairs reporting, drama inserts and even small productions such as documentaries. It becomes obvious that a vehicle must be designed to match the versatility of this remarkable little camera. Such a vehicle is the Marconi Mini-Mobile, the design and production of which is described in this article.

Facilities needed

The first consideration in any vehicle design must be: what kind of programmes do we need to produce and

what facilities will this involve? Examination of the full range of capabilities which many producers and directors would want from a small ob vehicle soon reveals that the designers have an impossible task but this has not daunted them in other fields, so why should this one be an exception! By examining the most straightforward production application a basic list of facilities began to form:

- (a) Two colour cameras with simple selection into a vtr
- (b) vtr to match studio quality and format selected with full colour replay capabilities
- (c) Stable and reliable signal source – high quality synchronizing pulse generator (spg)
- (d) Audio facilities for simple mixing and commentary
- (e) Full monitoring and communication facilities
- (f) Live programme link facilities wherever possible.

Vehicle physical requirements

If the vehicle was to match the versatility of the portable camera and allow the facilities above to be used in the widest possible applications it followed that it must meet a fairly stringent set of physical requirements, namely:

- (a) Compact yet not claustrophobic
- (b) Self contained – autonomous
- (c) Rugged and able to go anywhere
- (d) Comfortable to drive and ride in
- (e) Air-conditioned/heated for maximum crew comfort and equipment stability.

Design development

Having determined the physical and facility requirements of the vehicle it remained only to translate these requirements into a final design and then build it. That is how the theory goes, but in practice it is the eternal chicken and egg situation; how can one prove that the design is correct until it is built, but on the other hand, who wants to build an incorrect design? To overcome this problem, the designers decided that, alongside the paper design, a space model mock-up would be built to test ideas and allow expert vehicle users to be consulted on the practicality of particular layouts under simulated operational conditions.

This exercise proved invaluable since it quickly determined, not only a physical feeling for the adequate provision of space, but also the possibility of developing more comprehensive facilities along the following typical lines:

- (a) Use two cameras with simple cut in blanking switching to the vtr to record inserts for editing at studio base
- (b) Add mixing and wiping to allow more flexibility and less editing
- (c) Provide incoming and outgoing video lines for direct inserts and replay
- (d) Provide direct outputs from both cameras to enable them to be used to support a larger vehicle or studio or to allow two small vehicles to be used together
- (e) Allow space for more complex link equipment for live transmissions, perhaps eventually with the vehicle in motion.

All of these requirements were quickly translated into equipment and tried in the space model. In parallel, the power consumptions were calculated, a vital exercise since it was clear that the vehicle would need to carry its own generator. Weights of all the necessary structure and equipment were finally calculated and the task of selecting a suitable vehicle chassis to meet the space requirements and weight loadings began.

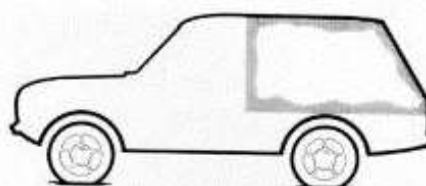
Selection of vehicle chassis

As an earlier design of vehicle had been executed on a Land Rover chassis, this was the first obvious unit to examine.

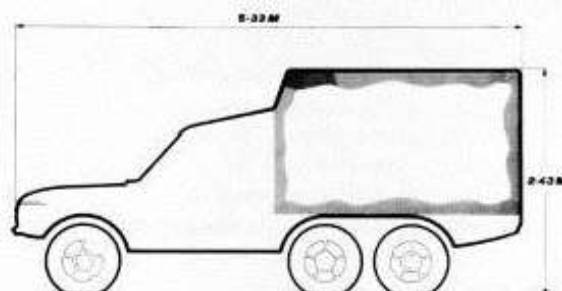
Unfortunately it quickly revealed itself as too small and lightweight for a practical design. The standard Range Rover with its longer wheelbase was also examined but it was clear that this provided very little body space. Even the specially extended Range Rover, used commonly for ambulance, fire engine and other such applications, could only offer limited body space within its overall length, because of the length of the engine and cab compartments. However, it was also clear that this extended Range Rover was the ideal overall length and width and provided many of the required driving features for a versatile ob vehicle, if only it could provide more space for ease and comfort of the operators. The roof line could be raised further but this still left the engine length unused. What was needed was a forward control type of vehicle.

This led to a specially built chassis which had come onto the market – the Stonefield 6 × 4. Not only was this forward control but with its special space-frame design, it could carry approximately 1½ times the payload of a conventional vehicle of the same unladen weight. With a raised roof level it provided all the space needed and yet retained an overall length of less than 5,4m and a width of just over 1,9m.

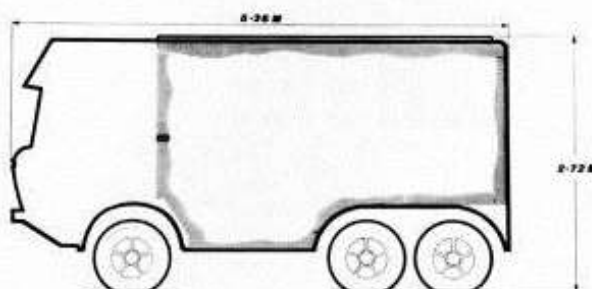
It was an ideal choice for a compact versatile ob vehicle as can be clearly seen from figure 1. Not only did it have the physical attributes outlined previously but it could be fitted with a 6-cylinder petrol engine developing 135 b.h.p and an automatic transmission system with four-wheel drive distributing power in the ratio $\frac{2}{3}$ to the rear wheels and $\frac{1}{3}$ to the front, including an automatic lock-up device which passes power to all wheels the moment one wheel loses surface adhesion.



STANDARD RANGE ROVER



EXTENDED RANGE ROVER



STONEFIELD



Figure 1. Chassis selection – space considerations

The design from the space model was transferred to this chassis, the space and loading calculations were checked and the final design was completed well within the capacity of the chassis. It now remained to build the first complete vehicle to this Mini-Mobile design and equip it with two Mark VIII portable cameras. This task was not to be undertaken lightly and the fact that the design proved successful at the first attempt owes much to the skill and experience of the builders. Thanks to the advice from the vehicle body constructors, chassis designers, ob engineers and operators, and prospective customers, the first of a new generation of ob vehicles emerged.

Final design - the Mini-Mobile

The vehicle, as can be seen from figure 2, is divided into three main sections, the driver's cab, the operational/production area and the generator and stowage area. The cab, with its access doors either side, provides positions for driver, commentator and forward camera

operator, working through a suitable roof hatch.

The operational/production area is reached through a single access door and provides operational accommodation for Producer/Vision Mixer, Vision Engineer and Sound Engineer/vtr Operator. Racks containing the majority of the electronic equipment are positioned at the rear of the operational area. These racks can be drawn forward on runners for maintenance purposes, access to the rear being gained through a small door in the side of the vehicle. On the front of these racks there are fitted two desks which house camera and vision mixer controls respectively. The sound mixer and vtr, a full size quad machine, are mounted at the front of the operational area, allowing the sound engineer to have full control over the vtr machine as well as performing his usual function of sound balancing. Alternatively the vision operator or producer may swivel in their chairs to operate the vtr.

The rear compartment of the vehicle at the lower level houses the petrol-driven electric generating set, with access doors at the rear for maintenance. The unit

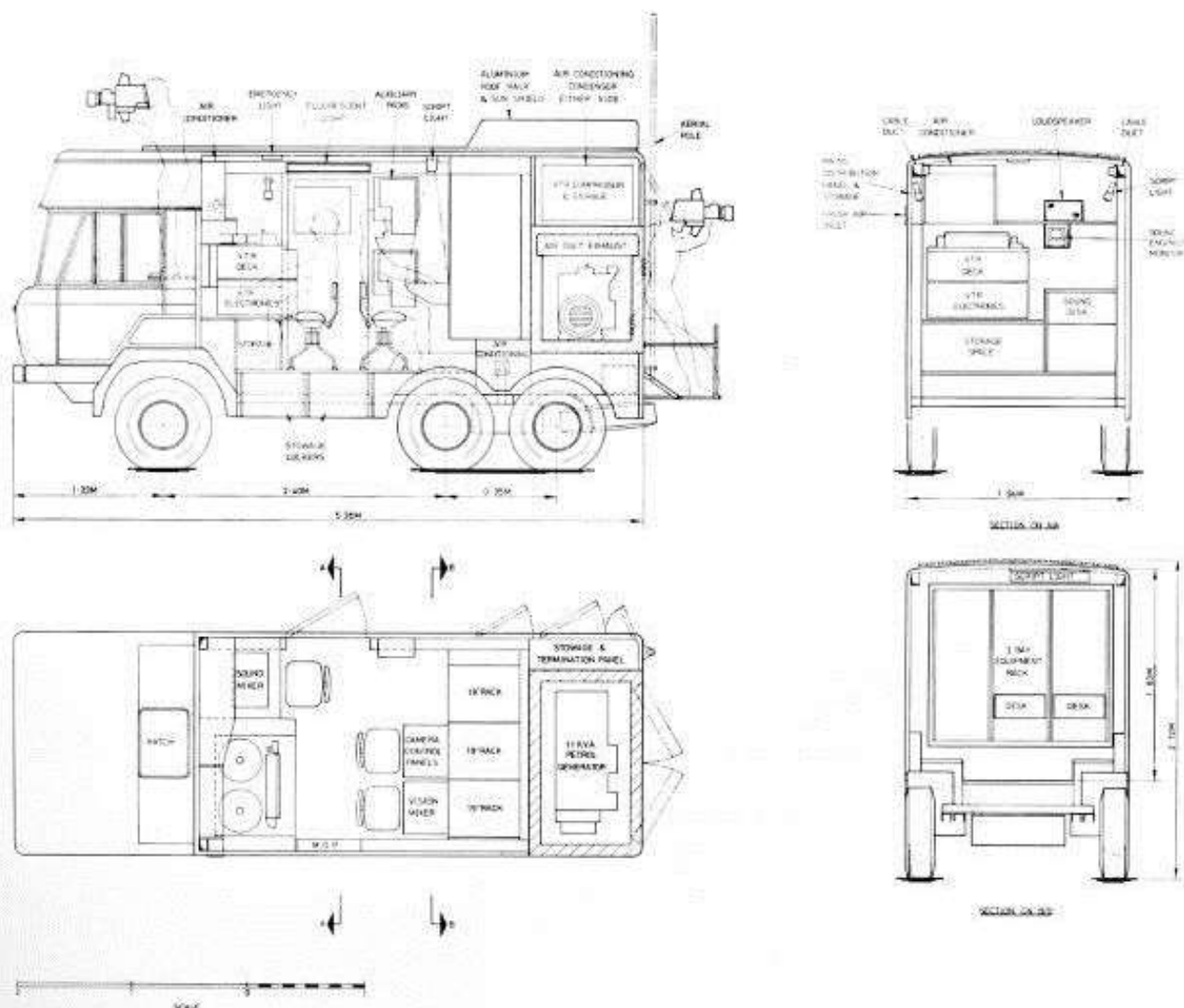


Figure 2. Mini-Mobile layout

is acoustically treated by the use of a sound absorbing compartment, exhaust attenuation and specially designed mountings. This ensures that generator noise inside the vehicle is less than 12dB above ambient.

The generator itself is rated at 12.5kW in free space at normal temperature and pressure (NTP) and provides all the power required for the electronic equipment, air conditioning and interior lighting with sufficient surplus under most conditions for limited external lighting or similar application. The generator is controlled remotely from a panel in the operational area of the vehicle. This panel provides metering of amps, volts and frequency together with a frequency adjust control, start and stop control and indicator lamps for low fuel, low oil pressure, high engine temperature, overload and overspeed. The whole vehicle may be operated from local single phase mains supply as an alternative to the generator.

The upper section of the rear compartment houses the vtr compressor and microwave link if required, together with two air conditioning units. These units will each provide 9000Btu of cooling so allowing the interior of the vehicle to be maintained at 25°C (78°F) with an external ambient of 35°C (95°F). One unit conditions the equipment racks whilst the second cools the operational area. This latter unit will also provide 2.7kW of heating to the operational area as required. The whole system is thermostatically controlled and operates on a recirculating principle with a 10% fresh air top-up.

The vehicle is fitted with two portable colour cameras, the camera control units being rack mounted with their operational and auxiliary control panels mounted horizontally in the vision control desk. The auxiliary packs for the portable cameras are conveni-

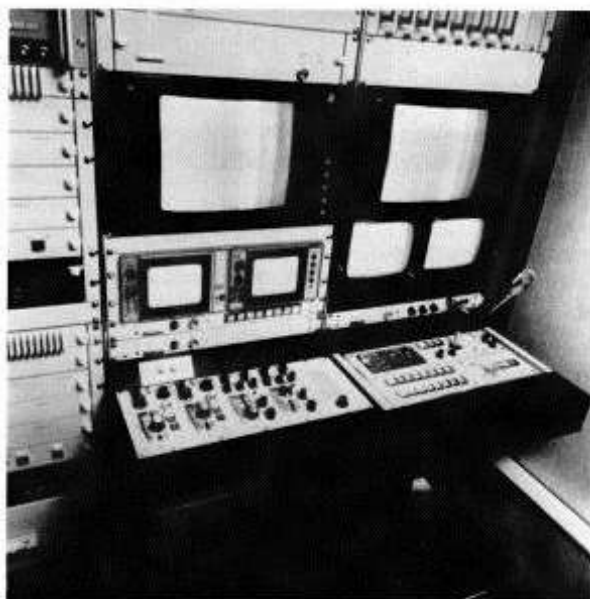


Figure 3. Mini-Mobile equipment racks and control positions

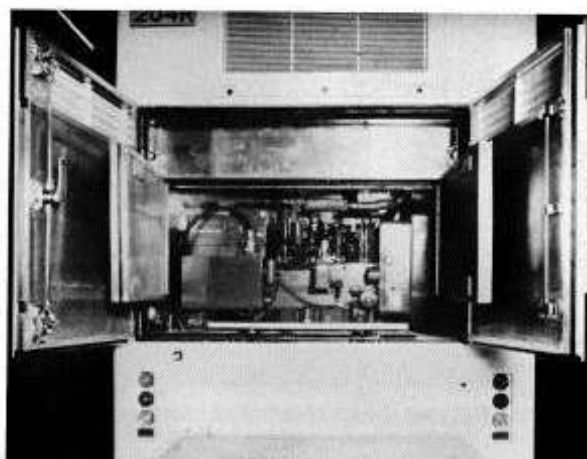


Figure 4. Mini-Mobile generator compartment

ently wall mounted just inside the door of the operational area. Cable ports are provided so that the vehicle may be operated in three modes:

- (1) Mobile with a camera through the hatch in the cab of the vehicle and a second cameraman on the rear platform
- (2) Static with the cameras at a distance from the vehicle determined by the maximum length of cable from the camera to the auxiliary pack inside the vehicle
- (3) Static with the camera and auxiliary pack outside and at maximum distance from the vehicle.

A simple eight input vision mixer provides the vehicle with fade, mix and wipe facilities if required, the transmission output being displayed on a 12-in colour monitor. A second 12-in colour monitor provides colour matching and preview set-up facilities whilst two monochrome monitors are connected permanently to the camera outputs. A waveform monitor and vectorscope are provided for the maintenance and line up of the equipment including the vtr, so ensuring that this latter item does not need to be provided with its own monitor bridge.

The vehicle has been designed to accept a wide range of vtr machines. These can be either helical scan or quadruplex and in some cases two machines may be accommodated. In all cases the vehicle can accommodate a single 2-in quadruplex studio quality machine with full colour replay facilities.

The audio facilities centre round a simple high quality mixer with a maximum of eight to 12 channels depending on the type. A high quality loudspeaker monitor is provided in the operational area of the vehicle, although headphones may be used if preferred. The second engineer's position is provided with sufficient space for a small audio tape recorder and a 5in picture monitor. A further similar monitor can be housed in the cab of the vehicle for use by a commentator if required. Direct inputs to the mixer for commentator or effects microphones are provided. All other microphone inputs are fed via the termination panel of



Figure 5. Mini-Mobile alongside standard ob vehicle

the vehicle together with all the video and communications inputs and outputs.

A full talkback system is provided for communications between the producer, cameraman, vision controller and commentator. In the operation and cab areas of the vehicle microphone and loudspeaker facilities may be used but these are muted when headsets are used. The commentator facilities in the cab of the vehicle may be transferred to an external position if required. Camera talkback facilities are provided individually for each camera to enable them to operate in a supporting role, with full communications, to an outside producer or director. A mobile radio system is provided to allow communications between the vehicle and a base station.

The vehicle is provided with a dual pulse generating system utilizing the latest digital techniques to ensure that excellent stability and reliability are achieved. In addition essential test signals are generated within the vehicle and space is provided for an off-air receiver.

Continuing development

Although the Mini-Mobile is described in the previous paragraphs as a specific design it is really, as was stated earlier, a new generation of vehicles. Already a design is under way for a Mini-Mobile which can operate in a mode nearer to film location techniques. This vehicle utilizes two portable cameras and two helical scan MRI recorders, together with monitoring and set-up facilities for these equipments. Its principle of operation is to record the output from each camera on a separate vtr, with the director working either inside the vehicle or actually out on the location scene if that suits his technique better. Sound is also recorded directly with each camera picture and the whole sequence is edited after

the return of the vehicle to its base. The advantage of such a method of operation is that on the spot playback can be used to check the location work but the vehicle is left simple as it does not need vision and sound mixing facilities. The space saved by using this technique can be utilized to incorporate vtr editing facilities if required.

A further design is available for a unit incorporating both studio and low power transmitter facilities. Yet another is under consideration for three cameras if only small enough directors and vision operators can be found, for it is not the vehicle or equipment which limits the flexibility of the Mini-Mobile it is the number of people needed to support the programme.

Conclusion

The quality and versatility of modern colour cameras continues to develop. As was shown in the introduction, ob vehicles need to keep pace with this development. By a careful process of design using a space-model and a thorough investigation of facilities and chassis characteristics it is believed that a vehicle has been evolved which can meet the needs of modern television ob techniques for drama inserts, sports and current affairs reporting and coverage of news features as well as operating in its own right for small productions or supporting a second vehicle. It is compact, rugged and versatile, providing more than half the features of a full sized ob vehicle yet in less than half the size. It really does fulfil its name of Mini-Mobile, a new generation of outside broadcast vehicles, which will continue to grow in application but not in size.

Acknowledgements

The author would like to acknowledge the contributions of all those people both within and outside Marconi Communication Systems Limited, without whom the Mini-Mobile and consequently this article could not have existed. Particular thanks are due to Messrs. J. Smith, B. E. Francis and E. Scales of the Installation Design Office, Mr. K. T. D. Hughes, Regional Sales Manager Europe and to all members of Studio Systems Engineering who supplied most of the information in this article.

Footnote

The first production Mini-Mobile described in the article above was sold to Televizija Novi-Sad, Yugoslavia, where it is in regular use covering a variety of programmes. The photograph shows the Mini-Mobile on a typical location near Novi-Sad.