THE ECONOMIC ASPECTS OF LAND MOBILE RADIO BACKGROUND PAPER FOR SPECTRUM ALLOCATION IN THE 406 - 960 MHz BAND

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The Economic Aspects of Land Mobile Radio: Background Paper for Spectrum Allocation in the 406 - 960 MHz Band

In the study of spectrum demands at 406-960 MHz, economic factors must take second place to other considerations for most of the services involved in the band. The economic motive is not paramount in the amateur, radiolocation, radioastronomy and ISM services, and even in TV broadcast it is overshadowed by social and cultural concerns. For the fixed service there is the alternative of other frequencies, or the non-radio medium of cable, to relieve commercial pressures in this band. It is in land mobile, made possible by radio alone and ideally suited to the 406-960 MHz band by transmission, that economics comes into its own. Aeronautical and marine mobile pale by comparison, owing to their much smaller role in the business world and greater freedom from transmission restraints.

An appreciation of the commercial nature of land mobile radio can be obtained from a review of license data. As of March 1977, there were 215,000 mobile units licensed to business users, concentrated in the transport, taxi and construction industries (attachment 1). Only 40,000 licenses were issued to all government agencies, although these represented a somewhat greater number of mobile units since municipal and national defence users operate under a blanket license. If 15 mobiles per license are assumed in the municipal and defence categories, the total mobile population becomes 300,000 units in early 1977, 70% of them in commercial service.

Since the oil crisis of 1973, energy conservation has taken on a new dimension, transcending the familiar boundaries of cost. The public need to relieve the dependence on oil has now a significance not reflected by the market, and in this regard the contribution of mobile radio should be acknowledged. The 24 hour ability to communicate with a vehicle on the road will manifestly save the wasted trips that would

otherwise result from the contingencies of business or government. The difficulty is to calculate the saving; for the reasons discussed below, users do not possess the necessary source data. In the absence of detailed, factual records from the user, recourse must be had to the published estimates of the mileage saved by mobile radio. Those vary from 15% to 40% and if the lower value is applied to the existing population of radio equipped vehicles, the indicated saving is 100 million gallons of motor fuel per year. This benefit is a surprisingly high 0.4% of the total domestic oil consumption for all purposes in 1976. The future growth in oil consumption is difficult to predict, since it will be affected by shortages, conservation and the development of substitute energy sources. What seems certain is that the demand for mobile radio with its attendant fuel efficiencies can only be enhanced as oil supplies become scarce. In Attachment 2 this factor is discounted, and the projected fuel saving of 400 million gallons in the year 2000 may be taken as a conservative estimate.

In order to obtain the benefit of first-hand experience, discussions were held with as many users of mobile radio as time permitted, seven in number:

Diamond Taxi)
CP Rail)
Abitibi Paper) Reported in a companion paper
Smith Transport) by P. Julien

Ontario Department of Transportation
Ontario Hydro
Consumers' Gas

In such a small sample, no attempt could be made to represent the population of mobile users. Major firms were selected as these would have the resources necessary to study the cost effectiveness of radio,

should they find it desirable. None had done so[1] on the grounds that radio is essential to the firm's operation, and its costs negligible in relation to other business expense. Under these circumstances, there is little justification for elaborate cost studies. An objective assessment of radio would involve a "before and after" comparison, not available in retrospect for most firms and requiring now an expensive, controlled experiment.

The economic justification for mobile radio in the simple case, without considering data systems or specialized design, can be demonstrated by a comparison of vehicle and radio costs. At the very least a vehicle driver, who may also perform other duties, will command $5 per hour whereas the radio will typically cost $2.50 per day (attachment 3). This calculation assumes that dispatching can be accomplished with no increase in staff, which would be true in small radio systems. In large systems the allowance for a full-time dispatcher would be prorated over 25 or more vehicles with little effect on the unit cost. At the above rates, the cost of radio will be paid if 30 minutes of driver time can be saved in the day, a not unreasonable expectation. Similarly, an automobile operating at a typical 7¢ per mile,[2] or a small delivery truck at 15¢ per mile,[2] will defray the cost of radio if less than 40 miles can be saved in the day. The combination of driver and vehicle economies makes a powerful argument for radio.

On some occasions the cost of a mobile system can be repaid in a single radio call. The Ontario Government reports of such a case, in which $80,000 was saved by instructions from the field to delay the pour for a concrete highway bridge. Ontario Hydro expedite the restoration of transmission lines by using a radio-equipped helicopter to locate storm damage and direct the ground crews. The saving of even a

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1 For a complete answer on cost effectiveness studies, refer to the companion paper. Data for these studies is being provided by some of the companies.

2 These costs are for gasoline, maintenance and tires. Fixed costs such as depreciation are excluded.

few hours in this operation is highly significant to the utility, which sustains a loss of $500,000 per day when a power station is disconnected from the grid. An 8 yard shovel used in open-pit mining is equipped with radio to minimize work stoppages, which cost $2000 per hour. Numerous other examples can be drawn from industry, wherever vehicles or roving personnel are essential to the functioning of a large undertaking.

It is perhaps unfortunate that the user organizations interviewed in this part of the study (Ontario Hydro, Ontario Department of Transportation, and Consumers' Gas) are utilities or quasi-utilities, with all the priority in radio service that that implies. In the Policy Manual, services for the safety of life and property such as fire, ambulance and police are given precedence over services essential to the operation of utilities, transportation, etc. The line between these two service categories is very thin. Fire protection, for example, is difficult if the roads are not plowed in winter; mobile radio is required for both. In such cases, there is little doubt that frequencies will be made available to meet the public need. What about the small user, not engaged in so important an affair?

The myriad small users of mobile radio, in the construction, manufacturing, resource and service industries, also have a claim on radio frequencies. If the economic impact of radio is not visible because it is diffused over many small users, there is no reason to suppose that it is any the less real, or significant. The public still benefits from improved productivity, fuel savings, and a standard of service not otherwise obtainable. In view of the public benefits it would be preferable not to restrict the demand for mobile services, relying instead upon spectrum management to avoid an undue proliferation of channels and wastage of spectrum. The merit of any mobile licence must be judged in retrospect, by the exercise made of it. For new businesses or service applications, radio usage is necessarily a matter of conjecture, being dependent on the success of the venture. It would be undesirable to stifle opportunities for the small user through the lack of spectrum allocations.

The problem of wasted spectrum is likely to occur least among the major users of radio, who have systems large enough to permit efficiencies through trunking and frequency reuse. Already the firms interviewed have taken steps towards frequency conservation, with the active support of the Department. The Ontario Government proposes to operate its entire radio system for highway maintenance throughout the province on 8 VHF channels and 12 UHF channels. Ontario Hydro conducts all its construction and maintenance of transmission lines on 24 channels in the low band (50 MHz); additional channels are required for generating stations and other purposes. Consumers' Gas needs only 10 UHF channels for its operations, distributed over several communities. These economies of scale are not open to the small mobile user, who must combine with other users to achieve the same result.

The real impact of mobile radio is to be found in the public domain, where unfortunately it is least susceptible to definition in economic terms. Mobile radio was first used in police work, in the early 1930's. Here the public benefit from the protection of life and property is indisputable, although no dollar value can be placed on it. The next mobile application was in taxis, yielding a significant gain to the public in the form of faster service. Since those early days, the instances of public benefit have grown in proportion with the spread of mobile radio. Consumers' Gas undertake to have a repairman on the scene in 15 minutes if a gas leak is reported, minimizing the risk to human life. The public safety depends on the continuous delivery of energy, food and other essential supplies, all requiring radio. The cost of a mobile telephone call is far below the return to the user. How can all these benefits be assessed at their true worth to the public? Not by any known technique of economic analysis.

Conclusion

For anyone familiar with mobile radio, this paper will be no more than a statement of the obvious. The paper is therefore directed to those not conversant with the subject, in the hope that mobile radio will receive its due in the forthcoming reallocation of the 406-960 MHz band. Mobile radio speaks with a small public voice because its economic benefits are incapable of precise determination, and pass unnoticed. This should not be allowed to detract from its rightful claim to spectrum.

J.B. Young
15 July 77

ATTACHMENT #1

Distribution of Mobile Licences by Industry Sector - 15 March 1977

Service Category	Licences		
Construction	19,673		
Taxi	19,557		
Truck Transport	15,445		
Air Transport	15,117		
Special Trade Contractors	12,755		
Electric Power	12,463		
Railway Transport	10,936		
Logging	10,590	116,536	45.6%
Other Industry		98,899	38.7%
Government Services			
Forestry	7,203		
Highway and Bridge Maintenance	7,200		
Other Federal	12,623		
Other Provincial	9,990		
Other Municipal	2,938	39,954	15.6%
Total Licences		255,389	100.0%

Municipal and National Defence users operate under a blanket licence. On the assumption of 15 mobiles per licence for these users, the total population would be 300,000 mobile radios in March, 1977.

ATTACHMENT #2

Fuel Savings Due to Land Mobile Radio

In 1976, the total domestic oil consumption for all purposes was 1,796,000 barrels per day, or 23 billion gallons for the year. (1 barrel = 35 imp. gal.)

In the EEMAC Submission "Spectrum Allocations in the 406-960 MHz Frequency Band" dated 3 Dec 76, a 7.5% annual growth is projected for land mobile radio in the period 1981-2001. This rate allows for market saturation in relation to the 11.5% annual growth experienced in 1964-74, and appears to be reasonable. A 7.5% rate of increase implies that mobile radio and its attendant fuel efficiencies will quadruple by the year 2000.

Assuming a 15% mileage saving due to mobile radio, at 25,000 miles/year and 10 miles/gallon for each vehicle:

Year 1976 Fuel saving per vehicle

$$\frac{25{,}000 \text{ miles} \times .15}{10 \text{ miles/gal.}} = 375 \text{ gal.}$$

Total fuel saving

300,000 radio-equipped vehicles X 375 gal. = 100 million gallons, approx. or 0.4% of total oil consumption

Year 2000 Total fuel saving = 400 million gallons

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