another three months. This means that the last of the transmitters to be installed within the six year period must be ordered about 27 months before the end of the period. A main assumption is that the majority of broadcasters will have placed their orders sufficiently well in advance so that all manufacturers' production and installation capacity can be used efficiently.

Other key conditions that must be met by manufacturers include the addition of more shifts of production workers and possibly constructing additional production capacity to handle periods of peak orders. Manufacturers expressed willingness to expand production capacity to meet demand. Of course, this assumes that the greater demand is predictable well in advance.

The survey found an adequate supply of skilled personnel and components for the production of transmitters in the projected quantities.

Some of the observations above are based on manufacturers' current production capacities and on estimates of the quantities of transmitters needed at various power levels, e.g., at the 30 KW level current (NTSC) production capacity is about 250 transmitters per year. At 10 KW, capacity is almost 300 transmitters per year, and at power levels above 30 KW capacity reduces to 175 per year. An uncertain number of stations will decide to use low power transmitters (1 KW to 5 KW) to activate their license during the initial years of operation. Production capacities of transmitters at these power levels are considerably higher.

Various assumptions were made in arriving at the above observations. These include the following: estimates of the number of transmitters, their types -- mostly single-ended v. redundant -- and the power levels that will be needed per year; the technology will not be appreciably more complex than NTSC technology; the transmitter power levels required for ATV will be about 30 KW or less for most installations; and the vast majority of transmitters will be UHF.

2. Antennas

The survey found that the production capacity of manufacturers is likely to meet demand for antennas, in spite of a number of uncertainties. One of the main assumptions is that stations' procurement orders are spread over a number of years.

Actual sales by manufacturers are well under capacity and imported antennas can be used.

There are many uncertainties in assessing aggregate production and installation capacity. These relate to factors such as: power levels -- capacity is about 475 antennas for levels above 30 KW, and 600 below that level; antenna design, e.g., top-mount, side-mount, or wrap-around; and the actual quantities of antennas needed to use common antennas. Other contributing factors are choices of coaxial cable or waveguide transmission lines and the use of multi-station installations.

3. Tower and Installation Considerations

Tower installation and reinforcement are singled out as being a critical path function likely to delay the conversion of many stations. IS/WP-2 believes that the Commission will receive requests from many stations for extensions of time for construction. This is a significant problem even under the favorable assumptions that: all stations requiring new or reinforced towers initiate their procurements early and in a staggered way over time so that optimum use can be made of installation and reinforcement crews; financing is not a problem.

A small community of firms do the related work of manufacturing towers for broadcast use, erecting towers and making structural changes such as reinforcements. Some firms handle replacement or new installations of antennas and transmission lines. The members of this community can install about 400 antennas per year. If the number of antennas that can be installed can be increased to 500 per year and those installations are scheduled over a three-year period for construction or the installation can begin in the third year, then the total need for antennas can be met in a timely manner. Note that this analysis applies only to the installation of new antennas, any requirements for requirements for rearranging existing equipment will decrease the number of total antennas that can be installed.

A critical problem is in the shortfall of the current availability of crews for installing and reinforcing towers. The crews can install or reinforce some 100 towers per year if they were to devote full-time to broadcast television and their work were spread uniformly over time. However, the number of new towers that will be needed is projected at between 375 and 750 (between 25 and 50 percent of all stations) during the three-tear construction period. Even allowing for a large margin of error in IS/WP-2's estimates, it seems clear that many stations will not have their tower and antenna work completed within the scheduled period for construction.

If the low power option is taken by a substantial number of stations then the numbers of new towers needed may be significantly reduced.

G. Availability of Other ATV System Equipment

H. Availability of Video Software

One important ingredient in the transition to Advanced Television will be the availability of suitable programming in sufficient quantity to attract audiences to first buy the ATV receivers and to then watch the programs. There was general agreement among those contacted that programming will be available in quantity from a wide range of sources. Participants were asked how long following an FCC decision on an ATV system they expected initially to provide such programming. Responses fell into two broad categories: those with explicit time periods and those for whom felt it was marketplace driven. In general, respondents from the broadcast networks and some of the studios gave explicit answers, with the time periods ranging roughly from one to two years. Respondents from the remaining studios, the cable network, and the post production community felt that their provision of ATV programming would depend heavily on marketplace demands. The participant from the cable network made it clear that the timing for his company was unrelated to the FCC decision, per se, but was dependent on the availability of receivers to consumers. The respondent from the television production company pointed out that it will be sensitive not only to demand in the U.S. but also to demand for its product in Europe.

Regarding the order in which programming will become available, there was general agreement that early material will be derived from film production and will fall into two categories: prime time episodics and movies. This derives from the fact that material shot on film can be converted to HDTV form by scanning in a telecine. Thus all theatrical motion pictures can be made available relatively quickly. Since approximately eighty per cent of prime time material is shot on film, it, too, can be made available relatively quickly. Which of these two forms is seen as becoming available first depends upon the respondent's point of view – the networks tend to expect prime time programming first while the studios expect movies first. Asked about who will be producing the material, the participants from the studios and the television production company expected to be producing it themselves; the post production company expected only to handle material produced by others – both as would be expected. The networks anticipated a mixture: obtaining some from producers and producing some material themselves.

The participants generally ranked sports as most apt to follow programming based on film production. It is seen as the type of programming most likely to benefit from a combination of the value of live pickup and the attractiveness to audiences of Advanced Television. Beyond sports, there was a general scattering of opinions on what other types of programming would come in what order. There was agreement among the commercial broadcast networks, however, that news will be last.

It should be noted that, throughout this examination, the perspective of the participant from public television was somewhat different from the other respondents. His view was that the first material to be distributed will be produced in video, as opposed to film, and will be material being produced now that is timeless in nature. Material will be produced both by his organization and by others, largely through co-productions, as has been the case so far. Beyond the initial ATV program material, a substantial amount of upconverted 525-line material, in component form, some of it possibly widescreen, is anticipated. The amount and exact form of this material will depend on co-production arrangements for ATV/HDTV.

******* Alternate section

H. Availability of Video Software

The results of an inquiry into the likely availability and timing of video software for ATV indicate that programming will be available in quantity and from a wide range of sources in time to meet market demand. [See IS/WP-2 Report on Software Availability in its public documents.]

IS/WP-2 conducted telephone opinion surveys with representatives from commercial broadcast networks, public television, the cable television industry, production studios and post-production firms to get their opinions on the availability of programming, types of programming, sources, etc. Responses to the question of the time period (following the FCC's selection of an ATV system) before video software will become available varied widely, but generally indicated that adequate quantities will become available as needed. ATV software software will be provided by all of the above sources either within one or two years after the FCC's decision, or as warranted by market demand, i.e., by suitable penetration levels of consumer receivers.

Early ATV programming is expected to be derived from film production of both prime time episodics and movies, since film can be readily be converted to HDTV form. Sports is expected to follow next, and news is likely to come last.

I. Production System Issues

As part of the Video Software survey, IS/WP-2 also inquired of the respondents their views on the appropriate levels of technology for producing programming in an ATV environment, e.g., for programming produced on film, for sports, aspect ratio, etc., and about some of the acquisitions of equipment for HDTV operations.

There has been considerable interest in the necessary or appropriate levels of technology for the production of programming for use in the ATV domain. The possibilities range from full High Definition Television technology to intermediate levels of widescreen 525-line production to upconversion of standard 525-line and NTSC material. To explore the expectations of the respondents with regard to the level of production technology to be used, a series of questions was asked, some open ended and some with multiple choice answers. There was wide variability in the answers to these questions, but some strong tendencies do appear.

Material produced in film format will generally be transferred to full HDTV format for distribution in Advanced Television according to respondents from the production community. General agreement also existed that sports for ATV transmission will be produced in full HDTV. One studio respondent indicated that his organization was contemplating shooting network and first run syndication of non-reality based programming on film, protecting 16:9, transferring to 525-line components, post producing in 525 lines, and upconverting to HDTV at the end of the process. It will also be very expensive to conform a new HDTV transfer later, although the film will be saved in case this becomes desirable. Digital component 525, when upconverted, is expected by the responding studio to be good enough for ATV transmission, given the economics of full HDTV production or post production.

Participants were asked when they expected their organizations to begin installing equipment for some level of HDTV operation. Answers from the broadcast network respondents divided between 0-1 and 1-2 years. The cable network, which has some equipment already, has a plan calling for backtiming from the availability of receivers to consumers and beginning to equip itself 1-2 years before that time. Virtually all of the other participants, all of whom are in the production and post production aspects of the business, indicated they will begin to add HDTV when their clients begin to demand it.

There has been considerable discussion within the industry concerning the possible use of lower performance levels of production than full HDTV for use in ATV transmissions. As part of its survey, IS/WP-2 was requested by FCC staff to explore this concept and to try to shed some light on what should constitute ATV material. Among the issues in this discussion have been such matters as the aspect ratio, the use of component *vs.* composite processing, the provision of multiple audio channels, and the required resolution. There was unanimous agreement among respondents that with the concept something less than full HDTV performance will be adequate for production and distribution of programming for Advanced Television, although not all felt it would necessarily fit their respective businesses. Respondents were then asked what minimum characteristics they believed will be appropriate. There was a strong consensus on certain characteristics, namely 16 X 9 aspect ratio, component operation, multi-channel (some said digital) audio, and improved resolution, in the order of their frequency of inclusion. Improved resolution was deemed unnecessary by some.

Two responses were targeted at appropriate FCC Rules for programming to be carried on the ATV channel during the period that the FCC has proposed to permit stations to carry separate programming on their ATV and NTSC channels for purposes of developing ATV programming techniques. One suggested that since, in his opinion, simulcasting will essentially consist of upconverted NTSC material, then as a minimum, full HDTV (only as necessary to support the maximum capabilities of the transmission system) should be used as the source for any separate programming. The other suggested that material to be carried separately should be sufficiently different from NTSC that it would be shot differently and would therefore be difficult to downconvert to NTSC.

The timing of the general availability of consumer equipment (receivers and VCRs) in the marketplace is crucial to the projection of the timing of most other aspects of the transition to Advanced Television including, most importantly, consumer penetration itself. The experts from the consumer electronics industry participating in IS/WP-2 have made certain projections that recently have brought this item into focus. The ATV proponents all commented that technology now exists to build a consumer VCR that can record their signals.

J. Distributed Transmission Concepts

The concept of distributed transmission was formally presented in the American TeleVision Alliance's (GI/MIT) submittal of its certification documents for Channel-Compatible HDTV. The concept is similar to cellular television. Multiple transmitters, each requiring lower height and power and serving smaller areas than conventional full power broadcast transmitters are operated on the same channel. This concept could solve two problems: the short spacing of co-channel stations, and overcoming limitations of a main transmission facility. Two models of distributed transmission configuration were examined, one where each transmitter serves a relatively large area requiring fewer sites, and the other where each site serves a small area requiring many sites. The larger service area was found to be the only one economically equivalent to conventional full power single transmitter operations. The smaller area option would be useful for fill-in types of service.

VI. Conclusions

IS/WP-2 can draw a number of conclusions regarding the issues that have been examined. While technical developments may change these conclusions between now and the final Report and Order, the evidence for these conclusions is strong enough that they should be stated at this time.

A. Technical Information

The availability of technical information is crucial to the implementation of Advanced Television. If adequate attention is not paid to this issue, ATV cannot be implemented on the aggressive schedule the Commission favors. After the system selection decision itself, this one item has the greatest potential to delay the FCC's current schedule for implementing ATV among the tasks that must be carried out.

The structure for the necessary documentation and the responsibility for its generation should be established well in advance of a system selection. The system selected should be announced promptly, if possible before other formalities are completed, so that the documentation process can start at the earliest possible moment. No proponent will be willing to invest in this documentation effort until it knows that its system has been selected.

B. Critical Path Tasks

Each transition scenario for each industry segment has a number of tasks which effectively control the period of time required to complete the transition. These tasks are critical tasks because when they grow longer so does the total implementation time. Some of the critical tasks, however, will have a much greater influence on the overall implementation of Advanced Television than do nearly all of the others. Often they are the same tasks applied to several industry segments. These are pointed out here for the special attention they deserve.

Technical Information Available — This is the same issue discussed in A. above. It is repeated here because of the significance it has for every one of the transition scenarios. It is on the critical path, directly or indirectly, of every scenario. The timely availability of this information is key for all of the scenarios and is particularly critical to the broadcast, professional equipment, consumer electronics, and cable scenarios.

IC Design — Integrated circuits to implement the selected system are central to the design and manufacture of equipment of all kinds in each of the industry segments. ICs will be particular critical to the consumer electronics and cable industry segments because of the very large quantities involved. Any delays in their development will have a leveraged impact on the overall length of implementation times. This is because, where most tasks stretch out a day at a time, IC development can increment a month or more at a time when initial designs do not work and must be modified and tried again.

Equipment Availability — System-specific professional equipment is required for most of the industry segments, including broadcast, network, production/post production, cable, and satellite. Availability of professional equipment, in turn, will be dependent upon both the availability of the requisite technical information for its design and the difficulty of implementing the particular system selected in hardware. Assumptions have been made about the availability of the equipment. To the extent those assumptions are too optimistic, the length of implementation for those industry segments will be similarly impacted.

Satellite Space Segment Availability — Availability of satellite transponders has been assumed in the satellite transition scenario and indirectly in all of the other scenarios that depend on satellite distribution of signals. These include the local station, network, and cable scenarios. Lack of a space segment for any program distribution dependent on satellite delivery will preclude that service from implementation. To the extent that HDTV requires additional transponder channels, this could be a serious limiting factor. Systems that can reuse or share existing transponder space can ameliorate this situation.

C. Broadcaster Interests in Staged Implementation

The FCC proposal for a tight time schedule for implementation based upon "regulatory incentive" does not match broadcast licensees and their interests in a staged implementation of ATV. IS/WP-2 has found that adequate design personnel resources are available for the staged implementation to the pass-through milestone sought by broadcasters and documented by CBS. No such findings have been made regarding the faster implementation desired by the Commission. In fact, there is very strong evidence that in a large number of cases, especially in larger cities, broadcasters will not be able to achieve the Commission's timetable, at least for full facilities, no matter how hard they try and no matter what resources they apply.

D. Availability of Consumer ~~Receivers~~ PRODUCT

Consumer ATV receivers may very well not be generally available in the marketplace as quickly as has been predicted in some quarters. Detailed study by receiver manufacturers shows that it will take some 2-3 years following the FCC decision on a system to begin delivery of consumer receivers into the distribution channels. This is very likely to be a gating item in ATV implementation. It is of such significance that a wider range of inputs is being sought from consumer electronics manufacturers.

********** add IP VCRs not likely to be available at same time as receivers

E. Availability of Professional Equipment

Under the assumptions made that broadcasters place their orders in a timely manner, the capacity to supply transmitters and antennas is significantly greater than the capacity for installation of towers and antennas.

Professional equipment must be available to a wide range of participants in the production and delivery of programming before HDTV can regularly be produced and delivered to viewers. The move to ATV operation by broadcasters is likely to be impeded by a lack of sufficient capacity for the manufacture and installation of a sufficient number of transmitters and antennas within the six year timeframe the FCC has proposed to give to broadcasters to apply for and build facilities while retaining their preferential assignment of channels for ATV operation.

F. Availability of Software

There is consensus among the program producers and network executives interviewed for this study that there will be adequate programming available for the launch of ATV. Responses fell into two broad categories: those with explicit time periods for program availability and those who felt its timing would be driven by market demand.

G. Ability of Licensees to Afford Conversion

The ability of licensees to convert to ATV has not been assessed as part of IS/WP-2's work. However, recent ongoing efforts by PBS and others to estimate the cost for providing minimum (pass-through), low power ATV capabilities indicate that each station will incur a cost of perhaps $900,000 to $1,000,000. Intermediate power ATV capabilities are estimated at about $1.6 million and full power HDTV capabilities at over $2 million cumulative. These costs do not include new towers or production capabilities.

A key question concerns the ability of commercial and noncommercial stations to bear these costs.

For the 345 public television licensees -- most of which are dependent on the annual Federal subsidies -- clearly many will not be able to afford the price of conversion. Similar conclusions can be drawn fro commercial stations. Nor will extensions of time be of much help.

IS/WP-2 recommends that the FCC initiate on a priority basis an assessment of the financial shortfall of licensees and the alternatives to resolve this problem.

VI Open Issues

LD/WPL-0L78
14 OCT 92

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communications inc.
GRENIER FIELD • P.O. BOX 4365 • MANCHESTER, N.H. 03108 4365

September 21, 1992

S. Merrill Weiss
25 Mullberg Lane
Edison, NJ 08820-2908

Dear Merrill,

A recent survey of all stations showed the following results:

- Most broadcasters (95%) want to use their existing tower for the HDTV antenna.
- If tower without new antenna has to meet new Code RS-222E, many of the towers will have to be refurbished.
- Tower feasibility study will have to be done on the tower, if new antenna is added and new code is to be met.
- 55% of all towers had stress studies done more than 5 years ago.
- 50% of all towers are greater than 20 years old.
- The enclosed graphs show tower height in 100 ft. increments for all Lo V, Hi V and UHF stations.

  If new tower is not to be built and the height not changed, then the maximum height of the new UHF-HDTV is their present and shown on the enclosed graph .

  The enclosed graph shows that UHF stations have a big advantage, since their towers on the average are considerably taller than the VHF tower.

- The enclosed graphs for ERP show that 76% of low VHF and 70% of high VHF's now radiate maximum ERP, while 17% of UHF stations are radiating maximum ERP.

  Many of the restraints that prevented the U's from operating at maximum ERP will still apply to all stations for the new HDTV system.

- The enclosed graphs of HAAT will remain the same for all stations.

Yours truly,

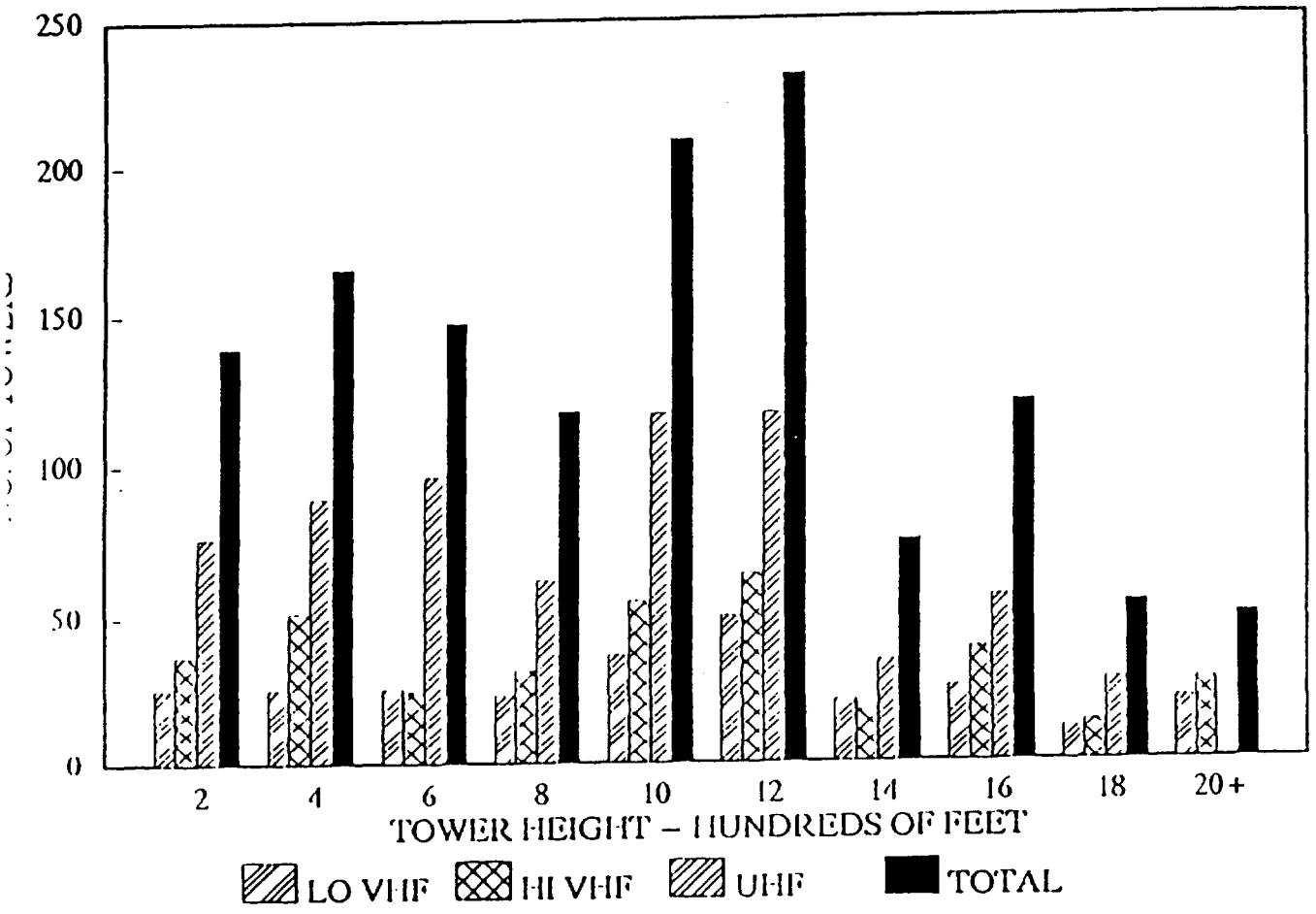
Thomas J. Vaughan
President

TJV/dmb
enclosures

MICRO COMMUNICATIONS, INC.

HDTV MARKET STUDY

HEIGHT OF EXISTING TOWERS ABOVE GROUND



Research to prepare this chart was undertaken to provide information relative to transmission line requirements and antenna specifications.

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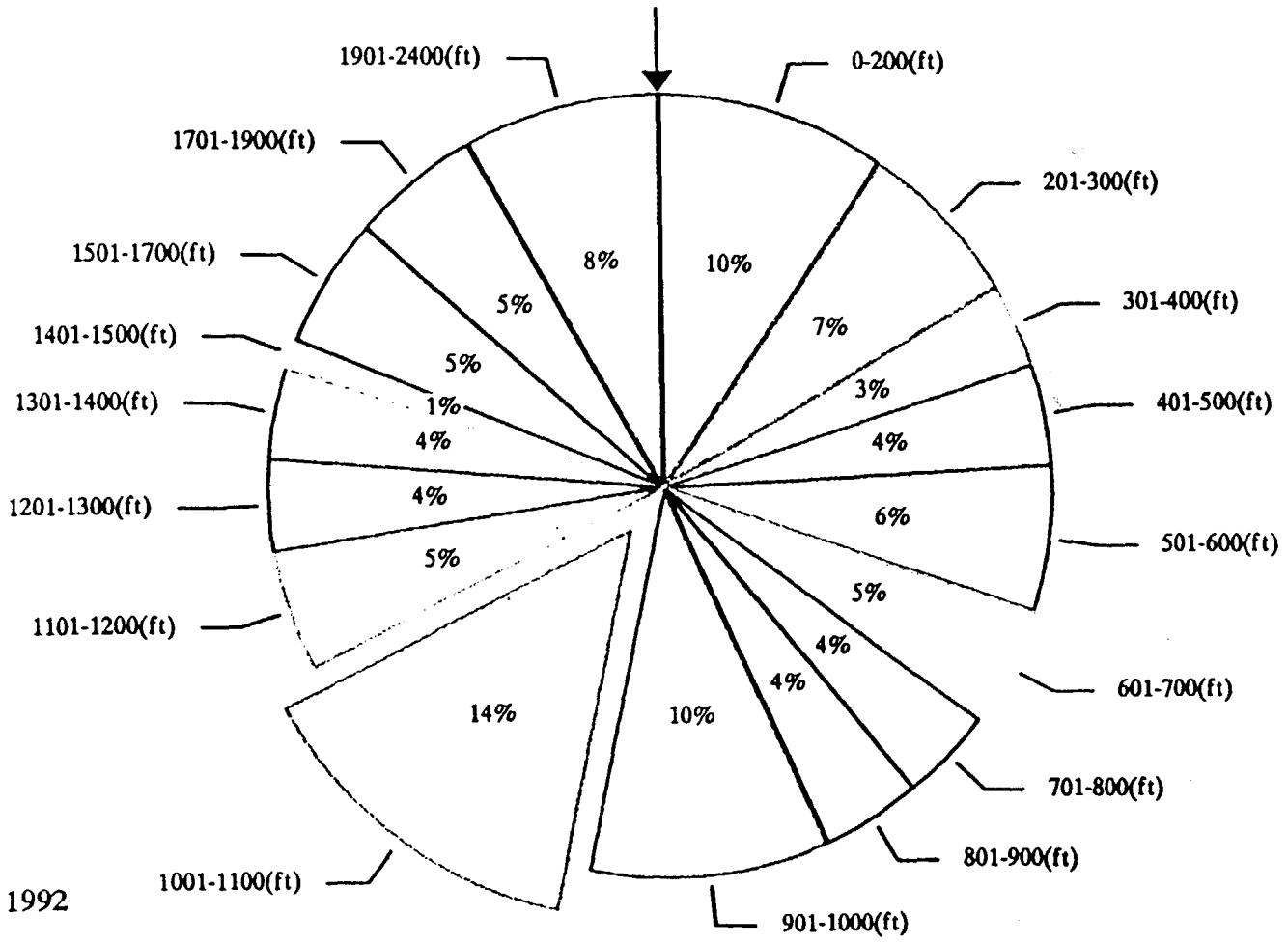
United States Television Broadcast Facilities Transmitting "Height Above Ground" (HAG)
*** Low VHF Channels ***
Total Number of Facilities = 261



January 1992

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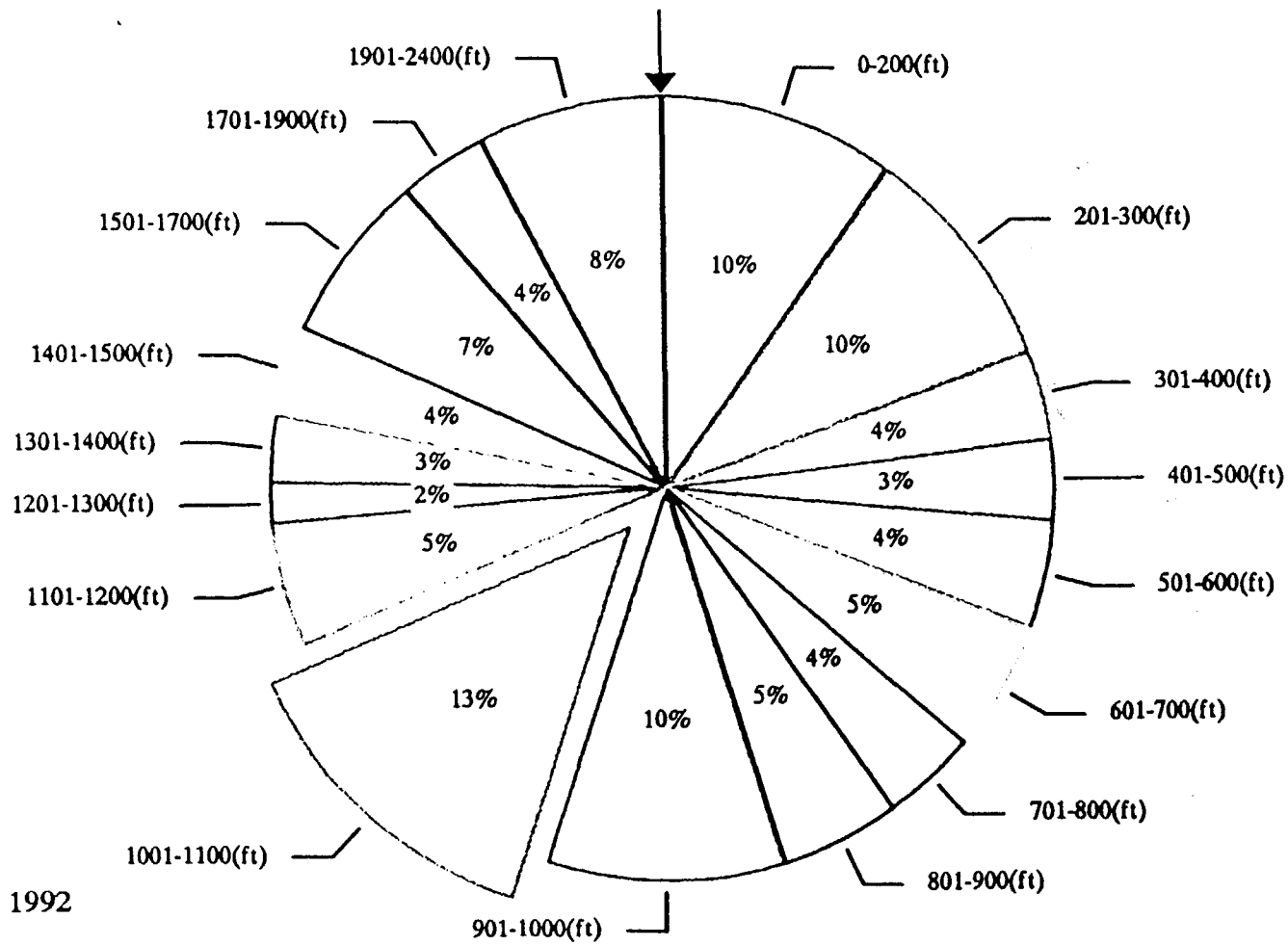
United States Television Broadcast Facilities Transmitting "Height Above Ground" (HAG)

*** High VHF Channels ***

Total Number of Facilities = 356



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United States Television Broadcast Facilities Transmitting "Height Above Ground" (HAG)
*** UHF Channels ***
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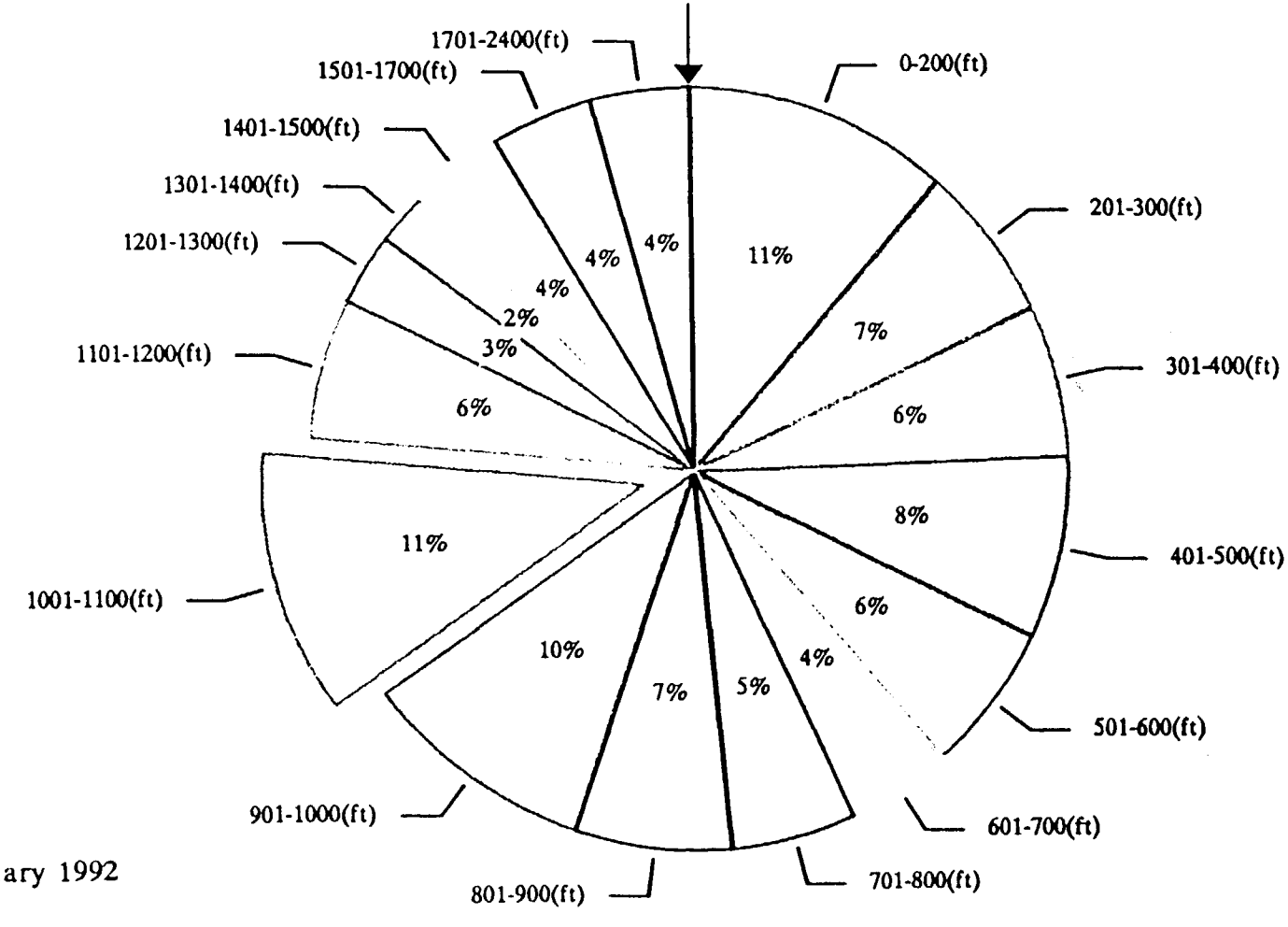

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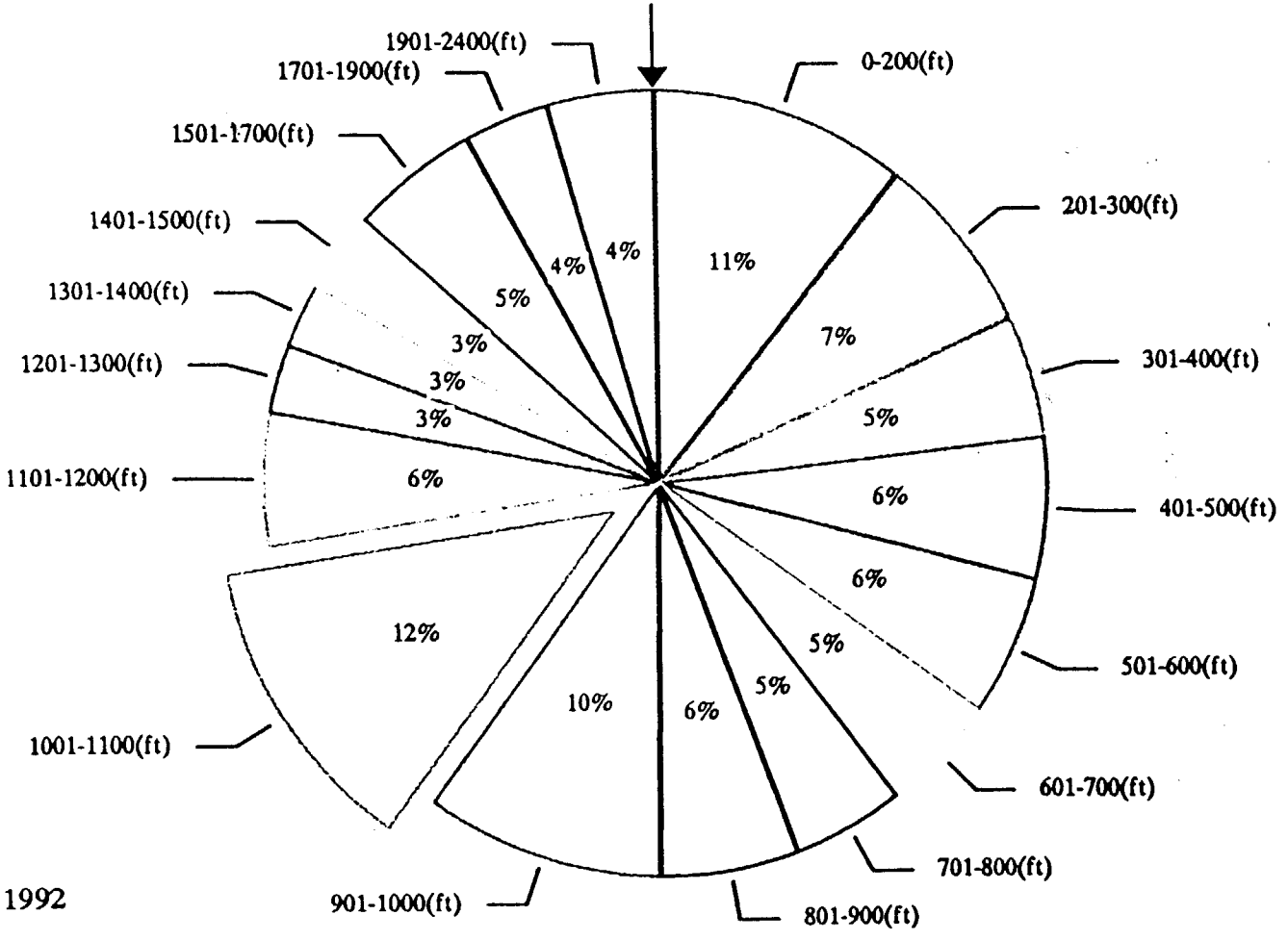
United States Television Broadcast Facilities Transmitting "Height Above Ground" (HAG)

Total Number of Facilities = 1,307



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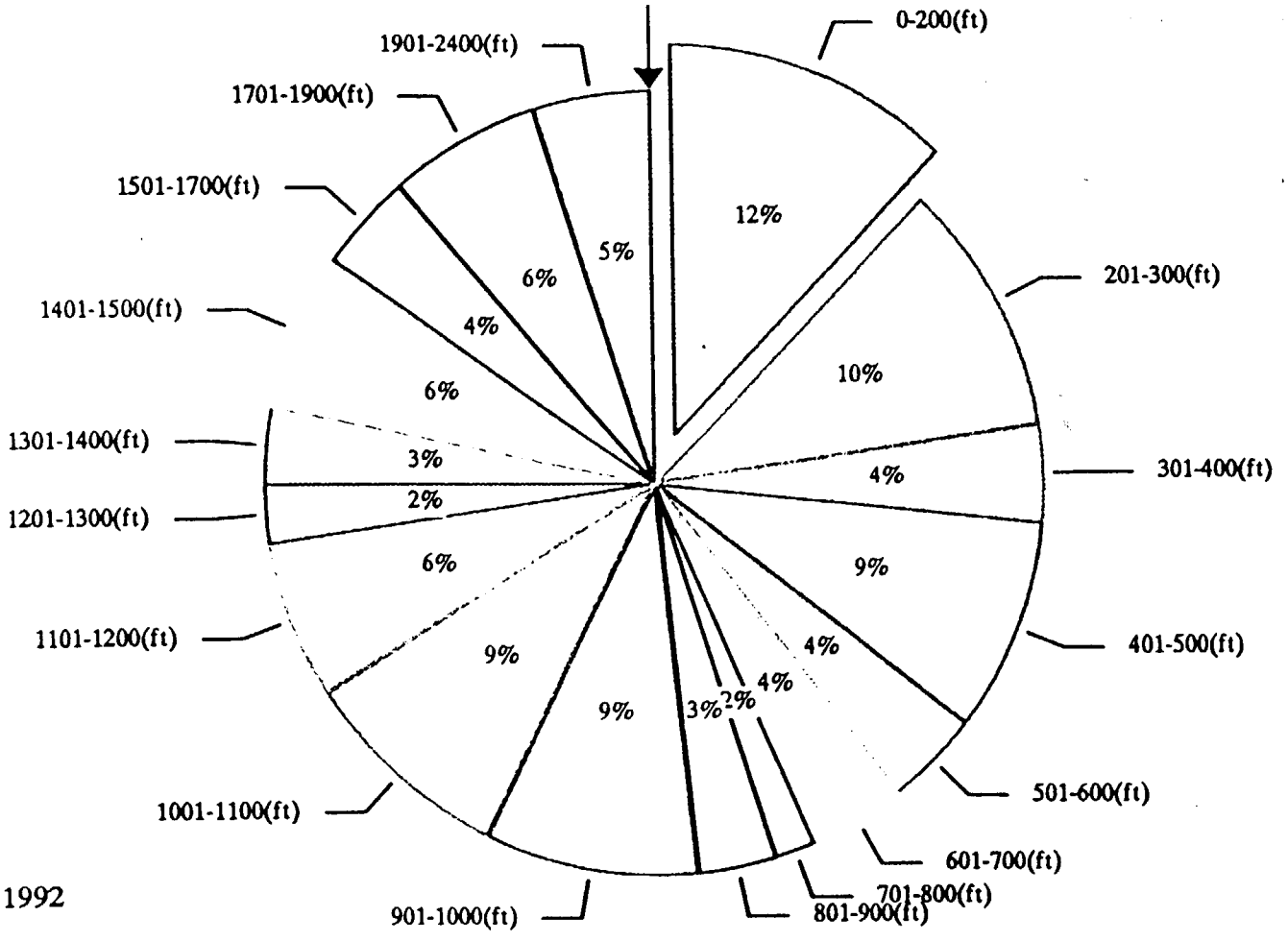
United States Television Broadcast Facilities Transmitting "Height Above Ground" (HAG) Markets 1 through 10 Total Number of Facilities = 124



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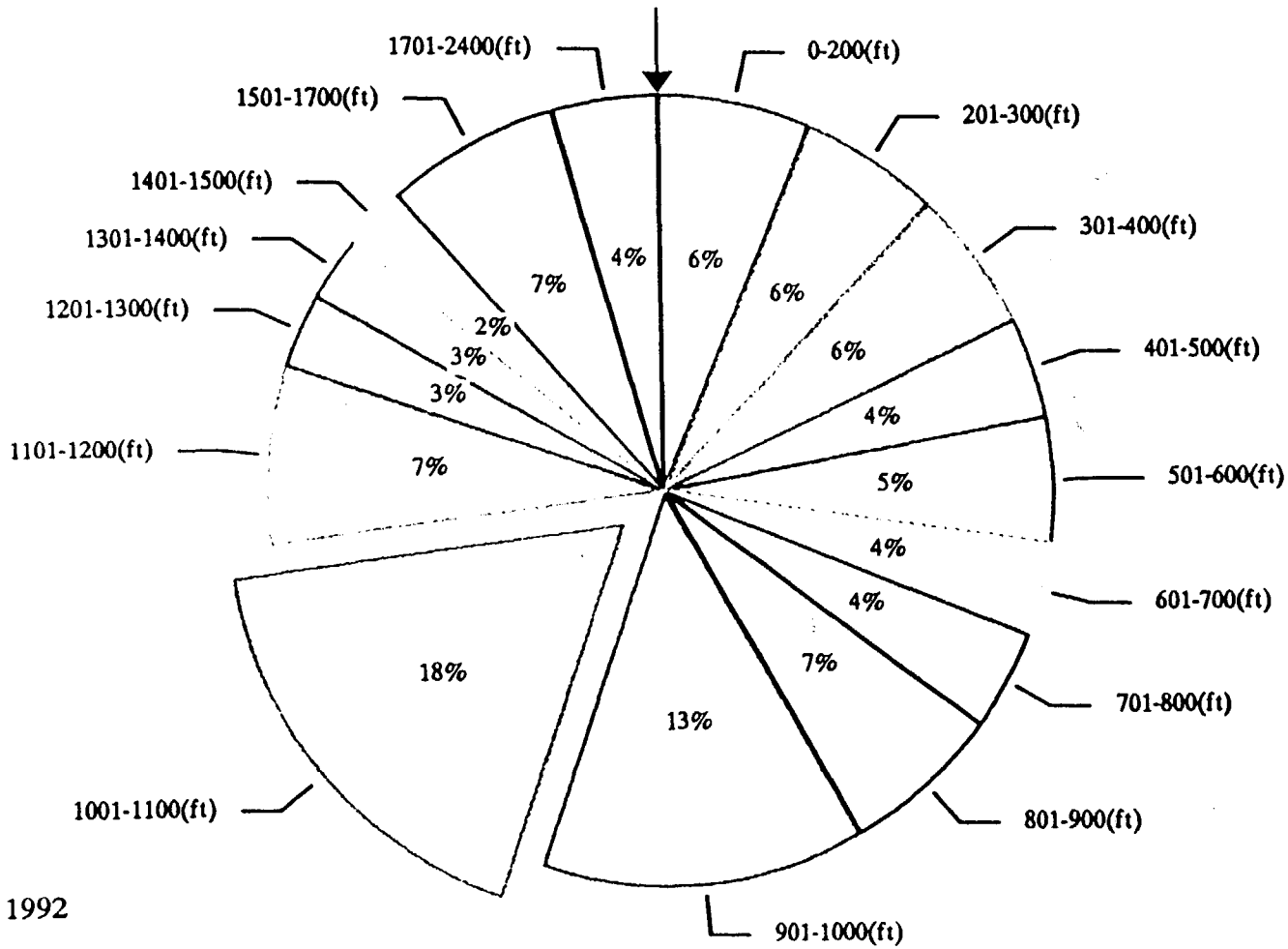
United States Television Broadcast Facilities Transmitting "Height Above Ground" (HAG) Markets 11 through 50 Total Number of Facilities = 364



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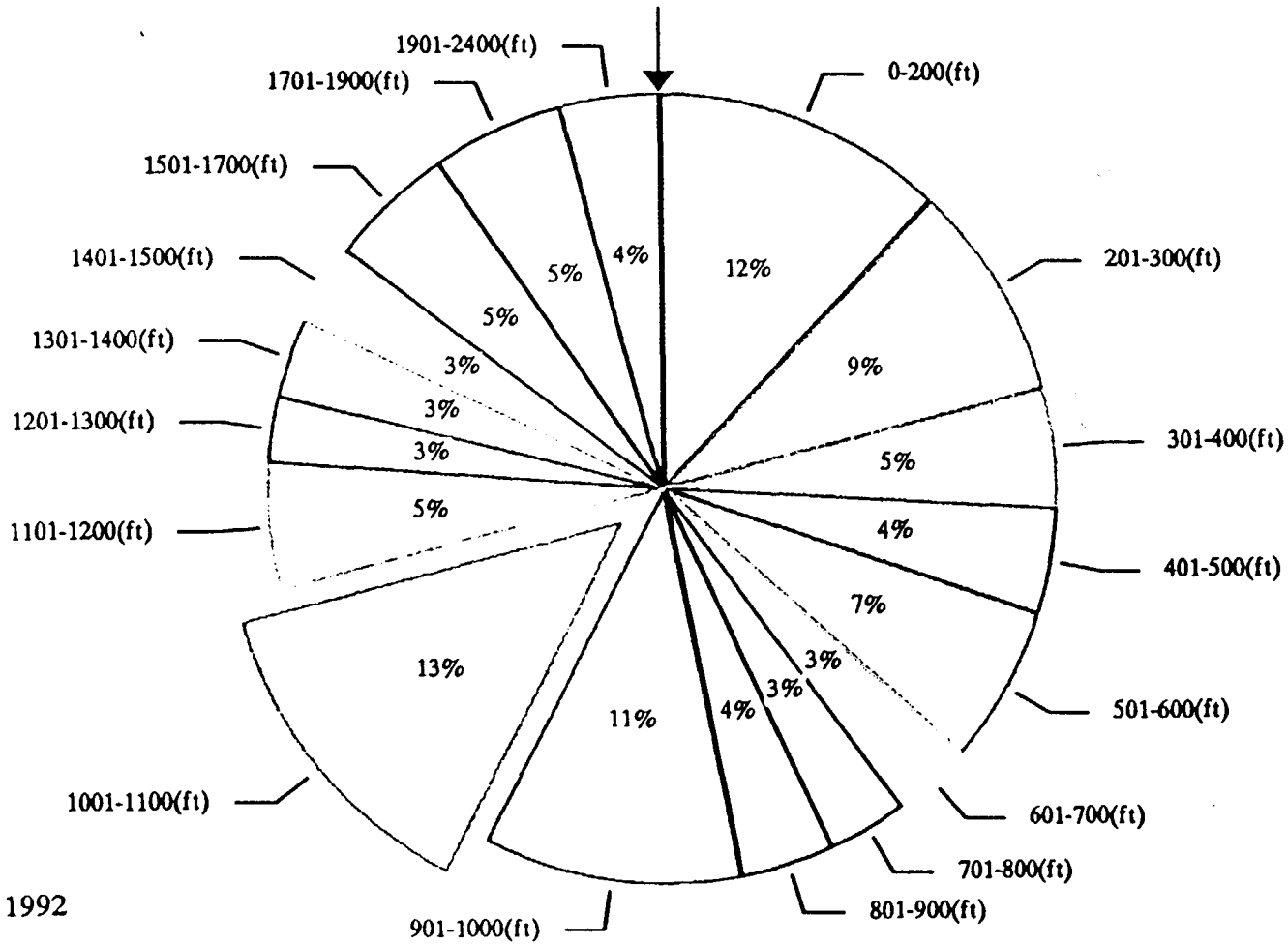
United States Television Broadcast Facilities Transmitting "Height Above Ground" (HAG) Markets 51 through 100 Total Number of Facilities = 368



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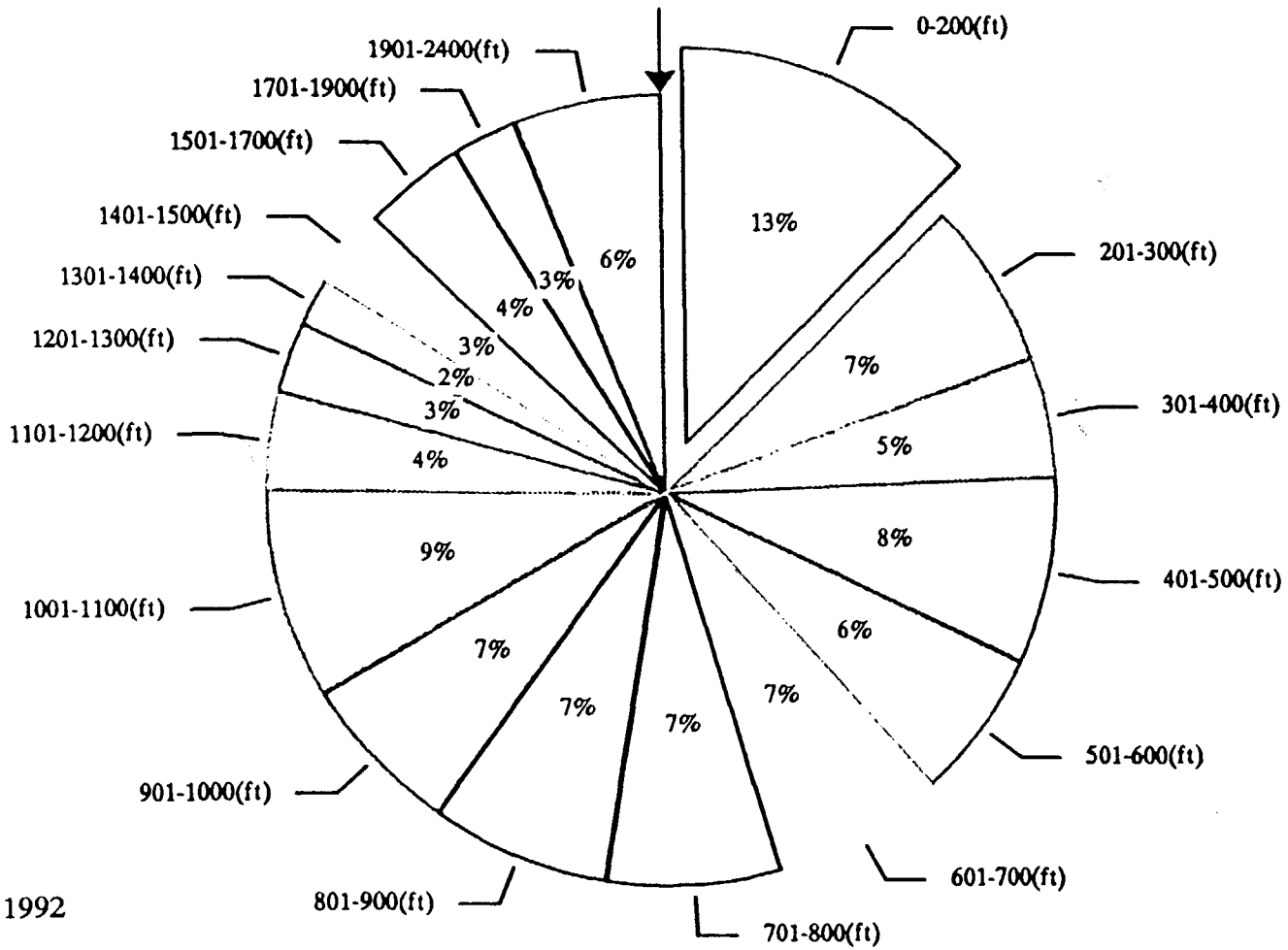
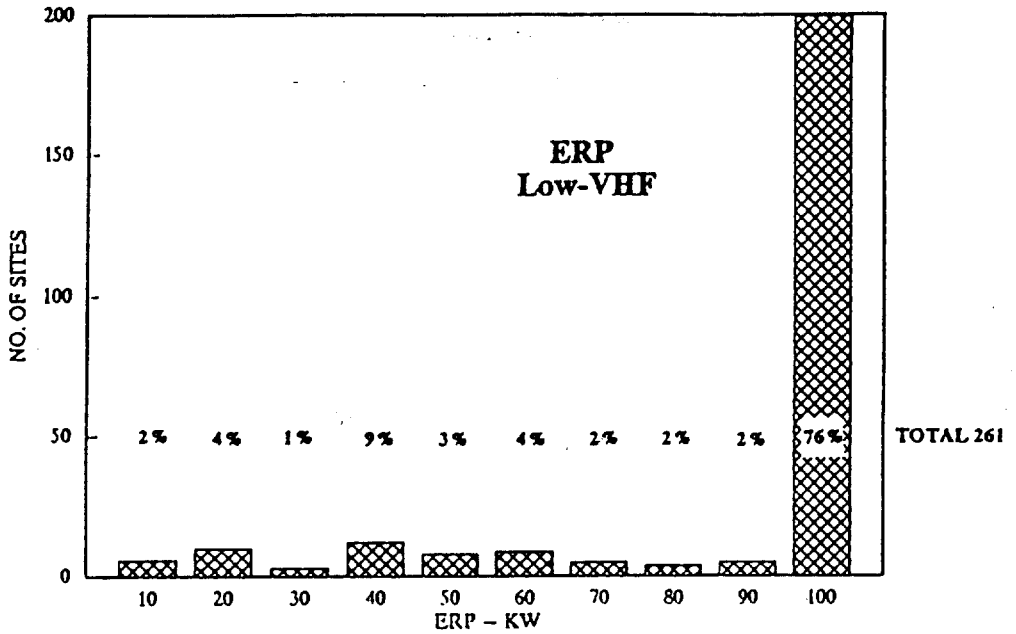
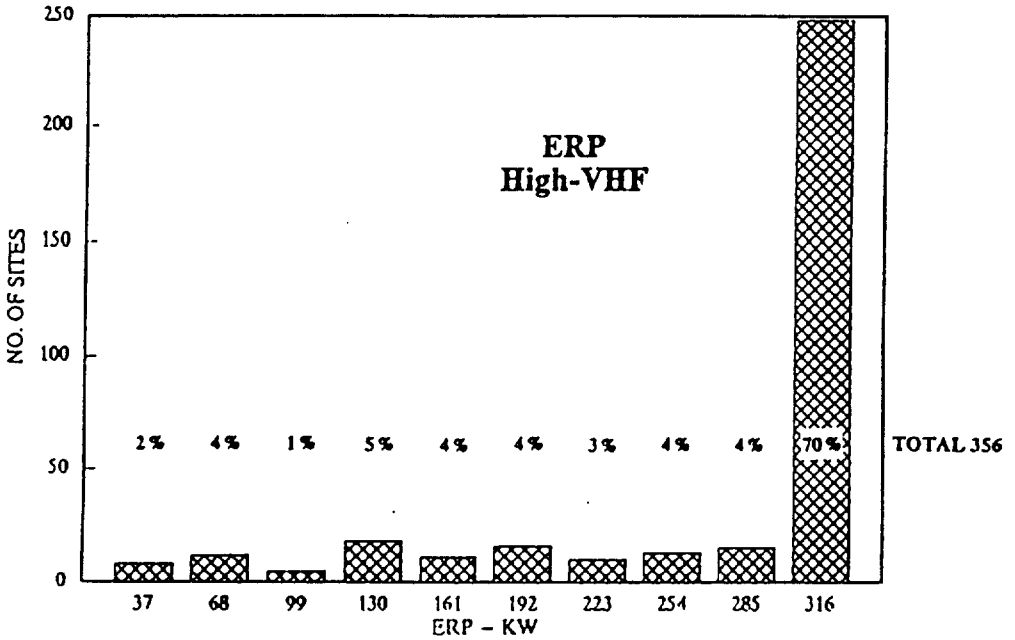
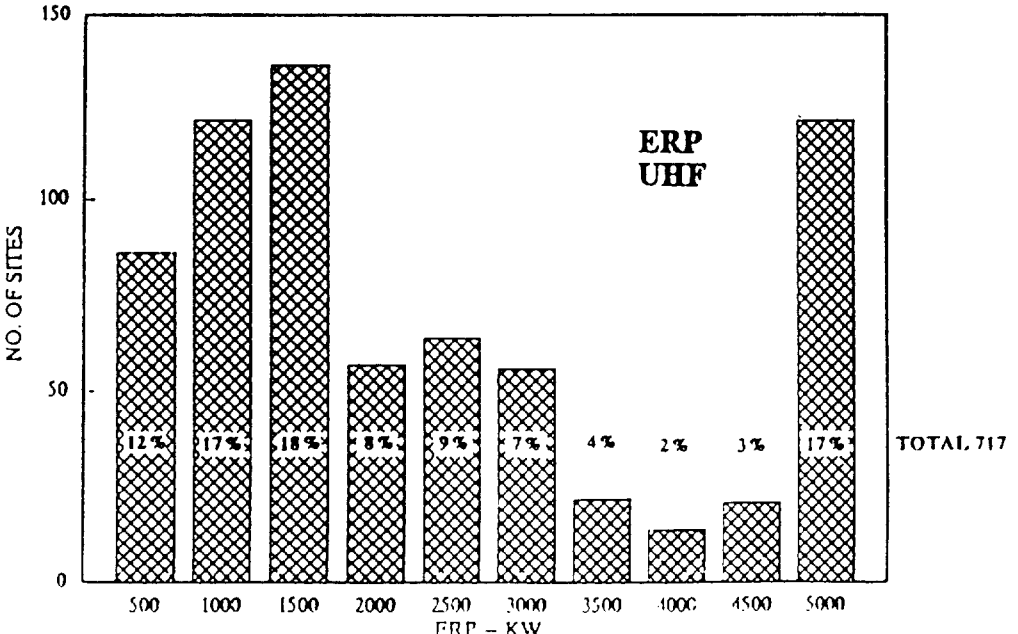
United States Television Broadcast Facilities Transmitting "Height Above Ground" (HAG) Markets 101 through 209 Total Number of Facilities = 451



January 1992


ERP
Low-VHF
NO. OF SITES
200
150
100
50
0
2%
4%
1%
9%
3%
4%
2%
2%
2%
76%
TOTAL 261
10
20
30
40
50
60
70
80
90
100
ERP – KW


ERP
High-VHF
NO. OF SITES
250
200
150
100
50
0
2%
4%
1%
5%
4%
4%
3%
4%
4%
70%
TOTAL 356
37
68
99
130
161
192
223
254
285
316
ERP – KW


ERP
UHF
NO. OF SITES
150
100
50
0
12%
17%
18%
8%
9%
7%
4%
2%
3%
17%
TOTAL 717
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
ERP – KW

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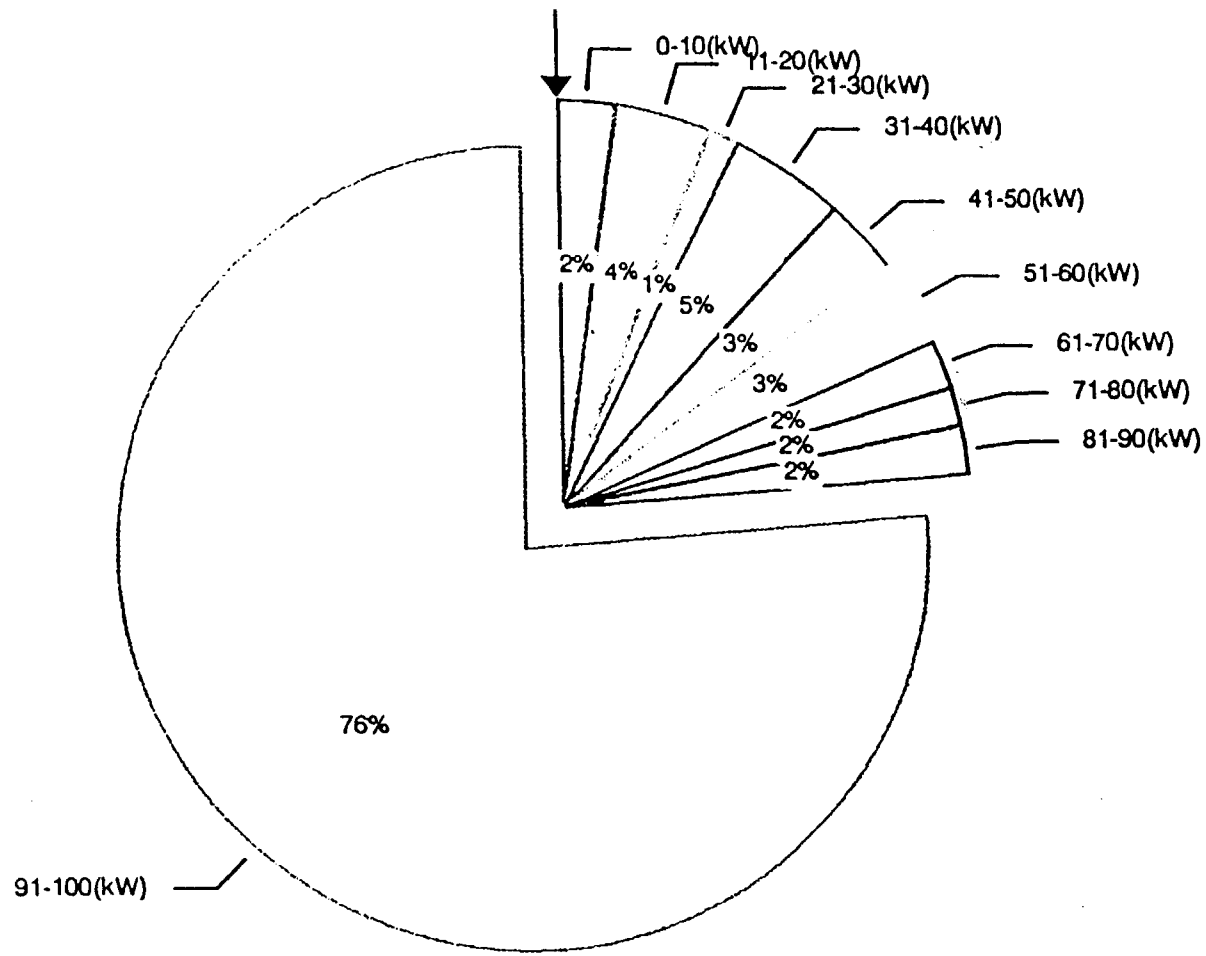
United States Television Broadcast Facilities
"Effective Radiating Power" (ERP)
*** Low VHF Channels ***
Total Number of Facilities = 261



February 1992

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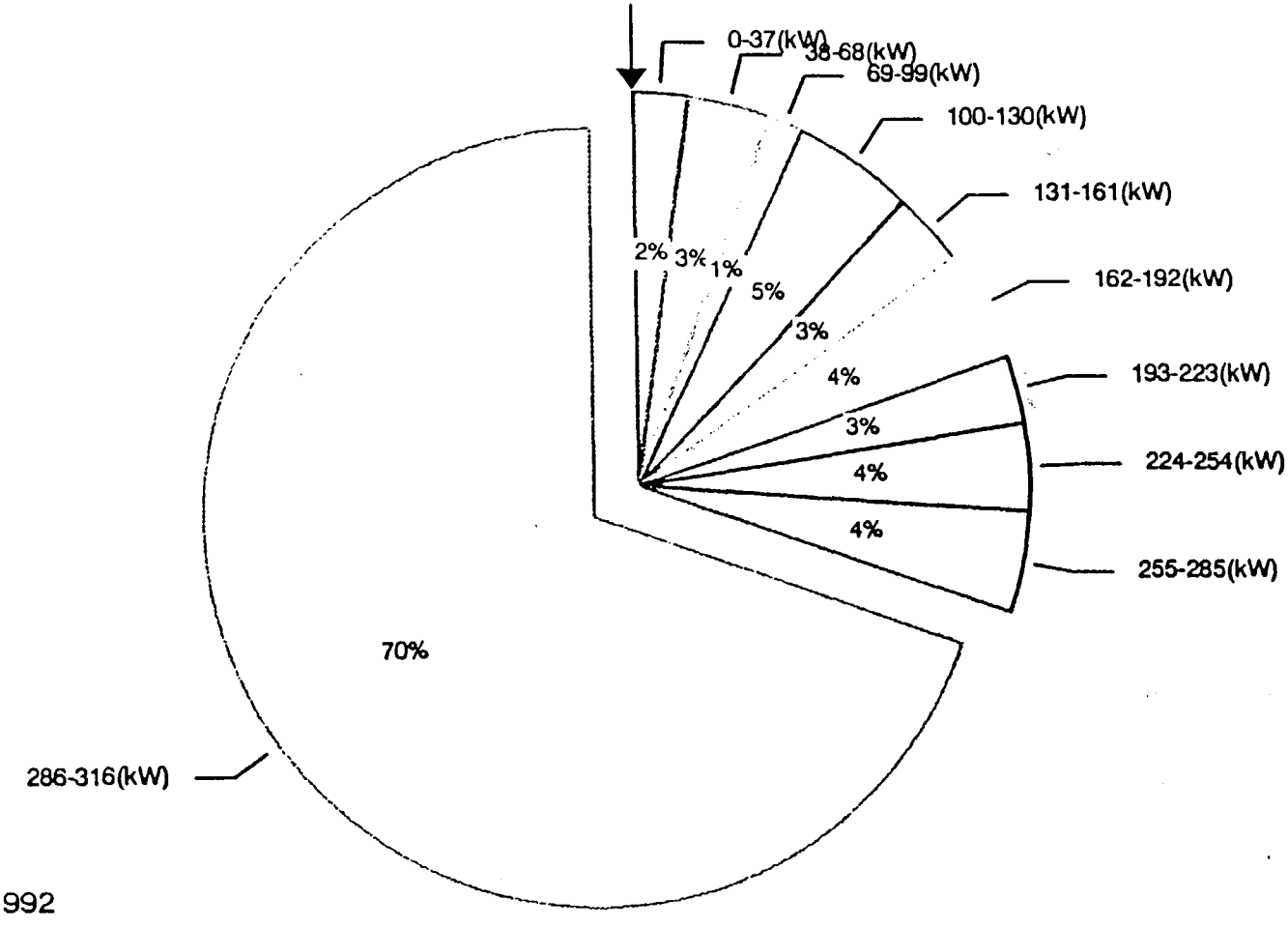
United States Television Broadcast Facilities
"Effective Radiating Power" (ERP)
*** High VHF Channels ***
Total Number of Facilities = 356



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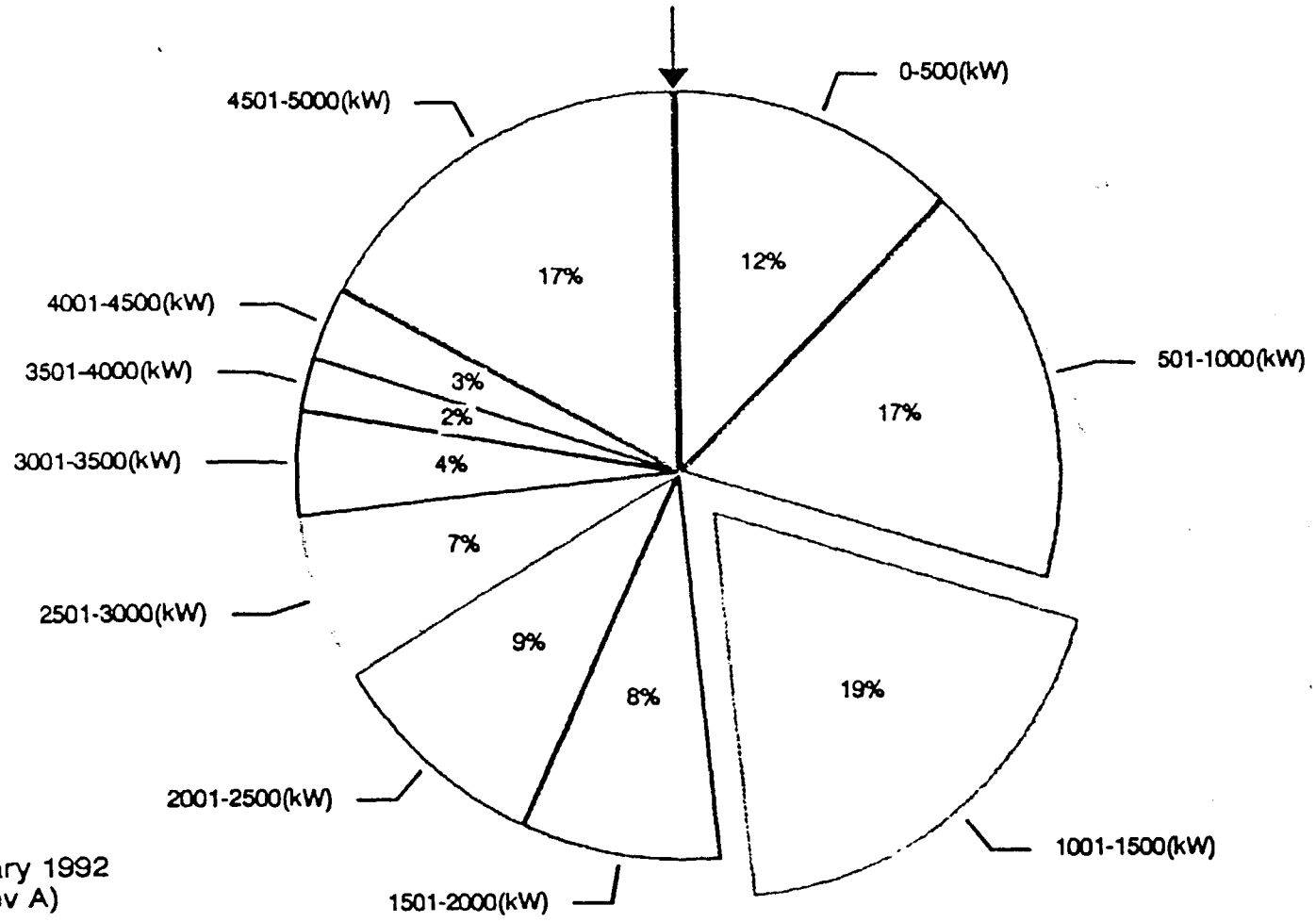
United States Television Broadcast Facilities
"Effective Radiating Power" (ERP)
*** UHF Channels ***
Total Number of Facilities = 717



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(Rev A)