



CHECKLIST: AUDIO DISPLAYS				
CRITERIA	YES	NO	N/A	COMMENTS
1. Are audio displays used when the information to be processed is short, simple, and transitory, requiring immediate or time-based response?				
2. Are audio displays used when the common mode of visual display is restricted by overburdening, ambient light variability or limitation, operator mobility, degradation of vision by vibration, other environmental considerations, or anticipated operator inattention?				
3. Are audio displays used when the criticality of transmission response makes supplementary or redundant transmission desirable?				
4. Are audio displays used when it is desirable to warn, alert, or cue the operator to subsequent additional response?				
5. Are audio displays used when custom or usage has created anticipation of an audio display?				
6. Are audio displays used when voice communication is necessary or desirable?				
7. Are audio displays used with several visual displays only when immediate discrimination is not critical to personnel safety or system performance?				
8. When audio presentation is required is the optimum type of signal presented?				
9. Does the design of audio display devices and circuits minimize false alarms?				
10. Are the audio display device and circuit designed to preclude warning signal failure in the event of system or equipment failure?				
11. Are all audio displays equipped with circuit test devices or other means of operability testing?				
12. Are audio signals provided as necessary to warn or alert personnel and does the alerting/warning system or signal provide the operator with a greater probability of detecting the triggering condition?				
13. Do audio warning signals consist of an alerting signal with the possibility of an identifying or action signal?				
14. When reaction time is critical and a two element signal necessary is the alerting signal 0.5-sec in duration and is all essential information transmitted in the first 2.0-sec of the identifying or action signal?				
15. When a single element signal is permissible is all essential information transmitted in the first 0.5-sec?				
16. When used are caution signals readily distinguishable from normal or warning signals and are they used to indicate conditions requiring awareness, but not necessarily immediate action?				
17. When used in conjunction with visual displays are audio warning devices supplementary or				
18. supportive and are they used to alert and direct operators attention to the appropriate visual display?				



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19. Is the frequency of warning tones different from that of the electric power employed in the system?				
20. Is the intensity, duration, and source location of audio alarms and signals compatible with the acoustical environment of the intended receiver and with the requirements of other personnel in the signal area?				
21. As applicable are audio signals loud enough to be heard and understood through equipment or garments covering the ears of the listener?				
22. Is the intensity of the normal audio signal less than 90 dB(A) at any personnel position and are evacuation signals less than 115dB(A)				
23. Are signals with high alerting capacity provided, when the system or equipment imposes a requirement on the operator for concentration of attention?				
24. Is the onset of critical alerting signals sudden and of sufficiently high volume to attract attention? Is this onset also not so startling as to preclude appropriate responses or interfere with other functions?				
25. When earphones will be worn in the operational situation is a dichotic presentation used whenever feasible?				
26. When the operator is wearing earphones covering both ears during normal equipment operation are the audio warning signals directed to the operator's headset as well as to the work area?				
27. When several different audio signals are to be used to alert an operator to different types of conditions are discriminable differences in intensity, pitch, or use of beats and harmonics and when absolute discrimination is required is the number of signals less than five?				
28. Where discrimination of warning signals from each other is critical to personnel safety or system performance are audio signals appropriately coded?				
29. Are audio alarms intended to bring the operator's attention to a malfunction or failure differentiated from routine signals?				
30. Are the meanings of audio warning signals selected for the system consistent with warning signal meanings already established for that function?				
31. Are established signals used provided they are compatible with the environment and are not used to convey new meaning?				
32. Are audio warning signals prevented from interfering with any other critical functions or warning signals and prevented from masking any other critical audio signals?				
33. When a warning signal delivered to a headset might mask another essential audio signal are separate channels provided?				
34. Are verbal alarms for critical functions at least 20 dB(A) above speech interference level but less than 90 dB(A)?				
35. Is the voice used in recording verbal warning signals distinctive and readily understandable?				



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36. Are verbal warning signals presented in a formal, impersonal manner?				
37. Are verbal warning signals processed only when necessary to increase or preserve intelligibility?				
38. When selecting words to be used in audio warning signals is priority given to intelligibility, aptness, and conciseness in that order?				
39. Do critical warning signals repeat with a 3-sec or less pause between messages until the condition is corrected or overridden by an operator?				
40. When an audio signal is designed to persist as long as it contributes useful information is a shut-off switch provided that is controllable by the operator or by sensing mechanism or by both?				
41. No matter how a warning signal is terminated is an automatic reset function provided?				
42. Are all non-verbal aural annunciations accompanied by a visual annunciation which defines the condition?				
43. Is the volume of an audio warning signal designed to be controlled by the operator or sensing mechanism or both depending on the operational situation and personnel safety factors?				
44. Additionally are control movements restricted to prevent reducing the volume to an inaudible level or to prevent increasing the volume to an unacceptable high level?				
45. When volume controls are ganged is the possibility of intense noise or inaudibility prevented?				
46. Are audio caution signals provided with manual reset and volume controls?				
47. Is audio warning signal duration at least 0.5 sec and does the completion of a corrective action automatically terminate the signal?				
48. In an emergency situation are signals that persist or increase progressively in level used if manual shut-off may interfere with the corrective action required?				
49. Are microphones and associated system input devices designed to respond optimally to that part of the speech spectrum most essential to intelligibility?				
50. When a microphone is used with a selected amplifier is the dynamic range great enough to admit variations in signal input of at least 50 dB(A)?				
51. In very loud, low-frequency noise environments are noise canceling microphones used?				
52. If necessary do speech system input devices employ frequency pre-emphasis?				
53. When peak-clipping (limited to 12 to 20 dB) is employed do the transmission channels show less than 15 dB peak speech to root-mean-square noise ratios?				
54. When the talker is in an intense noise field is a noise shield used?				



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55. When transmission equipment employs pre-emphasis and peak-clipping is not used does reception equipment employ frequency de-emphasis of characteristics complementary to those of pre-emphasis?				
56. When several channels are to be monitored simultaneously by means of loudspeakers are the speakers mounted at least 10° apart in the horizontal plane ranging from 45° left to 45° right of the operators normal forward facing position?				
57. When additional channel differentiation is required, is apparent lateral separation enhanced by applying low-pass filtering to signals fed to loudspeakers on one side of the central operator position? Is a visual signal provided to show which channel is in use?				
58. If listeners will be working in high-ambient noise (above 90 dB(A)) are binaural rather than monaural headsets provided?				
59. Is communication equipment to be worn by an operator designed to preclude operator discomfort?				
60. Are conventional powered operator microphones, headphones, telephone headsets, sound-powered phones, and walkie-talkie radio transceivers designed to permit hands free operation under normal working conditions?				
61. Where communication requirements necessitate the use of several telephone handsets is the accessibility of their standby locations determined by operational priority?				
62. Are accessible volume or gain controls provided for each communication receiving channel with sufficient electrical power to drive sound pressure level to at least 100dB overall when using two earphones?				
63. Where communication channels are to be continuously monitored is each channel provided with a signal-activated switching device to suppress channel now during no signal periods?				
64. When normal working conditions will permit the operator to remain seated at the working position and access to "talk-listen" or "send receive" control switches are required for normal operation are foot-operated controls provided?				
65. Is the speaker's verbal input in phase with its reproduction as heard on the headset and are side tones not filtered or modified before being received in the headset?				
66. In special environments such as control rooms are telephone systems selected that provide a good frequency response and are the system interfaces compatible with operator anthropometry?				
67. Are telephone cords non-kinking or self retracting, long enough to permit operator movement to any position from which phone use may be required, and positioned to avoid entangling critical controls or endangering passing traffic				
68. Are vertically mounted handset cradles designed and located to prevent the handset from being knocked out of the cradle by passing traffic?				
69. Where multiple telephone instruments are located together are they coded to indicate circuit or function?				



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70. Where press-to-talk button is used is the button convenient to both left and right hand operation?				
71. Is switching designed and/or programmed to minimize delay under both normal and emergency conditions and is switching programmed to give the control room and/or functions automatic priority of access to the switching system?				
72. Are volume controls for ringer and speaker output provided in noisy environments?				
73. Have all the potential listeners been identified?				
74. Are special categories of users included, such as older and partially deaf personnel, or instructors as well as operational personnel?				
75. Are hearing thresholds available including masked thresholds where appropriate?				
76. Are panels of at least 10 listeners, representative of the users, available for participation in tests of early acceptability as well as for final evaluation?				
77. To what extent are vision, hearing and particularly speech communication in active use when auditory signals are to be generated?				
78. What information must be transferred to the user?				
79. Is the use of an auditory channel to transfer detailed information avoided?				
80. In consultation with the user, has a decision been made on the need for a confidence signal?				
81. After the selection of meanings for intended auditory signals, have relative priorities been allocated?				
82. Are simple or complex auditory signals required?				
83. What is the vocabulary used with present equipment and has an initial list of keywords been selected for tests of compatibility with user expectancies?				
84. What actions are needed to obtain data on the sound level and spectral composition of each major portion of the mission or duty cycle, which shows a consistently distinct ambient noise characteristic?				
85. In any noise present, are there any periodic fluctuations which will match and therefore mask any temporal patterns intended for auditory signals?				
86. Do intended signals satisfy criteria to avoid hazards to hearing?				
87. Have signal characteristics been selected to ensure signal detection and recognition including cross-system compatibility with functionally similar systems or equipment?				
88. Have signal characteristics been selected to ensure signal detection and recognition including sufficient attention gaining and apparent urgency of signal to conform allocated priority and meaning?				
89. Have signal characteristics been selected to ensure signal detection and recognition including sufficient discrimination of each signal from all others in the set?				



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90. Have signal characteristics been selected to ensure signal detection and recognition including sufficient harmonic components to ensure consistency in perceived sound irrespective of variable degrees of masking by noise?				
91. Have signal characteristics been selected to ensure signal detection and recognition including absence of signal modulations (AM or FM) which are close to periodic fluctuations in environmental noise?				
92. Are sufficient resources available to ensure that a test panel of at least 10 user representative listeners is used?				
93. Are sufficient resources available to ensure that the ambiguity, attention gaining and urgency aspects of signals are tested on skilled personnel carrying out normal duties?				
94. Are sufficient resources available to ensure that real or simulated equipment is available for trained personnel to use during tests, trials and evaluations?				
95. Are sufficient resources available to ensure that all intended auditory signals are tested for mutual compatibility and discrimination?				
96. Are sufficient resources available to ensure that listener tests are carried out in real or simulated conditions of ambient and background noise, and if appropriate, speech and other auditory signals that are sounded simultaneously or close by?				
97. Are sufficient resources available to ensure that the design permits easy and relatively low cost changes in the components generating the auditory signals, thus facilitating response to the results of trials and evaluation?				
98. Are sufficient resources available to ensure that similar flexibility is built into production models to permit adaptation to either new or changing operational conditions?				