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NEC V. INTEL: A GUIDE TO USING "CLEAN ROOM" PROCEDURES AS EVIDENCE

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I. INTRODUCTION

The recent United States District Court decision in *NEC Corp. v. Intel Corp.*[1] has made a significant imprint on the field of copyright law in two respects. The case marks the first time that computer microcode[2] has been held copyrightable,[3] and the first time that "clean room" procedures have been used as evidence in an infringement action.[4] Simply put, clean room procedures comprise a method of creating a certain type of technology without the possibility of influence from outside sources. These procedures may be necessary in situations where the mere creation of the technology gives rise to an inference of copy-

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1. 10 U.S.P.Q. 2d (BNA) 1177, Copyright L. Dec. (CCH) ¶ 26,379, 89 D.A.R. 1715 (N.D. Cal. Feb. 6, 1989) [hereinafter NEC v. Intel]. All subsequent references shall be made to U.S.P.Q.

2. "Microcode" in the sense used herein refers to "a series of instructions that tell a microprocessor which of its thousands of transistors to actuate in order to perform the tasks directed by the macroinstruction set." NEC v. Intel, Memorandum of Decision at 3. *See also* Harris, *Legal Protection for Microcode and Beyond*, 6 COMPUTER/L.J. 187, 189 (1985) (microcode is a set of controlling "microprocessor[s], the central processing unit (CPU) of most personal computers). Each series of instructions within a microcode is usually called "microroutines."

3. *See Verdict for Intel Unlikely to Halt Cloning*, 11 NAT'L L.J., Feb. 20, 1989, at 6, col. 1. The microcode at issue in NEC v. Intel was initially held to be copyrightable pursuant to an earlier order in the case by Judge William A. Ingram. NEC Corp. v. Intel Corp., 645 F. Supp. 590 (N.D. Cal. 1986). However, that order, and all other previous orders and rulings, were later vacated by Judge Ingram in his subsequent recusal from the case. *See infra* p. 464.

4. Kostal, *A "Clean Room" Helped NEC's Microcode Case; Key Evidence Used to Defeat Intel's Infringement Claim; First Time Accepted*, L.A. Daily J., Feb. 10, 1989, at 1, col.2.

right infringement. For example, an inference of copying, and therefore possible infringement, may arise where existing technology is duplicated, or "cloned."

Most scholarly discussion of the case has focused upon the copyrightability issue.[5] This Article is instead intended to serve as a primer for the litigator who wants to use clean room procedures as evidence of non-infringement. Part II addresses the question of what clean room procedures are, and how such procedures can be used as trial evidence from a theoretical perspective. Part III describes the application of the theory developed in the Part II to the clean room evidence in *NEC v. Intel.* Part III is broken down into two subsections. The initial subsection briefly discusses the factual background of *NEC v. Intel.* The next subsection details the factual and legal issues before the court. That subsection contains a detailed description of the clean room procedures NEC used, and the foundation NEC laid at trial for admission of its clean room microcode into evidence. This Article concludes with an analysis of the future utility of clean room procedures as trial evidence.

II. WHAT IS A CLEAN ROOM?

The term "clean room" describes a process of producing a product under conditions guaranteeing independent design and foreclosing the possibility of copying.[6] In the context of the high-technology industry, the clean room process refers to a method of "cloning." Cloning is a method of duplicating an existing technology without infringing on the copyright of the original developer. Thus, in the computer code and software development area, a clean room project is a way of creating compatible code in an environment devoid of outside, "tainting" influ-

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5. *E.g.*, Comment, *Redefining the Limits of Copyright Law After NEC v. Intel*, 28 SANTA CLARA L. REV. 683 (1983) (the discussion in NEC v. Intel that microcode is copyrightable departs from traditional notions of copyright subject matter); Eitel, *Microcode Copyright and the Protection of Microprocessors Under Current Intellectual Property Law*, 21 COLUM. J.L. & SOC. PROBS. 53 (1987) (though NEC v. Intel holds that microcode is copyrightable, the scope of such protection has yet to be tested); Harris, *Legal Protection for Microcode and Beyond*, 6 COMPUTER/L.J. 187 (1985) (NEC v. Intel brings to the forefront the issue of whether copyright law applies to computer microcode).

6. Kostal, *supra* note 4; *see also* Derwin, *Licensing Software Created Under "Clean Room" Conditions*, 2 COMPUTER SOFTWARE 1989: PROTECTION AND MARKETING 441 (Practicing Law Institute, M. Goldberg ed. 1989) [hereinafter Derwin]. The term "clean room" was originally coined to describe a room used in the semiconductor manufacturing process. In that type of clean room outside contaminants such as dust particles are excluded to ensure the purity of the silicon processed there. Hinckley, *NEC v. Intel: Will Hardware Be Drawn Into the Black Hole of Copyright?*, 3 SANTA CLARA COMPUTER & HIGH-TECH. L.J. 23, 69 n.181 (1987).

ences which could suggest copying.[7] The process involves two groups of designers. The first group consists of engineers who analyze the microcode to be copied (the "target code"). The second group consists of the clean room programmer (or programmers—there may be more than one) who programs the microcode to be produced (the "competing code").[8] The programmer is said to be kept in a "clean room" because he or she is provided only with the design specification of the target code; any pieces or examples of the target code are kept out.[9]

Until NEC's use of its clean room procedures as trial evidence, clean room procedures had been used primarily by manufacturers of clone products. These manufacturers use these procedures as a form of "pre-litigation insurance," that is, a method of verifying independent development in order to avoid charges of copyright infringement.[10] For example, clean room procedures enabled Phoenix Technologies Ltd., the company which pioneered the clean room method in 1984, to clone IBM's ROM BIOS.[11] This is the basic input/output system that is the core of many companies' IBM PC compatible computers.[12] Clean room procedures enabled Phoenix Technologies to produce its ROM BIOS without much fear of being the target of an infringement action by IBM.[13] Clean room procedures are also used to avoid potential trade secret problems, such as when an employee leaves a company to work for a competitor, or to set up his or her own competing enterprise.[14] Both are common occurrences in fields of developing technologies.[15] Neil Colvin, the chairman of Phoenix Technologies, underscored the importance of clean room procedures as a cloning method: " 'the clean room method has made the PC compatibles industry. . . . If we didn't have the clean room, we wouldn't have clones. It has become the model for the entire industry.' "[16]

When clean room procedures are used in developing computer software, or, as in *NEC v. Intel*, developing microcode, an infringement action against the party duplicating the technology will probably be unsuccessful; the plaintiff will be unable to prove all the elements of infringement. The elements of a prima facie case of copyright

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7. Kostal, *supra* note 4; Burke, *Court Support of "Clean Room" Cloning May Legalize Intel '386 Chip Work-Alikes*, 6 PC WEEK, Feb. 27, 1989, at 63, col. 3.

8. Davidson, *Common Law, Uncommon Software*, 47 PITT. L. REV. 1037, 1096 n.151 (1986).

9. *Id.*

10. Kostal, *supra* note 4, at 7, col. 3.

11. Burke, *supra* note 7, at 63-64.

12. *Id.*

13. *Id.*

14. Kostal, *supra* note 4, at 7, col. 3.

15. *Id.*

16. Burke, *supra* note 7, at 63.

infringement are: ownership of the copyright at issue by the charging party, and copying by the defendant.[17] When no direct evidence of copying exists, as is usually the case, copying may be shown by circumstantial evidence.[18] The circumstantial evidence must show both "access to the copyrighted work and substantial similarity between the copyrighted work and defendant's work."[19] "Substantial similarity" in turn implies similarity of ideas as well as expression.[20] Thus, the use of clean room procedures to develop compatible software or microcode forecloses the possibility of access to the copyrighted work.[21] Without proof of access, the owner of the copyright on the target product cannot successfully prosecute an infringement action.[22] This is the case even if the resulting code is almost identical to the target code.[23]

The use of clean room procedures as evidence, as with its use as prophylactic "pre-litigation insurance," denies the infringement plaintiff the possibility of satisfying the necessary element of access. The holder of a copyright may still bring an infringement action against the developer of a compatible product notwithstanding the latter's correct use of clean room procedures. However, the use of the developer's clean room procedures as evidence effectively disproves the element of access, destroying the plaintiff's prima facie case.[24] The use of clean

17. Sid & Marty Krofft Television Productions, Inc. v. McDonald's Corp., 562 F.2d 1157, 1162 (9th Cir. 1977) (citations omitted).

18. *Id.*; Reback & Siegel, *Toward a Comprehensive Test for Software Copyright Infringement*, 1 THE COMPUTER LAW. 1, 2 (1984).

19. *Krofft*, 562 F.2d at 1162.

20. *Id.* at 1164.

21. *See, e.g.*, Derwin, *supra* note 6, at 444. Derwin, an attorney at Skjerven, Morrill, MacPherson, Franklin & Friel, and a member of NEC's trial team, calls the element of access the "weak link" in the "continuing campaign of computer industry market leaders to eliminate competition" from clone products.

Derwin also notes, however, that eliminating the element of access appears deceptively simple. For example, in cases where the new product being developed is designed to be functionally compatible with an existing product, such as a microchip, "access to some aspect of the competitor's product is necessary, since it is impossible to design a functionally compatible product without some information about the original product." *Id.* at 445. This "necessary" access could cause a clean room effort to backfire if access were allowed to a part of the competitor's product that was copyrighted or a trade secret. *Id.* NEC v. Intel establishes that access to a competitor's command set, or macroinstruction set, is lawful. *Id.* at 446; *see infra* note 31. Since the law in this area is still evolving, other instances of access may require extensive litigation. Derwin, *supra* note 6, at 446. Such a scenario would cause the clean room developer to lose the advantage of using the process: avoiding suit or terminating suit through summary judgment.

22. Stern, *Software Piracy*, 16 THE BRIEF, Vol. 4, 29, 33 (Summer 1987).

23. *Id.*

24. A copyright holder may conceivably bring an infringement action against the developer of a compatible product notwithstanding the latter's use of clean room procedures. An infringement action would seem likely if the copyright holder either did not

room evidence is much more likely to occur, therefore, in circumstances similar to those occurring in *NEC v. Intel*.

As explained *infra*, the developer of the compatible microcode, NEC, created its clean room microcode *after* Intel had already brought a copyright infringement suit against it.[25] NEC did not even begin developing the code until April 1986,[26] just before the start of the first trial. The clean room microcode was initially developed for "business reasons."[27] However, once development was complete, it became apparent that Intel's microcode and NEC's clean room microcode closely resembled one another.[28] NEC attorneys were perceptive enough to recognize that the results of the clean room procedures would be powerful trial evidence, and suggested using them.[29] Specifically, NEC used its clean room microcode as evidence to demonstrate that the similarities between the Intel microcode and its own code were compelled by constraints inherent in the virtually identical hardware design that both parties used as the basis for their microprocessors.[30] The nature of the hardware and the macroinstruction sets[31] used in both microprocessors limited the programming choices of both the NEC and Intel engineers in developing the respective codes. As a result, the two microcodes appeared substantially similar.

NEC's use of its clean room microcode as evidence demonstrates

know that such procedures were used, or thought that the clean room procedures had been implemented incorrectly. Assuming such procedures were correctly implemented and documented, the defendant in such a case could aptly dispose of the action by a FED. R. CIV. P. 12(b)(6) motion to dismiss, or a Rule 56 motion for summary judgment.

25. *See infra* note 27. Intel's action against NEC was actually brought as a cross-claim to NEC's initial action seeking a declaration of noninfringement.

26. Declaration of Gary Davidian in Opposition to Intel's Motion for Preliminary Injunction, filed Feb. 22, 1987, at 23-25.

27. Kostal, *supra* note 4, at 7, col. 1 (quoting Robert Morrill of Skjerven, Morrill, MacPherson, Franklin & Friel, trial counsel for NEC); The clean room microcode was thought of as an "insurance policy" in case of an adverse decision in the first trial; in case use of the original NEC microcode was enjoined, an alternative, "untainted" code would be available.

28. *Id.*

29. *Id.*; Letter from Alan H. MacPherson to David Elkins (June 22, 1989) (stating that the idea for using the clean room microcode as evidence of constraints was "immediate and obvious" once the microcode was completed).

30. NEC had a license from Intel to duplicate the hardware of Intel's 8086 and 8088 microprocessors to the extent contemplated by Intel's patents. 10 U.S.P.Q. 2d (BNA) at 1177, 1188 (Feb. 6, 1989).

31. A "macroinstruction set" is a defined set of functions which a particular microprocessor is capable of carrying out. NEC's Supplemented and Annotated Findings of Fact and Conclusions of Law (Copyrightability, Infringement, License and Misuse), filed July 19, 1988, July 19, 1988, 12:2-6. A transfer of information from one memory register to another, or an arithmetic operation, such as addition, are examples of such functions. *See id.* at 11:28-12:2.

the type of circumstances under which such evidence is likely to be used in the future. Infringement actions will rarely be brought in cases in which a compatible product has been produced by means of clean room techniques. Thus, the use of clean room techniques as evidence will probably be limited to situations in which such evidence is needed to prove that substantially similar expression was necessitated by technological constraints.

The logical relevance of clean room evidence is in showing that any substantial similarity in expression was compelled by technological constraints, as in *NEC v. Intel*. However, the evidence will be persuasive only if the clean room procedures used demonstrated that development of the clean room product was a truly independent effort. Any sign that the copyright-protected expression[32] of the target product was somehow copied into the clean room product would destroy the efficacy of the clean room product as proof of inherent constraints. The trier of fact could thus not be sure whether any similarity between the products[33] was due to copying or constraints. Therefore, clean room procedures undertaken to generate evidence of technological constraints must be as carefully implemented as clean room procedures undertaken at the initial product development stage, or to prove lack of access.

A. Clean Room Procedures: Requirements

Properly implemented clean room procedures will prove independent development. This is true whether the party is defending the infringement claim by showing a lack of access, or by showing that substantial similarity in expression was compelled by technological constraints. Proper clean room procedures include the following: (1) a lack of knowledge or experience with the target product or code on the part of the clean room programmer; (2) complete separation between the engineer developing the functional specification for the code, and the programmer writing the actual codes; and (3) all communication between the two groups passing through a third party who ensures no infringing material passes from the specification group to the coding group.[34]

32. The Copyright Act states that copyright protection extends only to the expression of original works, and not to any ideas embodied in such a work. 17 U.S.C. § 102 (1988).

33. Since the product involved in NEC v. Intel—the case which serves as the frame of reference for the use of clean room procedures as evidence—was microcode, all subsequent references to the fruit of clean room procedures will involve the terms "microcode" or "code," rather than the generic term "product."

34. *See* Davis, *IBM PC Software and Hardware Compatibility*, 1 The Computer Law. 11, 16-17 (1984); Reback & Siegel, *supra* note 18, at 6, 7.

1. *Unfamiliarity of the Clean Room Programmer with the Target Code*

The first requirement is that the coding programmer must be unaware of, or unfamiliar with, the target code.[35] Finding such a person may be a formidable task.[36] Once a programmer is found, he or she may prepare the compatible code only by using the specification given by the specification group, in addition to publicly available materials.[37] Both groups must be in constant, written communication during the coding process to ensure that the new code is compatible with the target code.

2. *Complete Separation Between the Clean Room Programmer and the Specification Group*

The separation between the engineers developing code specification, and the programmer writing the actual code, should be both physical and communicative. The separation allows the specification group to review and analyze the actual target code—and thus the expression of the target code—in preparing the specification for the compatible code.[38] Provided that no communication between the two groups passes on to the coder any hint of the expression of the target code, access to the protected expression of the target code—at least by way of the specification group—will be foreclosed. The ideas and functions of the target code may, of course, be freely transmitted.[39]

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35. Reback & Siegel, *supra* note 18, at 7; Davis, *supra* note 34, at 17. Derwin states that the clean room programmer, or each programmer if a team is being used, must undergo "rigorous" scrutiny before inclusion into the project. Derwin, *supra* note 6, at 449. This ensures that anyone who has *ever* had access to the target technology is kept off the project. *Id.* Derwin also cautions that persons who are former employees of the competitor should be avoided; even if all access can be disproved, complications in any future litigation are sure to arise. *Id.*

36. *See* Davis, *supra* note 34. For example, finding a person who has not been exposed to the target code may be difficult if the target code is an industry standard with which virtually all programmers are familiar.

37. *Id.*; Reback & Siegel, *supra* note 18.

38. Reback & Siegel, *supra* note 18, at 16-17. Derwin states that access to protected code is legitimate so long as the features of the target product themselves are not trade secrets or copyrighted. Derwin, *supra* note 6, at 447.

Davis advises that while the specifiers may refer to the source code of the target code (the human language-type code that most programmers are written in), technical manuals, and anything else publicly available, the specifiers should refrain from disassembling or decompiling any object code (the machine-language code expressed in series of 1's and 0's, which actually signify high and low electrical currents). Davis points out that the trial court decision in Hubco Data Products Corp. v. Management Assist., Inc., 219 U.S.P.Q. 450, COPYRIGHT L. REP. ¶ 25,529 (D. Idaho 1983) suggests that disassembly itself is a form of copyright infringement.

39. Reback & Siegel, *supra* note 18, at 6, 7.

Therefore, using the *Intel* case as an example, the specification group may transmit to the clean room programmer the idea that the microcode is to perform a certain function or microinstruction, such as addition. This information is not protected because ideas are not subject to copyright protection, and, therefore, may pass to the clean room programmer. However, the specification group would be prohibited from providing the clean room programmer with an example of how to code the microinstruction by using the analog microinstruction from the Intel microcode. To do so would provide the clean room programmer with access to the expression of the Intel microcode. Even if the programmer did not take advantage of the access, the party alleging infringement would be provided with the crucial element of its prima facie case for infringement, the fact of access.

3. *Preventing Access to the Clean Room Programmer: The Gatekeeper*

Reviewing all communications between the specification and coding groups is the third requirement in the successful use of clean room evidence.[40] A third party, independent of both the specification and the coding groups, should act as a "gatekeeper," or liaison, between the two groups.[41] The gatekeeper routes questions and correspondence between the two groups and ensures that the specification group does not accidentally transmit to the coder any material that may infringe the copyright of the target code.[42] Finally, to demonstrate independent development, the gatekeeper(s) should carefully preserve all communication flowing between the groups.[43] Other personnel should keep daily logs, and all drafts and working papers should be preserved.[44]

While no hard-and-fast rule exists as to who the gatekeeper should be, one authority suggests that counsel for the cloning concern should play this role.[45] However, the technical nature of the specification suggests that the gatekeeper role should be filled both by counsel and an independent engineer.[46] A gatekeeper with an engineering or similar technical background is more likely to spot the transmission of protected expression. For example, protected expression written in techni-

40. Reback & Siegel, *supra* note 18, at 7.
41. *Id.*; Burke, *supra* note 7, at 63.
42. Burke, *supra* note 7, at 63.
43. Reback & Siegel, *supra* note 18, at 7.
44. *Id.*
45. *Id.*
46. *E.g.*, Kostal, *supra* note 4, at 1 ("Any communication between the sequestered engineer[s] and source [should be] carefully monitored by attorneys and independent engineers."). Derwin echoes this, explaining that the gatekeeper, or gatekeeping team, must be able to understand the technical information communicated, as well as "evaluate the legal risks involved in sending particular information to the design team." Derwin, *supra* note 6, at 449.

cal language may be copied from—but not identical to—the source code, and then transmitted to the clean room programmer. An attorney who has been indoctrinated in a certain technical area merely for the litigation or to serve as gatekeeper may not have the expertise to identify the transmission of such protected expression. Of course, the optimal situation is when counsel has a prior technical background, so that the gatekeeper is at once both attorney and engineer.

B. The Proper Foundation

The persuasiveness of clean room evidence depends on the proper implementation of the above procedures. Proof of proper implementation provides the foundation for admitting the clean room evidence. Thus, the foundation can be laid simply by demonstrating that the clean room code was independently developed.[47]

The need to demonstrate independent development highlights the importance of carefully documenting all aspects of the clean room process.[48] Since the integrity of the clean room process depends on the complete denial to the clean room programmer of access to the target code, the ability to document such denial is paramount. Documentation should be such that proof of denial of access is conclusive so that even the strongest attack on the integrity of the process may be withstood.

Once the clean room microcode is admitted into evidence, the proponent may then persuasively argue that similarities between the clean room code and the copyrighted target code were due to technological constraints resulting from the physical layout of the microprocessor and the functioning of the macroinstruction set.

The inference that similarities result from hardware constraints logically follows from proof of independent development. Once he or she has a bare knowledge of the technology, a trial judge is fully capable of drawing the conclusion without further expert testimony. This was the case in *NEC v. Intel*. In a jury trial,[49] however, the proponent

47. Proof of independent development should include the declaration of the clean room programmer that he or she had no access to the target code prior to the clean room project. The declaration should also state that at no time during the project was any exposure to the target code given the programmer, either from project members or others. All of the notes and logs of all persons involved should be produced to show independent development. Finally, all communications between the specification group and the clean room programmer must be produced to document the fact of lack of access. The trier of fact would likely find helpful a summary description of each set of logs and notes, and a transcription of handwritten notes.

48. *See supra* note 43; Derwin, *supra* note 6, at 452-53.

49. An infringement case where the subject matter is of a highly technical nature, as in NEC v. Intel, is more likely to be tried before a judge without a jury. This may be due to a perception that it is easier to "educate" a judge about the technical concepts and terminology involved than a panel of laypersons.

of the evidence may want to rely on an expert witness to explain the inferences to be drawn from the clean room microcode. An expert who could explain in lay terms why independent development means that no copying was involved could drive the point home to a jury that might otherwise not follow the logic involved.[50]

III. THE USE OF CLEAN ROOM PROCEDURES AS EVIDENCE IN *NEC V. INTEL*

The preceding section outlined what clean room procedures are, and how such procedures can be used as evidence. This Article next examines how NEC put these theoretical concepts into practice in the litigation against Intel. First, however, it is necessary to put NEC's use of its clean room evidence into the context of the litigation as a whole.

A. *NEC v. Intel*: A Brief History

In April 1978, Intel introduced its 8086/88 microprocessors.[51] These microprocessors, which serve as the electronic "brains" of computers, soon became immensely popular with the personal computer industry.[52] This popularity was primarily due to the use of these microprocessors in IBM personal computers (and in many IBM PC-compatible machines). Approximately two years later, NEC introduced its own version of the 8086, known as the uPD8086,[53] as a second source.[54] While NEC was licensed in 1976 to duplicate the patented hardware of the 8086, NEC was

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50. Under FED. R. EVID. 703, an expert could render an opinion on the results of the clean room procedures without the clean room microcode itself being admitted into evidence. FED. R. EVID. 703 (1983) states:

> The facts or data in the particular case upon which an expert bases an opinion or inference may be those perceived by or made known to him at or before the hearing. If of a type reasonably relied upon by experts in the particular field in forming opinions or inferences upon the subject, the facts or data need not be admissible in evidence.

However, the probative value of a clean room microcode lies in maintaining the integrity of the development process. The proponent of an expert opinion based on such evidence therefore must establish that integrity was maintained at each step of the development process. In other words, a proponent must still pursue a foundation for admission of the clean room microcode as evidence.

51. Dunlap, *NEC v. Intel: A Challenge to the Developing Law of Copyright in the Protection of Computer Programs*, 3 SANTA CLARA COMPUTER & HIGH-TECH. L.J. 3 (1987) (the author of this article, F. Thomas Dunlap, Jr., is general counsel for Intel).

52. Kostal, *supra* note 4, at 7.

53. Hinckley, *supra* note 6, at 26 (the author, Robert C. Hinckley, is general counsel for NEC Corp.).

54. A "second source" is an alternative source of supply for manufacturers of products that use microprocessors. Usually such manufacturers insist that a second source exist in order to ensure adequate supply and price competition. *See* Hinckley, *supra* note 6, at 26 n.11.

not free to duplicate the 8086's copyrighted microcode.[55] Consequently, when Intel discovered that the microcode of the uPD8086 was virtually identical to that of its own 8086, Intel notified NEC that it had infringed Intel's copyright on the 8086 microcode.[56] As a result, the two companies settled their differences in January 1983, and entered into a copyright license agreement.[57]

After the parties entered copyright license agreement, NEC began development of its "V-Series" line of microprocessors.[58] The V-Series were designed to be compatible with the Intel 8086/88, i.e., capable of running the same macroinstruction set, as well as additional new macroinstructions.[59] The V-Series was also designed to run faster and use less power than the 8086/88.[60] While the microarchitecture of the V-Series microprocessors contained some new features, such as a dual bus,[61] the basic V-Series microarchitecture remained very similar to that of the 8086/88.[62]

The first V-Series microprocessors introduced were the V-20 and the V-30.[63] Samples of these microprocessors were given to Intel to analyze, ostensibly to encourage Intel to become a second source for the products.[64] After these samples were provided, but before any response by Intel, rumors began circulating in the computer industry that the V-20 and V-30 infringed on Intel's copyright for its 8086/88 microcode.[65] Worried that this bad publicity would hurt marketing efforts for its V-Series,[66] NEC launched a preemptive strike against Intel by filing suit in federal court. The suit sought a declaratory judgment that Intel's copyrights on its 8086 and 8088[67] microcodes are invalid and/or not in-

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55. *Id.* at 26-27.

56. *Id.*

57. *Id.*

58. *Id.* at 27-28.

59. *Id.* at 28 n.16.

60. *Id.*

61. *Id.* A "bus" is a pathway for the transmission of information, usually between "registers," which are storage locations for information. *See* NEC's Supplemented and Annotated Proposed Findings of Fact and Conclusions of Law (Copyrightability, Infringement, License and Misuse), filed July 19, 1988, at 13:10-14 (citations omitted). The dual bus configuration of the V-Series microprocessors, as contrasted with the single bus configuration of the 8086/88, theoretically speeds up the transmission of information within the microprocessor. *See* Hinckley, *supra* note 6, at 28 n.17.

62. Hinckley, *supra* note 6, at 28.

63. *Id.*

64. *Id.*

65. *Id.*

66. *Id.*

67. Because the 8086 and 8088 microcodes were regarded as identical in the case, this Article will follow the usage of the court and refer to both codes in the singular as the

fringed by NEC.[68] Intel counterclaimed for infringement of its copyrights for those microcodes.[69]

The action was originally assigned to Judge William A. Ingram. A trial was held before Judge Ingram from May 12 to June 10, 1986. Judge Ingram's Partial Decision, Findings of Fact and Conclusions of Law held that the 8086/88 microcode was copyrightable, and that Intel had "good, valid and existing copyrights on its 8086/88 microcode."[70] However, after this decision, NEC learned that one of the investments listed on Judge Ingram's financial disclosure report was an interest in an investment club.[71] Counsel for NEC discovered that the investment club held 60 shares of Intel stock, and notified Judge Ingram that 28 U.S.C. section 455, the judicial disqualification statute, might be implicated.[72] The Northern District of California's Assignment Committee decided that Judge Ingram's investment club interest did not disqualify him from hearing the case. However, Judge Ingram entered an order vacating all his prior findings of fact and conclusions of law, and recused himself from the case.[73]

Following Judge Ingram's recusal, the case was assigned to Senior United States District Court Judge William P. Gray of the Central District of California. After a new trial, Judge Gray entered his decision on February 7, 1989. Once again Intel's microcode copyrights were held to be valid. However, relying heavily on NEC's clean room procedures as evidence of constraints, Judge Gray found that NEC had not infringed these copyrights.[74]

B. Issues Before the Court

The trial court identified the distinct issues in the case as follows: whether Intel's microcodes for the 8086 and 8088 microprocessors were proper subject matter for protection under United States copyright laws; whether these copyrights were forfeited by Intel for failure to af-

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"8086/88 microcode." *See* NEC Corp. v. Intel Corp., 10 U.S.P.Q. 2d (BNA) 1177 n.1 (Feb. 6, 1989).

68. 10 U.S.P.Q. 2d (BNA) 1177.

69. *Id.*

70. NEC Corp. v. Intel Corp., 645 F. Supp. 590, 591 (N.D. Cal. 1986).

71. NEC v. Intel, 654 F. Supp. 1256, 1257 (N.D. Cal. 1987) (opinion by Schwarzer, J., holding that disqualification of Judge Ingram was not justified given the fact that Judge Ingram's interest in the investment club was too remote and too slight to raise a reasonable question as to his impartiality).

72. *Id.* at 1260.

73. *See* Order, filed Dec. 16, 1987.

74. All issues in the case remaining after trial, such as NEC's claims of unfair competition and damages, were settled by NEC and Intel in early December 1989. *See* Kostal, *Computer Code Copyright Ruling Upheld in Settlement*, San Francisco Banner Daily J., Dec. 6, 1989, at 2, col. 4. No appeal was therefore made by either party.

fix copyright notices required by 17 U.S.C. section 401; and whether the microcode developed for NEC's V-Series microprocessors infringed the Intel copyrights for the 8086 and 8088 microcodes.[75]

1. *Copyrightability*

Judge Gray defined microcode as "a series of instructions that tell a microprocessor which of its thousands of transistors to actuate in order to perform the tasks directed by the macroinstruction set."[76] This description, Judge Gray wrote, comes squarely within the Copyright Act's definition of a "computer program," which is "a set of statements or instructions to be used directly or indirectly in a computer in order to bring about a certain result."[77]

A computer program is afforded copyright protection as a "literary work" under 17 U.S.C. section 101.[78] Two requirements must be satisfied for a particular literary work to be copyrightable: the work must be "fixed in any tangible medium of expression," and the work must be "original."[79] Noting that it was undisputed that Intel's microcode is fixed in a tangible medium of expression, the court proceeded to consider the issue of originality.[80]

Judge Gray rejected NEC's contention that Intel's microcode was not original because the microsequences consist of only a few obvious steps. The court pointed out that originality amounts merely to independent creation and that NEC had provided no evidence that Intel's microcode was not independently created.[81]

Judge Gray also rejected NEC's contentions that Intel's microcode does not come within the copyright Act's definition of a computer program,[82] and that copyrightability was precluded by application of the

75. 10 U.S.P.Q. 2d (BNA) at 1177-78. The fourth issue was whether NEC's V20 and V30 microprocessors were merely "improvements" upon its uPD8086 and uPD8088 microprocessors, licensed by Intel under its copyrights. *Id.* at 1178. Because this last issue was raised by NEC only as an alternative basis for relief in case it lost on the infringement issue, the issue is not discussed herein.

76. *Id.* at 1178.

77. *Id.* (quoting 17 U.S.C. § 101).

78. 10 U.S.P.Q. 2d (BNA) at 1178.

79. *Id.* (citing 17 U.S.C. § 102(a)).

80. *Id.* at 1178.

81. *Id.* at 1178-79.

82. NEC argued that microcode does not fall within the Copyright Act definition because the microcode cannot at once be used in a computer and also be a defining part of the computer. The court stated that NEC's argument was "semi-semantical," running counter to authority cited by Intel. *Id.* at 1179 (citing Apple Computer, Inc. v. Franklin Computer Corp., 714 F.2d 1240, 1252 (3d Cir. 1983) (quoting Apple Computer, Inc. v. Formula Int'l, Inc., 562 F. Supp. 775, 780 (C.D. Cal. 1983)).

merger doctrine.[83] Thus, the court concluded, Intel's microcode is copyrightable.

2. *Forfeiture of Copyright*

NEC contended that Intel forfeited its microcode copyrights pursuant to 17 U.S.C. section 401(a).[84] The court found that many copies of Intel's microcode did not contain the required copyright notice.[85] The court also found that Intel did not make reasonable efforts to add the copyright notice after the discovery of omissions by licensees of the microprocessors (including NEC). Finally, the court found that the licensees' omissions in failing to properly mark the products did not violate an express, written agreement that mandated the marking. The court thus found that Intel's initially valid copyrights had been forfeited.

3. *Infringement*

As an alternative basis for its decision, the court next decided the issue of infringement. The court stated that to establish a prima facie case for infringement, "Intel must have a valid copyright, which it did as noted above, establish access to the copyrighted microcode, which is admitted [by NEC], and show substantial similarity between the latter and the accused microcode of NEC."[86]

83. This doctrine was first announced in the landmark Supreme Court decision, Baker v. Selden, 101 U.S. 99, 103 (1879). The doctrine provides that when an "idea" and its "expression" are inseparable, copying the expression will not be barred, since protecting the expression would in effect grant a monopoly of the idea to the owner of the copyright. 10 U.S.P.Q. 2d (BNA) at 1179 (quoting Herbert Rosenthal Jewelry Corp. v. Kalpakian, 446 F.2d 738, 742 (9th Cir. 1971)). The court stated that while this doctrine may be relevant to the issue of infringement, "it should not be the basis for denying the initial copyright." 10 U.S.P.Q. 2d (BNA) at 1179.

84. That statute provides that failure to affix copyright notice to a work invalidates the copyright, with the following exceptions provided by 17 U.S.C. § 405(a): (1) notice was omitted from a relatively small number of copies; (2) a reasonable effort was made to add notice to all copies; or (3) the omission violated an express, written requirement that all copies bear the prescribed notice. 10 U.S.P.Q. 2d (BNA) at 1180 (quoting 17 U.S.C. § 405(a)).

85. The court found that 10.6% of a total 28 million copies of microcode were distributed without copyright notice, and that this amount "cannot reasonable be considered to constitute a relatively small number." 10 U.S.P.Q. 2d (BNA) at 1180.

86. *Id.* at 1183 (citing Cooling Sys. & Flexibles v. Stuart Radiator, Inc., 777 F.2d 485, 491 (9th Cir. 1985)). The court noted that out of the approximately ninety microroutines in the NEC microcode, none was identical to the Intel microcode. 10 U.S.P.Q. 2d (BNA) at 1183. Some of the shorter microroutines, however, did appear substantially similar to their analogues in the Intel microcode. *Id.* The court further noted that similarity between microroutines generally declined as the length of the routines increased. *Id.* at 1183-84. Thus, of the approximately 50 microroutines that Intel alleged to be substantially

The court adopted the "ordinary observer" standard of substantial similarity suggested by Intel. The court declared that " '[t]he test for infringement or substantial similarity is whether the work is recognized by an ordinary observer as having been taken from the copyrighted source.' "[87] The court concluded that "based on its own perusal, as well as upon the conflicting testimony of the experts, that the ordinary observer, considering the accused microcode as a whole, would not recognize it as having been taken from the copyrighted source."[88]

The court stopped short, however, of making that conclusion dispositive of the case. Judge Gray initially stated that "I believe that the foregoing conclusion comes close to resolving the issue of infringement."[89] However, he added, his obligation was "to 'make a qualitative, not quantitative, judgment about the character of the work as a whole and the importance of the substantially similar portions of the work.' "[90] The court stated that some of the shorter, similar microroutines may be very important. If the similarities resulted from copying, the court continued, the court would enjoin NEC from using them. Therefore, analysis of the copying evidence was necessary to gauge whether copying, and not technological constraints, was responsible for the similarities between the two microcodes.[91]

a. *Evidence of Copying*

Intel presented several arguments that NEC created the V20/V30 microcode by copying substantial portions of Intel's 8086/88 microcode. The court found none of Intel's arguments compelling.[92]

Intel's initial argument was that the NEC programmer who wrote its microcode, Hiroaki Kaneko, must have copied the Intel microcode. In support of its argument, Intel noted Mr. Kaneko's inexperience in writing microprograms and the tight schedule under which he was instructed to write the microcode.[93] Intel also noted the fact that compared to Mr. Kaneko's notes on the dissimilar microroutines, many fewer notes were taken on the microroutines that appeared similar, the implication being that fewer notes were needed for the similar

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similar, "most . . . involve simple, straightforward operations in which similarity in approach is not surprising." *Id.* at 1183.

87. 10 U.S.P.Q. 2d (BNA) at 1184 (citing Intel's Proposed Conclusions of Law, para. 5).

88. *Id.*

89. *Id.*

90. *Id.* (quoting Whelan Assoc. v. Jaslow Dental Laboratory, 797 F.2d 1222, 1245 (3d Cir. 1986)).

91. 10 U.S.P.Q. 2d (BNA) at 1184.

92. *Id.*

93. *Id.*

microroutines if they were indeed copied.[94] Intel also argued that because Mr. Kaneko admitted to disassembling the 8086/88 microcode and could not deny having copied portions of it, Mr. Kaneko had copied the Intel microcode. The court, however, found Mr. Kaneko to be a credible witness with superior technical skills and knowledge. The court accepted his testimony that he did not attempt to copy the Intel microcode.[95]

Intel's next argument was that NEC vicariously "admitted" copying during a conversation between two of its corporate officers that occurred in front of an Intel employee. The Intel employee had told the two NEC officers that he thought the 8086/88 microcode had been copied. Allegedly, one NEC officer asked the second one if the allegation was true. The latter allegedly replied, "It is so." Intel argued that although the two NEC officers were speaking in their native Japanese, the Intel employee understood enough Japanese to realize that the second NEC officer had admitted copying. The court, however, found no significance in the conversation, and rejected the argument.

Intel's next argument was based on the presence of a microcode "patch" in both parties' microcodes. Intel argued that the appearance of the patch in NEC's microcode, which had been programmed into its own microcode to circumvent a "bug" in the 8088 microprocessor, indicated "slavish copying."[96] The bug in the 8088 microprocessor had caused Intel to use different microcodes for the 8086 and 8088. Intel argued that rationally, NEC should have created the hardware for the V20 (NEC's analog to the Intel 8088) without the bug, so that the same microcode could run on both the V20 and V30.[97] Instead, Mr. Kaneko

94. *Id.*

95. *Id.*

96. *Id.* at 1185.

97. The Intel 8086 and 8088 microprocessors share a common macroinstruction set; in other words, they can perform identical functions. But for the bug in the hardware of the 8088 microprocessor, Intel could have employed the same microcode for both the 8086 and 8088. An alteration or "patch" had to be placed in the 8088 microcode to circumvent the bug. The NEC V20 and V30 microprocessors, because they are the analogues to the Intel microprocessors, also share a common macroinstruction set. Theoretically, a single microcode could be used for the V20 and V30. However, the V20 microcode contained a patch, resulting in the use of different microcodes for the NEC microprocessors.

Intel argued that NEC knew about the bug in the 8088. Further, Intel argued, it was more efficient and therefore more desirable to use a single microcode for both the V20 and V30. Therefore, Intel concluded, the fact that the patch was present in the V20 microcode indicated that Mr. Kaneko slavishly copied the Intel microcodes. 10 U.S.P.Q. 2d (BNA) at 1185. The court pointed out, however, that this argument was based on the assumption that the V20 microcode was written before the hardware was designed. Intel asserted that the bug in the V20 was designed to accommodate the patch in the microcode. The court found, however, that the opposite was true. *Id.*

copied the Intel microcode patch and all. Thus, the bug had to remain in the V20 hardware.

The court found that this argument, too, lacked merit. The court pointed out that the circuitry for the V20 was in an advanced stage when Mr. Kaneko wrote the microcode.[98] Because NEC was licensed to copy the 8086/8088 hardware, including the bug, it was reasonable to infer that the hardware bug was already in place by the time Mr. Kaneko wrote the microcode. The court was persuaded that the clean room microcode contained the same patch in the same microsequence. The clean room microcode was independently created. Hence, Mr. Kaneko wrote the patch because the V20 hardware required it, not because he copied the disassembled 8088 microcode.

Intel's next to last argument was that one particular microsequence, labeled RESET, was, in the NEC microcode's original form (called "Rev. 0"), almost identical to the 8086/88 microsequence. Because there were many alternative ways of programming the microsequence, as Intel's expert testified,[99] the fact that Mr. Kaneko made almost identical choices in writing the NEC microcode could not be a coincidence.

The court, however, again rejected Intel's argument. NEC's expert testified that programming a microroutine in a certain sequence may obtain better microprocessor performance, although many alternative choices are available. The court also turned once again to the clean room microcode. The court noted that the clean room RESET microsequence was ordered in the same approximate manner as the RESET microsequences in the 8086/88 and Rev. 0 microcodes. Emphasizing that the clean room microcode was independently developed, the court concluded that Mr. Kaneko was likely guided by his independent judgment in choosing a sequential order, and thus did not copy.[100]

Intel's final argument concerned microsequences in NEC's microcode that were substantially similar despite a plethora of programming choices. The court dismissed this argument as well. The court noted that the disputed microsequences were similar only in Mr. Kaneko's first draft of the code, Rev. 0; the programming had been changed in the final version ("Rev. 2"). The Ninth Circuit rule is that " '[copying deleted or so disguised as to be unrecognizable is not copying]'."[101] The court stated, therefore, that since the challenged microcode was Rev. 2, not Rev. 0, and that the challenged microsequences did not appear substantially similar in Rev. 2, Intel was left

98. *Id.*

99. *Id.* at 1186 (citation omitted).

100. *Id.*

101. *Id.* at 1186-87 (quoting See v. Durang, 711 F.2d 141, 142 (9th Cir. 1983)).

with no basis for its claim of copying.[102]

b. Evidence of Constraints: The Clean Room Microcode

In its decision, the court stated that

> [T]he Clean Room microcode constitutes *compelling evidence* that the similarities between the NEC microcode and the Intel microcode resulted from constraints. The Clean Room microcode was governed by the same constraints of hardware, architecture and specifications as applied to the NEC microcode, and copying clearly was not involved.[103]

Therefore, because expression of the simpler microroutines is constrained to a limited range of expression, these microroutines are protected by copyright " 'only against virtually identical copying.' "[104] The court concluded that while NEC appropriated the underlying ideas of the macroinstruction set of the 8086/88, it did so "without virtually identically copying" the limited expression of those ideas.[105] Thus, NEC did not infringe Intel's copyrighted microcode.

NEC's use of its clean room microcode as evidence bears closer examination for two reasons. Because this was the first case in which clean room procedures were admitted as evidence, it serves as the prototype for future use of clean room evidence. Furthermore, it illustrates the model for use of clean room evidence constructed in Part I of this Article.

As noted above, NEC initially began development of the clean room microcode in early 1986, for "business reasons."[106] As discussed below, NEC generally followed proper clean room procedures, first in developing the microcode, and then in laying a proper foundation for admission of the microcode at trial.

i. NEC's clean room procedures

Once NEC decided to develop its clean room microcode in early 1986, it went outside the corporation to search for a programmer to serve as the coder. In April 1986, NEC representatives contacted Gary Davidian, and asked him to perform consulting duties including the task of creating the clean room microcode.[107] Mr. Davidian had considerable experience as a microprogrammer, but had never "come into contact with any microcode created by either NEC or [Intel], or with

102. 10 U.S.P.Q. 2d (BNA) at 1187.

103. *Id.* at 1188 (emphasis supplied).

104. *Id.* (quoting Frybarger v. International Bus. Machines, Inc., 812 F.2d 525, 530 (9th Cir. 1987), and citing Worth v. Selchow & Righter Co., 827 F.2d 572 (9th Cir. 1987)).

105. *Id.* at 1189.

106. Kostal, *supra* note 4.

107. Declaration of Gary Davidian in Opposition to Intel's Motion for Preliminary Injunction, filed Feb. 22, 1988, at 1 [hereinafter "Declaration"].

any microcode designed to execute the instruction set from the Intel 8086/88 microprocessors."[108] Mr. Davidian's lack of knowledge and experience with both the Intel 8086/88 microcode and the original NEC microcode satisfied the clean room procedural requirement that the coder cannot have had prior access to the target code.

NEC also satisfied the next procedural requirement, complete separation between the specification group and the coder (except for screened, written communication). Mr. Davidian created the microcode at his home (the clean room in this instance).[109] All communications between him and the specification group were in writing, and those writings were saved for use at trial.[110] Finally, writings transmitted from the specification group to Mr. Davidian contained only details of the V-Series macroinstruction set and the microarchitecture of the V-Series microprocessors.[111] None of the expressions of either the Intel microcode or the original NEC microcode was included in any communications, despite access to both microcodes by Mr. Belgard and the other NEC programmers in the specification group.[112]

At his home, Mr. Davidian had the use of several computer programming devices to aid him in preparing the code.[113] The devices included a simulator to test the microcode and an assembler which translates microcode into the simulator format.[114]

Finally, NEC satisfied the requirement that a "gatekeeper" monitor all communications between the clean room programmer and the specification group. Daniel R. Siegel, a litigation associate with the firm representing NEC in the instant litigation with Intel, originally conceived of the clean room[115] and served as its gatekeeper.[116] All information transmitted by the specification group to Mr. Davidian, whether written or sent by electronic mail via personal computer, passed through Mr. Siegel. Mr. Siegel then screened each communication to ensure that any clue to either the Intel microcode or the original NEC code was

108. *Id.*; NEC's Supplemented and Annotated Findings of Fact and Conclusions of Law (Copyrightability, Infringement, License & Misuse) [hereinafter "NEC's Proposed Findings of Fact and Conclusions of Law"], filed July 19, 1988, at 23:10-13 (citing NEC Corp. v. Intel Corp., Transcript of Record, Vol. 18 at 3060:4-12).

109. NEC's Proposed Findings of Fact and Conclusions of Law at 23:14-15 (citing Tr. Vol. 18 at 3064:7-3065:19; NEC Ex. 912).

110. *Id.* at 23:15-17 (citations omitted). The specification group was headed by Mr. Belgard, with assistance from Mr. Kaneko. Both men definitely had access to the disassembled Intel microcode.

111. *Id.* at 23:19-24:4 (citations omitted).

112. *Id.*

113. *Id.* at 24:6-17 (citations omitted).

114. *Id.*

115. Tr. Vol. 18 at 3197:1-5.

116. *Id.* at 3203:3-8 and at 3208:21-24.

removed.[117]

ii. NEC's foundation for admission of its clean room microcode as trial evidence

NEC's foundation for admitting the clean room evidence showed that the clean room microcode was created without access to either the Intel or the original NEC microcodes. NEC structured its foundation in proper sequential manner as set forth above: the clean room programmer, Mr. Davidian, was unfamiliar with both the Intel and original NEC microcodes; there was complete physical and communicative separation between Mr. Davidian and the specification group, which was led by Richard Belgard; and all communications conveying the specification to Mr. Davidian went through the gatekeeper, Mr. Siegel.

A clean room team effort consists of three components: the clean room programmer, the specification group, and the gatekeeper. Each component is a potential source for providing access which would destroy the integrity of the clean room process. A proper foundation must therefore demonstrate that integrity was maintained at each step of the process. NEC's foundation established that such integrity was maintained.

(a) Trial testimony of the clean room programmer: Gary Davidian

NEC first offered the testimony of Mr. Davidian. After testifying to his academic accomplishments and work experience,[118] NEC counsel asked Mr. Davidian whether he had ever seen microcode created by either Intel or NEC. Mr. Davidian answered in the negative.[119] This testimony merely repeated averments in Mr. Davidian's pretrial declaration that he had never seen any microcode designed to execute the Intel 8086/88 instruction set.[120] The testimony was intended to negate any inference suggesting that the clean room microcode was tainted *ab initio* by Mr. Davidian's prior knowledge. Mr. Davidian also testified that during the clean room project he did not have any substantive communications with anyone about his work on the clean room microcode.[121]

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117. *Id.*

118. Mr. Davidian testified that he received both a B.S. and an M.S. in Computer Science from the State University of New York at Buffalo. Tr. Vol. 18 at 3058:20-21. Mr. Davidian also testified to his work experience in the microcode field, which including developing microcode at Nanodata, Data General and Rational Corporations. *Id.* at 3058:22-3059:2.

119. *Id.* at 3060:4-7.

120. Declaration of Gary Davidian in Opposition to Intel's Motion for Preliminary Injunction, filed Mar. 22, 1988.

121. Tr. Vol. 18 at 3084:17-3088:12. Mr. Davidian's employment contract with NEC for his work on the clean room project contained provisions prohibiting him from communi-

This testimony negated any further inference that the clean room microcode was tainted by outside influence once Mr. Davidian began work on the project.

Mr. Davidian also testified about the documentation of his restricted access to information while he developed the clean room microcode. Documentation efforts were undertaken pursuant to written procedures developed by NEC attorneys.[122] These procedures provided for documentation of all clean room work performed by Mr. Davidian: all of Mr. Davidian's written notes were kept in a log book; he kept copies of the microcode and files that he created each day; and he sent NEC daily status reports, advising NEC of what he had accomplished each day and asking any questions that he had.[123] Mr. Davidian testified that NEC messengers periodically picked up copies of his work, including his log book and the second-most recent listing of his microcode.[124]

(b) Trial testimony of the specification Engineer: Richard Belgard

NEC next called Richard Belgard to the stand. Mr. Belgard served as chief of the specification group during the clean room project.[125] Belgard also played a large role in selecting Mr. Davidian as the clean room programmer.[126] After summarizing his technical background,[127] Mr.

cating with certain specified persons. *Id.* at 3087:1-7. The contract also contained a provision prohibiting him from disclosing to anyone, other than those directly involved with the clean room project, that he was consulting for NEC. *Id.* at 3085:23-25. Mr. Davidian testified at trial that during the clean room he did in fact have two conversations with Richard Belgard, chief of the specification group. One conversation was at a wedding and another at a microprogramming conference that both men attended. *Id.* at 3084:17-3086:8. At neither time did they discuss anything related to the substance of the project. *Id.* Mr. Davidian also testified that he had lunch with a friend, Kimberly Harms, who was included in a class of persons with whom Mr. Davidian was prohibited from speaking. *Id.* at 3086:23-3088:4. Nothing substantively related to the clean room project was talked about at that meeting. *Id.*

122. *See id.* at 3064:2-6. These written procedures were produced in NEC's Trial Exhibit 912.

123. *Id.* at 3064:13-22.

124. *Id.* at 3064:23-25.

125. *Id.* at 3151:10-3152:18.

126. *Id.* at 3149:13-3150:12.

127. Mr. Belgard testified that he had received bachelor's and master's degrees from the State University of New York at Buffalo "around 1972 or '3," but neglected to state the subject his degrees were for. *Id.* at 3147:24-3148:2. Mr. Belgard's work experience included microprogramming work at Burroughs Corp., Data General Corp. and Rational Corp. *Id.* at 3148:3-13. Mr. Belgard also stated that he had been chairman and vice-chairman of the Association for Computing Machinery, Special Interest Group on Microprogramming, and at the time of trial was the president of Embedded Performance, a firm building "software and hardware tools for reduced instruction set microprogramming." *Id.* at 3148:14-24.

Belgard testified that during the pendency of the clean room project, he did not communicate directly with Mr. Davidian.[128] All questions directed from Mr. Davidian to the specification group asking for clarification were sent to the gatekeeper, Mr. Siegel, who in turn passed the questions on to Mr. Belgard. Mr. Belgard testified that he never received questions or microcode directly from Mr. Davidian,[129] and that none of the materials he sent to Mr. Siegel for transmission to Mr. Davidian contained descriptions of the NEC or Intel microcodes.[130] Belgard's testimony, corroborated by that of the clean room programmer, Mr. Davidian, established that the programmer did not have access to either Intel's or NEC's original microcode. The testimony was essential in establishing that the programmer did not have access from the second component of the clean room effort, the specification group.

Mr. Belgard further testified that the specification he created, with assistance from NEC engineers, including those in Japan, was compiled from various NEC documents which predated the clean room effort.[131] Mr. Belgard's access to the Intel and NEC microcodes is, however, irrelevant. The most important requirement of a clean room effort is that the clean room programmer not have access to the target code, and to document that fact.[132] Assuming that the gatekeeper successfully monitors the specification transmitted to the programmer in order to remove any references to the target code, access to the target code by anyone else involved in the project does not matter.[133]

(c) Trial testimony of the gatekeeper: Daniel Siegel

Daniel R. Siegel, an attorney for Skjerven, Morrill, MacPherson, Franklin & Friel, the law firm representing NEC at trial, played the role of the clean room gatekeeper.[134] Mr. Siegel acknowledged that he had probably suggested the idea of the clean room effort and that the clean room was originally thought of as an "insurance policy" in case of an adverse decision in the first trial.[135] If NEC's use of its original microcode were enjoined, NEC could replace it with microcode that

128. *Id.* at 3150:17-24. Mr. Belgard corroborated Mr. Davidian's testimony that, while the two men had spoken to each other twice during the pendency of the clean room project, their communications involved only "social chitchat." *Id.*; *see supra* note 120.

129. Tr. Vol. 18 at 3163:15-24.

130. *Id.* at 3171:9-24.

131. *Id.* at 3152:19-23.

132. *See id.* at 3202:13-20 (testimony of Daniel R. Siegel).

133. *Id.*

134. Kostal, *supra* note 4, at 7, col. 2. Mr. Siegel is now an associate with the advanced technologies group of the law firm Irell & Manella in Menlo Park.

135. Tr. Vol. 18 at 3197:1-14; Letter from Alan H. MacPherson to David Elkins (June 22, 1989) (stating that the idea for using the clean room microcode as evidence of constraints was "immediate and obvious" once the microcode was completed).

could be proven to be untainted by virtue of its development in the clean room.[136] The ultimate purpose of the clean room, as described by Mr. Siegel, "was to document that microcode had been created without access to Intel's microcode or to any microcode, Intel or NEC; and, therefore, to demonstrate that that microcode hadn't been copied and to provide documentary evidence of that."[137]

Because of the technical nature of microprocessor specification and microcode itself, the role of gatekeeper should be filled by two persons, an attorney and an independent engineer, unless that role could be filled by an attorney who was qualified as an engineer.[138] Mr. Siegel had the requisite education and experience to fill both roles. He received a bachelor of science degree in computer science from Brown University in 1980, later received a law degree, and was admitted to practice law in 1983.[139] Mr. Siegel was well-suited for the role of gatekeeper.

All information going to Mr. Davidian passed through Mr. Siegel.[140] Siegel screened the information to ensure that any access to the Intel or NEC microcode possibly contained in that information was removed.[141] Mr. Siegel testified that he reviewed the specification developed by Mr. Belgard in "great detail. . . . I went through it literally word by word a number of times and made various modifications to it and suggestions and so forth."[142] Despite Mr. Belgard's testimony that nothing in the specification contained information that might be considered access to the Intel of original NEC microcodes,[143] Mr. Siegel occasionally removed parts of the specification and reworded other parts because he thought access might be imparted.[144] Mr. Siegel's testimony therefore established that the gatekeeper role was properly carried out. Siegel

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136. *Id.*

137. *Id.* at 3198:4-11.

138. Burke, *supra* note 7, at 7.

139. Tr. Vol. 18 at 3195:23-3196:18.

140. *Id.* at 3203:3-8.

141. *Id.*

142. *Id.* at 3204:19-25.

143. *Id.* at 3171:19-24.

144. *Id.* at 3207:23-3208:15. Mr. Siegel described one instance where he asked Mr. Belgard to omit a part of the specification as follows:

> . . . Mr. Belgard provided an example of how a particular piece of hardware worked in the microarchitecture and he did so by giving an example using microcode, because oftentimes by looking at microcode you can see how that particular piece of hardware works.
>
> It occurred to me that Intel might jump on the fact that there's microcode in the specification and say that we were somehow giving Mr. Davidian access to the Intel or [original] NEC microcode. That type of information I took out but that's just one example, but there were others.

Id. at 3208:5-15.

exercised due care in ensuring that all possible access to the target code was eliminated from communications to the clean room programmer.

(d) Intel's choice not to use expert witnesses at trial to establish/ contest the validity of the clean room microcode as an indication of constraints

Neither NEC nor Intel used independent expert testimony to establish or contest the validity of clean room results as an indication of hardware constraints.[145] The court found the clean room microcode to be "compelling evidence that the similarities between the NEC microcode and the Intel microcode resulted from constraints."[146] Therefore, NEC's decision not to use independent expert testimony to show that its clean room procedures were correct did not effect its case. Intel, however, could have profited by successfully contesting NEC's assertions that the clean room microcode was conclusive proof of a lack of infringement. Intel could have done so by having an independent expert testify that NEC's clean room procedures were improperly executed.

During the pretrial motion period before the second trial, Intel filed a Motion to Exclude the "Clean Room" Microprograms. Intel's arguments for excluding the clean room microcode from evidence during trial were based mainly on its assertion that the evidence was "manufactured."[147] Intel charged that the communications between Mr. Davidian and the specification group tainted the clean room process, and the fact that all communications passed through a gatekeeper, Mr. Siegel, was a "formalistic" claim of no contact.[148] While Intel later suggested it was contemplating the use of an expert witness at trial to establish that "NEC did not follow acceptable industry practice in developing its so-called 'clean room' microcode,"[149] Intel did not use such a witness at trial.

The apparent reason for Intel's inaction with regard to expert testimony on the clean room procedures is that it had no realistic means of attacking the clean room results. That conclusion is arrived at by examining Intel's post-trial brief.[150] Intel did not attack NEC's clean room methodology as improper. Rather, Intel argued that the clean room

145. Each party employed its own expert, yet neither expert testified as to the validity of clean room procedures, or why such procedures either do or do not indicate lack of access.

146. 10 U.S.P.Q. 2d (BNA) at 1188.

147. Intel's Reply Memorandum in Support of Its Motion to Exclude the "Clean Room" Microprograms at 2, filed Mar. 18, 1988.

148. *Id.*

149. *See* Intel's Statement of Witness Testimony at 14, filed June 8, 1988.

150. Intel's Post-Trial Memorandum for the Court, filed July 18, 1988.

microcode illustrates that choices were available to the original NEC programmer, Mr. Kaneko, despite any claimed constraints.[151]

As the court pointed out in its opinion, however, that argument is irrelevant. The substantial changes made to the original NEC microcode, Rev. 0, prior to NEC's release of its final version as Rev. 2, made useless any claim that Rev. 0 infringed.[152]

(e) Summary of NEC's foundation at trial

In establishing the freedom of the clean room microcode from the influence of the prior Intel and NEC microcodes, NEC presented the necessary witnesses and elicited from them the required information. NEC examined the three witnesses who had direct knowledge of the "purity" of the clean room microcode: the clean room programmer, Gary Davidian; the engineer with primary responsibility for developing the specification, Richard Belgard; and the gatekeeper, Daniel Siegel. Each testified to the procedures their tasks involved, and that at all three steps in the process of developing the clean room microcode, no access was provided.

In addition to witness testimony, NEC produced its documentation of the clean room microcode, including Mr. Davidian's notes, records of his daily progress in developing the microcode, and records of both written and computer modem communications between Mr. Siegel and Mr. Davidian. Intel was unable to successfully point to any communication between Mr. Siegel and Mr. Davidian and claim that access to the Intel or original NEC microcodes was imparted.

(f) Could NEC have done a better job laying its foundation?

NEC's trial team successfully admitted the clean room procedures as evidence. And, as indicated above, the foundation for admission was laid in such a way that Intel had no meaningful basis upon which to attack the integrity of the clean room process. Criticism of NEC's trial team, therefore, is difficult in light of its success.

One commentator, however, has indirectly suggested how NEC might have reinforced its argument for admissibility. That suggestion is to have the clean room process audited by an independent expert.[153]

151. *Id.* at 26.

152. *See* 10 U.S.P.Q. 2d (BNA) at 1186-87 (quoting See v. Durang, 711 F.2d 141, 142 (9th Cir. 1983): "Copying deleted or so disguised as to be unrecognizable is not copying"; and quoting Eden Toys, Inc. v. Marshall Field & Co., 675 F.2d 498, 501 (2d Cir. 1982): " 'a defendant may legitimately avoid infringement by intentionally making sufficient changes in a work which would otherwise be regarded as substantially similar to that of the plaintiff' " (quoting in turn Warner Bros. v. American Broadcasting Cos., 654 F.2d 204, 211 (2d Cir. 1981))).

153. *See* Derwin, *supra* note 6, at 454-56. Derwin's article is directed to a potential li-

This independent expert or auditor[154] should investigate the following areas:

(1) Selection of the clean room programmer, to ensure no prior access to the target;

(2) The clean room procedures themselves, to ensure that access to copyrighted sources or trade secrets was foreclosed;

(3) Communications between the specification group and the clean room programmer, to ensure that no access was imparted;

(4) Documentation of the clean room process, to ensure no gaps exist; and

(5) Interviews with all clean room personnel, to ensure that procedures were properly followed and that no access was imparted to the programmer.[155]

Hopefully, the auditor will conclude that the clean room procedure and its documentation constitutes solid evidence of lack of access. The auditor's report, and the testimony of the auditor at trial, should render both the foundation for admission of the clean room procedures into evidence, and the admission evidence itself, even more unassailable.

The problem with performing such an audit lies, of course, with the added expense. A clean room is expensive enough to operate without having to pay an expensive hourly rate just to have extra, and probably unnecessary, ammunition. Further, NEC was quite capable of admitting and using its clean room evidence without the need for an audit. However, as use of clean room procedures as evidence proliferates, inventive methods of defending against it are sure to arise. When that day comes, some kind of auditing process may well prove to be an integral part of the clean room process.

iii. *The court's reliance on the clean room microcode as evidence of constraints*

As noted above, the court considered the similarities between the Intel 8086/88 microcode and the independently developed clean room microcode to be "*compelling evidence*" that similarities between the

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censee of a product created under clean room conditions. Derwin writes that a potential licensee of such a product should prepare an audit of the licensor's clean room procedures. *Id.* at 454. Such an audit will expose any problems in the latter's product development, *id.* at 454-55, and thus reduce the risk of litigation against the potential licensee by the manufacturer of the target product.

154. The auditor should be familiar with both the legal and technological principles involved in a clean room. Thus, the likely candidates for auditor are either law firms with experience in managing clean rooms, or consultants with the requisite legal and technological experience.

155. Derwin, *supra* note 6, at 455-56.

shorter, challenged microsequences were the result of constraints.[156] The court found this conclusion reinforced by the fact that "the similarities between the Clean Room microcode and Rev. 2 are at least as great as are the similarities between the latter and the Intel microcode. . . . The strong likelihood follows that these similarities . . . also resulted from the same constraints."[157]

The importance of convincing the court that similarities between the Intel and NEC microcodes was caused by constraints lies in triggering the *scenes a faire* doctrine.[158] That doctrine is "applied in infringement cases to ' "expression . . . which necessarily results from the fact that the common idea is only capable of expression in more or less stereotyped form." ' "[159] When this doctrine is triggered, expression will be protected only against virtually identical copying.[160] Therefore, by using its clean room microcode as evidence of constraints, NEC narrowed the standard of protection for the Intel microcode. That standard was shifted from "substantially similar," which the court conceded the shorter, simpler microroutines to be, to "virtually identical copying." The court was clearly unconvinced that the NEC microcode violated the latter standard.

Finally, NEC's use of its clean room microcode as evidence almost certainly made a close case a bit easier to decide for the court.[161] Daniel R. Siegel, the attorney who managed NEC's clean room project, opined that without the clean room microcode, the judge would have been simply left with " 'two programs that are similar, and two explanations. Intel says it was copied, and NEC says it had to be that way.' "[162] "[Judge] Gray would have probably needed a much more sophisticated under-

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156. *See supra* p. 470 (citing 10 U.S.P.Q. 2d (BNA) at 1184 (emphasis supplied)).

157. NEC Corp. v. Intel Corp., 10 U.S.P.Q. 2d (BNA) at 1188. The court pointed out that the fact that greater similarities exist between the clean room microcode and Rev. 2, than between the latter and the Intel microcode, "is made evident by an examination of Exhibit 705." *Id.* Exhibit 705 (which is part of the sealed court record) is a series of tricolumnar graphics which depict the microroutine coding differences between the three microcodes listed above.

158. *Scenes a faire* are events or settings that naturally flow from a given situation or idea; since an idea is not copyrightable, and the idea can be expressed in no way other than through the particular *scene a faire*, the *scene a faire* itself is not copyrightable. *See* Whelan v. Jaslow, 797 F.2d 1222, 1236 (3d Cir. 1986); *see also* Yankwich, *Originality in the Law of Intellectual Property*, 11 F.R.D. 457, 462-65 (1951) (explaining the *scenes a faire* doctrine as it relates to drama and literature).

159. Frybarger v. International Business Machines, 812 F.2d 525, 530 n.3 (quoting Atari, Inc. v. North American Philips Consumer Elecs. Corp., 672 F.2d 607, 616 (7th Cir. 1982), in turn quoting M. NIMMER, 3 NIMMER ON COPYRIGHT § 13.03[A][1], at 13-28 (1986)).

160. *Frybarger*, 812 F.2d at 530 (citing Atari, 672 F.2d at 616; Sid & Marty Krofft v. MacDonald's Corp., 562 F.2d at 1168).

161. *See* Kostal, *supra* note 4, at 7.

162. *Id.*

standing of the expert witness' testimony in this area without the clean room evidence."[163]

IV. THE FUTURE UTILITY OF CLEAN ROOM PROCEDURES AS EVIDENCE

While the concept of clean room procedures is relatively new, dating back only to 1984,[164] its use has grown since then.[165] Given NEC's success, the use of such procedures will continue to increase as a defense in copyright and trademark infringement cases and as a type of pre-litigation insurance.[166] Two limitations on the use of clean rooms exist, however, indicating that they may never become a standard practice in the realm of developing technology.

One limitation on using clean room procedures is the cost. Phoenix Technologies, for example, spent twice as much to clone IBM's ROM BIOS in a clean room as it would have spent if the procedure had not been used.[167] Another company, Chips & Technologies, Inc., spent $3 million on its clean room procedures while developing a line of microprocessors.[168] Such prohibitive costs may force many small, young start-up companies to avoid performing clean room projects. Instead, these companies may proceed with their cloning projects and take their chances on being sued for infringement. Such companies, however, still have the option of going back and performing a clean room procedure, as NEC did, to prove that expression of the common idea is constrained.[169]

The other limitation is that use of clean room procedures as evidence may be constrained itself. Because "there are few situations where the [technological] constraints are as strong as they are in the area of microcode,"[170] the use of clean room evidence may not be necessary outside the realm of disputes involving microcode or similar types of high technology. However, confining the use of clean rooms to cases involving microcode only limits the scope of such use. Limiting the use of clean rooms to microcode and related cases does not appear to be much of a numerical limitation on the number of clean rooms that will be performed, considering the number of enterprises currently occupying the field, and the number who may be jumping in, encouraged by

163. *Id.* (citing Daniel R. Siegel).
164. *See* Burke, *supra* note 7, at 63.
165. *See* Derwin, *supra* note 6, at 441.
166. *See* Kostal, *supra* note 4, at 1.
167. Burke, *supra* note 7, at 63-64.
168. *Id.* at 64.
169. Kostal, *supra* note 4, at 7.
170. *Id.* (citing Hans R. Troesch, a partner with the law firm Graham & James in Palo Alto).

NEC's success.[171]

While these two limitations may limit the use of clean rooms in product development, NEC's successful use of clean room procedures may just as likely cause the opposite effect. Since, as NEC demonstrated, clean room procedures may be used as evidence, such procedures may serve not only as pre-litigation insurance by decreasing the likelihood of an adverse judgment, but also as a disincentive against even filing a lawsuit. This latter effect follows from proper implementation of clean room procedures; proof of such procedures should constitute prima facie evidence of lack of access, compelling a finding of noninfringement. In short, a properly implemented and documented clean room should "maximize the possibility of terminating a lawsuit at the summary judgment stage,"[172] making a lawsuit futile. If litigation is thwarted or reduced as a result of clean room development, the cost of staging the procedure could be more than offset by foregone litigation costs.[173]

Thus, while the utility of clean room procedures as evidence will never reach the point of a standard practice, its use does promise to be an important new addition to the arena of copyright and trademark infringement litigation. Even if a company chooses not to implement clean room procedures in developing competitive technology, it may subsequently use such procedures to disprove copying. This fact, coupled with the assurance that use of such procedures may be used as evidence at trial, should spur companies to more aggressively pursue development of competing products. The increased competition that results should in turn increase both the number and quality of consumer products available to the public.

171. *See Verdict for Intel Unlikely to Halt Cloning*, 11 NAT'L L.J., Feb. 20, 1989 at 6, col. 2 ("Some observers predict the practical result [of a finding of noninfringement by NEC] will be to encourage the cloning of chips, but only cloning that stops short of wholesale copying of microcodes").

172. Derwin, *supra* note 6, at 444.

173. *Id.*