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D E C I S I O N
of 19 May 2004

Case Number: T 0053/00 - 3.5.3

Application Number: 92300781.9

Publication Number: 0510789

IPC: H04B 7/195

Language of the proceedings: EN

Title of invention:
Cellular telephone satellite system

Patentee:
Northrop Grumman Corporation

Opponent:
HUGHES ELECTRONICS CORPORATION

Headword:
Medium earth orbit satellites/NORTHROP GRUMMAN

Relevant legal provisions:
EPC Art. 52, 56

Keyword:
"Inventive step - no"

Decisions cited:
T 0872/98

Catchword:
-

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Case Number: T 0053/00 - 3.5.3

D E C I S I O N
of the Technical Board of Appeal 3.5.3
of 19 May 2004

Appellant: Northrop Grumman Corporation
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Decision under appeal: **Decision of the Opposition Division of the European Patent Office posted 10 November 1999 revoking European patent No. 0510789 pursuant to Article 102(1) EPC.**

Composition of the Board:

Chairman: A. S. Clelland
Members: D. H. Rees
M.-B. Tardo-Dino

Summary of Facts and Submissions

I. European Patent No. 0 510 789 was revoked in a decision given at oral proceedings held on 2 November 1999, with written reasons despatched on 10 November 1999.

II. The independent claims of the patent read as follows:

"1. A cellular telecommunications system, comprising:

- at least one handheld mobile cellular telephone station (5), said handheld mobile cellular telephone station (5) including means for transceiving radio frequency energy (RF) including an omnidirectional antenna (6);
- at least one telephone exchange (9) including an antenna (10) for transceiving radio frequency energy (RF) and being spaced from said mobile cellular telephone station (5) within a predetermined region of the earth, with the telephone exchange being connected to a fixed telephone station (7);
- a satellite constellation located in space over the earth and including apparatus for transceiving radio frequency energy (RF) for providing a radio frequency energy communication link with said mobile cellular telephone station (5) and said telephone exchange (9); wherein
- said satellite constellation comprises a plurality of telecommunications satellites (1a-1c, 2a-2c, 3a-3c);
- said plurality of telecommunications satellites (1a-1c, 2a-2c, 3a-3c) being spaced and moving in a plurality of orbits (P1, P2, P3) about the earth

with the movement of said satellites (1a-1c, 2a-2c, 3a-3c) being non-synchronous to the rotation of the earth, and

– said plurality of orbits (P1, P2, P3) being circular,

characterised by

– all of said plurality of telecommunications satellites (1a-1c, 2a-2c, 3a-3c) being at an altitude between 7400 km (4000 nmi) and 13890 km (7500 nmi) above the earth;

– at least one of said telecommunications satellites (1a-1c, 2a-2c, 3a-3c) being in the line of sight to both said mobile cellular telephone station (5) and said telephone exchange (9) at any instant of time, with said line of sight being at a minimum elevation angle of no less than 10°;

– the radio frequency energy (RF) propagation time between said satellite and each of said mobile cellular telephone station (5), and said telephone exchange (9) being less than 60 msec; and

– said telecommunications satellites (1a-1c, 2a-2c, 3a-3c) having receiving sensitivity and antennas permitting reception at said altitude of signals from said handheld mobile cellular telephone station (5).

15. A method of cellular telecommunications comprising the steps of:

– initiating a telephonic communications session between a handheld mobile cellular telephone station (5), said handheld mobile cellular telephone station (5) including means for transceiving radio frequency energy (RF), and a fixed telephone station (7), said fixed telephone

station (7) being connected to a telephone exchange (9) including an antenna (10) for transceiving radio frequency energy (RF), and said telephone exchange (9) being spaced from said mobile cellular telephone station (5) within a predetermined region of the earth, by transmitting a radio frequency energy (RF) signal from said mobile cellular telephone station (5) through an omnidirectional antenna (6) to be received by at least one satellite (1) of a predetermined constellation of telecommunications satellites (1a-1c, 2a-2c, 3a-3c) for providing an RF communication link between said mobile cellular telephone station (5) and said telephone exchange (9);

wherein

- said satellite constellation comprises a plurality of telecommunications satellites (1a-1c, 2a-2c, 3a-3c);
- said plurality of telecommunications satellites (1a-1c, 2a-2c, 3a-3c) are spaced and moving in a plurality of orbits (P1, P2, P3) about the earth with the movement of said satellites (1a-1c, 2a-2c, 3a-3c) being non-synchronous to the rotation of the earth, and
- said plurality of orbits (P1, P2, P3) are circular,
- all of said plurality of telecommunications satellites (1a-1c, 2a-2c, 3a-3c) are at an altitude between 7400 km (4000 nmi) and 13890 km (7500 nmi) above the earth;
- at least one of said telecommunications satellites (1a-1c, 2a-2c, 3a-3c) is in the line of sight to both said mobile cellular telephone station (5) and said telephone exchange (9) at any instant of

time, with said line of sight being at a minimum elevation angle of no less than 10°;

- the radio frequency energy (RF) propagation time between said satellite and each of said mobile cellular telephone station (5) and said telephone exchange (9), is less than 60 msec;
- said telecommunications satellites (1a-1c, 2a-2c, 3a-3c) have receiving sensitivity and antennas permitting reception at said altitude of signals emitted from a mobile cellular telephone station (5) having an omnidirectional antenna with an RF power level of one half watt, and
- retransmitting said RF signal through an antenna of said satellite (1) to said telephone exchange (9) to be received at said telephone exchange (9) and establishing a communication link between said said telephone exchange (9) and said mobile cellular telephone station (5)."

III. The opposition division decided in the oral proceedings (see Facts and Submissions, 8) that the subject-matter of these claims was new but lacked an inventive step, having regard to the combination of the disclosures of either of the documents

D1: EP-A-0 365 885 and

FCC4: "IRIDIUM system application", Before the Federal Communications Commission, Washington, D.C., In re application of: Motorola Satellite Communications, Inc., for authority to construct, launch and operate a low earth orbit satellite system in the 1610-1626.5 MHz band, 3 December 1990, (extracts),

these two documents being considered to relate to the same subject-matter, with either of the documents

D49: K. Iwasaki et al., "Global mobile satellite communications system using multi-orbit satellites", articles of Lectures at General Meeting of the Institute of Electronics and Communication Engineering 1983 (Vol. 8), Tokyo, Japan, Article 2095, and

D50: P. Estabrook et al., "Use of non-geostationary orbits for a Ka-band personal access satellite system", 13th AIAA International Communication Satellite Systems Conference and Exhibit, Los Angeles, CA, March 11-15 1990, Technical Papers, Part 1, pages 14 to 24.

English translations of D49 were submitted by both the original opponents. The board will refer to the version submitted by Opponent 1 (whose opposition was later withdrawn), when necessary.

The following further documents will be mentioned in this decision:

D30: T. Logsdon, "Mobile communication satellites", McGraw-Hill, New York, USA, 1995; Pages 129 to 147 and 201 to 209;

D51: P. Estabrook et al., "A 20/30 GHz personal access satellite system design", IEEE International Conference on Communications BostonICC/89, Boston, MA, 11-14 June 1989, pages 0216 to 0222;

FCC12: Federal Communications Commission Record, Public Notice, Report No. DS-1134, 24 October 1991.

IV. Notice of appeal, requesting that the opposition decision be set aside and the patent be maintained unamended, was filed with the appropriate fee on 23 December 1999. The appellant (patentee) submitted a statement of grounds of appeal on 8 March 2000. In a letter dated 27 March 2000, received 29 March 2000, the respondent (opponent) requested that the appeal be dismissed. Both parties made conditional requests for oral proceedings.

V. After further arguments from both parties had been received, the board issued an invitation to oral proceedings. In the accompanying communication the board gave its preliminary opinion that the claimed subject-matter was novel with respect to the disclosures of D49 and D50, but that there were doubts as to whether it involved an inventive step in the light of various combinations of D1/FCC4, D49 and D50. Relevant to this issue was the determination of the problem solved by the invention and the question of whether the skilled person was prejudiced against using "medium earth orbits" (MEOs), as had been argued throughout the proceedings by the appellant.

VI. In a final written submission the appellant dealt with *inter alia* the issue of prejudice. It was argued not that there was a technical prejudice as such, but that there had been a "development of the art in a different direction"; decision T 872/98 (unpublished) was cited in support of this being an indication of an inventive step.

VII. In a letter received on 30 April 2004 the respondent's representative withdrew their request for oral proceedings and indicated that the respondent would not attend. Accordingly only the appellant presented arguments at the oral proceedings.

VIII. At the oral proceedings the appellant requested that the decision under appeal be set aside and that the patent be maintained as granted. The respondent's written request was that the appeal be dismissed. At the end of the oral proceedings the chairman closed the debate and announced the board's decision.

Reasons for the Decision

1. The appeal satisfies the requirements of Articles 106 to 108 and Rule 64 EPC and is therefore admissible.

2. *Novelty*

2.1 The only grounds of opposition considered in the opposition division's decision and raised in the appeal proceedings are lack of novelty and lack of an inventive step. As to novelty the respondent argues that the subject-matter of claim 1 of the disputed patent is not new compared to either of the disclosures of D49 and D50. However, in D49 the board does not find any disclosure of at least one feature specified in claim 1, namely a telephone exchange so placed that it and at least one mobile cellular telephone station can be seen from the same satellite at any given instant of time.

2.2 In assessing novelty with respect to D50, the board notes that claim 1 of the patent refers to a "telephone station" and a "telephone exchange", the telephone station having an omnidirectional antenna. In the view of the board, the term "telephone" requires a capability of voice communication, even if other services may be provided in addition (e.g. fax, as mentioned in the patent). The only reference in D50 to an omnidirectional antenna is at page 14, column 2, lines 27 to 30 where it is stated that "it may be possible to use azimuthally omnidirectional antennas in some applications." The applications referred to must be those envisaged by PASS ("Personal Access Satellite System"), the subject of the document as a whole, these applications being described as "voice and data service" in the Abstract on page 14 (column 1, line 4). Clearly there exist data services which may require lower bandwidth than voice, and D51, which has the same primary author as D50 and also concerns PASS, confirms that PASS is intended to provide such services, including: database enquiry; paging; data distribution nets; remote monitoring and control (D51, page 0216, column 2, lines 14 to 18). The board accordingly concludes that the reference in D50 to omnidirectional antennas does not directly and unambiguously disclose their use for voice communications, even implicitly. The subject-matter of claim 1 is therefore novel with respect to the disclosure of D50.

The respondent accepts that claim 15 is novel because it specifies that the output power of the mobile cellular telephone station antenna is one half watt.

3. Inventive step

3.1 Turning now to the question of whether the invention as claimed involves an inventive step, it would appear necessary first to look at certain specific arguments raised by the appellant, relating to (1) the objective technical problem, and (2) the direction of technical development in the art.

3.2 The objective technical problem

3.2.1 In the grounds of appeal (page 9, lines 1 and 2), the appellant characterised the problem "underlying the invention" as being, "to provide a cost effective and technically sound cellular satellite-based telecommunications system." In the oral proceedings the appellant accepted the more modest formulation suggested by the board in its communication accompanying the invitation to oral proceedings (page 5, lines 23 to 26), the problem being to provide "a technically feasible cellular satellite-based telecommunications system". However, it would appear appropriate to recapitulate the arguments which led the board to this formulation.

3.2.2 It does not appear to the board that the patent teaches the skilled person the elements necessary to arrive at a cost-effective system. Firstly, many factors mentioned in the literature are simply not dealt with in the patent. These include: The signal coding and bandwidth requirements, frequency reuse, the Doppler effect, signal variability resulting from change of satellite distance between zenith and minimum elevation, handoff, and necessary radiation tolerance. The only

indication in the disputed patent of the kind of satellite to use is that it could be a conventional satellite of the type used in geostationary orbits. Since several of the above issues do not arise in the geostationary case, it would be clear to the skilled person that in fact the conventional satellite would have to be adapted, so that the final cost could at best be only roughly estimated.

3.2.3 Moreover, the arguments put forward as to the feasibility of the technical solution are based on the use of "presently available 'dumb' satellites" (published specification page 7, line 31). As explained at lines 14 to 23 of the same page, a dumb satellite does not process the signals it receives, but merely retransmits them at a different frequency. It is further explained that in some "smart" satellite designs there may be multiple RF beams, but these require signal processing within the satellite. It would have been known to the skilled person that with only a single RF beam the satellite could only have one "cell", so that there could be little or no frequency reuse in the system, which would therefore have low communications capacity. It would be clear that while the disclosed system was technically feasible it would not be cost effective, and that to arrive at a cost effective system the skilled person would have to develop a multiple beam system at unknown cost.

3.2.4 In this context the board notes that the later proposals for the Odyssey system add considerably to the teachings of the patent specification (as well as indicating still more factors not mentioned in the present patent but of relevance to the overall cost).

For example, D30, page 203, lines 15 to 18, "As an Odyssey satellite travels round its orbit, it systematically swivels to compensate for its forward motion. Thus, its footprint covers the same region on the ground for an extended interval. This approach toward precise and accurate attitude control minimizes the number of hand-offs ...". This document, published in 1995, also gives, at line 12 of the same page, a very different weight for the satellite, 4200 lb (1900 kg), to that specified, presumably for a dumb satellite, in the patent, where it is stated to be 2400 to 3000 lb (1091 to 1364 kg) (specification page 7, line 38).

3.2.5 Thus the invention as claimed does not solve the problem of providing a "cost effective and technically sound cellular satellite-based telecommunications system" but in fact provides at most a technically feasible cellular satellite-based telecommunications system.

3.3 The direction of technical development in the art.

3.3.1 The appellant has argued, in all stages of the procedure, that when assessing inventive step, a high degree of importance should be given to two arguments which are not usually considered primary in the assessment of inventive step. The first argument relates to the very small number of satellites of any kind which had used circular MEOs up to the priority date. The second is that the board, in considering what the skilled person would do, should be guided by what was in fact done, as evidenced in the submissions to the FCC (United States Federal Communications

Commission) which are more or less contemporaneous with the present patent. At some stages these arguments have been presented as evidence of a technical prejudice in the field, but the appellant clarified in the final written submission that what is meant is rather a "development of the art in a different direction", citing T 872/98.

3.3.2 As to the first point, the nature and number of the satellites launched has depended on many factors, in particular the application. What was required for a TV broadcast satellite was not the same as for a mobile telephony system. Equally, what would suffice for a military communications system would not be satisfactory for a mass consumer application. At the same time, the many documents on file discussing MEOs in the context of telecommunications show that, throughout the history of space flight, skilled workers in the field have been quite willing to consider the use of such satellite constellations, even if, up to the present priority date, they have not turned out to be optimal for the applications required.

3.3.3 With regard to the second point, the board notes that the FCC's invitation to tender was not specifically for a telephony system, but rather for a "radiodetermination satellite service" (RDSS) system (FCC12, first paragraph). In fact even according to the appellant's arguments, only four of the proposals submitted were comparable as systems with the present patent. That these proposals did not employ circular MEOs does not provide strong evidence of what the skilled person would have considered if asked to provide a technically feasible cellular satellite-based

telecommunications system. The proposals put forward to the FCC were, as is mentioned in various of the submissions themselves, the result of balancing many factors. Many of the factors cited simply have not been considered in the patent, and the entire range of factors actually taken into account cannot even be guessed at by the board. For example, a particular proposal might have preferred an LEO solution because the proposer had a parallel project to develop a low-orbit launch vehicle, so that there would be cost synergy effects in having both projects underway in the same company. Some of the considerations may have been, as in this example, purely commercial. At any rate a major consideration would have been to provide a cost-effective system and, as stated above, it has not been convincingly argued that the invention as claimed in the patent is more cost-effective than other systems.

3.3.4 In T 872/98, cited by the appellant, a competitor had contemporaneously applied for a patent which solved the same problem but went in a different development direction to that of the application being considered. This was considered evidence for an inventive step (Reasons 5.4, second paragraph). However, the case presently before the board is different. Firstly, T 872/98 also makes use of a conventional problem-and-solution analysis, rather than replacing it, which is what the board is urged to do in the present case. Secondly, there is no analogy between a competitor's patent application, as in T 872/98, and the FCC proposals. As argued above, the FCC proposals would have been influenced by many factors not necessarily relevant to a patent application.

3.3.5 Thus the board is neither convinced that there was a "development of the art in another direction", nor that, even if there were such a development, it should necessarily take priority over a conventional analysis of obviousness.

3.4 In the oral proceedings the appellant retracted the statement in the written submission of 19 April 2004 that "D1/FCC4 *only* requires structural and functional modifications regarding the feature ‘MEO' of the patented invention," (page 6, lines 11 and 12) but nonetheless maintained the view that D1/FCC4 must be considered to be the closest prior art because it belongs to the same technical field as the subject-matter claimed in the disputed patent, and discloses more of the claimed features than either D49 or D50.

3.5 All of these documents share the purpose of providing mobile-to-satellite telecommunications systems suitable for telephony applications, and the question of which has the most features in common with the claims of the patent is not of itself conclusive but only a general guide as to the choice of a starting point for inventive step. In the board's view the single most relevant document is D49.

3.6 D49 as starting point

3.6.1 D49 discloses a telecommunications system including mobile units and satellites. It further discloses a favoured constellation of eighteen satellites in three circular (page 1, line 12) orbits, inclined at 75°, each orbit containing six satellites spaced at 60° intervals, with a period of six hours, corresponding to

a height of 10 362 km (Conclusion, Table 1 and Fig.2). The minimum angle of incidence of a satellite above an arbitrary mobile unit is 44.1°, and the maximum distance of the unit from a satellite is 11 659 km (Table 1), implying a propagation delay from mobile unit to satellite or vice versa of less than 60 msec (in fact, approximately 39 msec).

3.6.2 The patent in suit does not give any definition of the term "cellular". The board takes it to refer to a system in which mobile units select one base station at any one time to communicate with by radio, the selected base station being determined by geographical location. The "cell" is the geographical area served by a base station. In the course of a call, the base station may have to be changed by means of a "handoff", as users may change cells. Satellite telecommunications systems using non-geostationary satellites are by definition "cellular", since the footprint of a satellite moves across the earth, also causing the mobile user to change from one cell to another, as one satellite replaces another.

3.6.3 The system specified in D49 therefore possesses all the features specified in claim 1 of the present patent, with the possible exception of the following: that the telecommunications service is telephony; that the telephone stations are handheld; that the antenna of the telephone station is omnidirectional; and that there is a telephone exchange with an antenna within a predetermined region of the earth such that at least one of the satellites is in line of sight to the telephone station and the exchange with an elevation of no less than 10°.

3.6.4 The technical problem arising from D49 is the implementation of a technically feasible system having the characteristics given in D49. This problem arises immediately and obviously from D49 itself.

3.6.5 "Telephony"

D49 states that the first priority of a mobile communications service is the simplification of the mobile (earth) station equipment (page 1, lines 7 and 8, Opponent 1's translation). Its aim is to specify the characteristics necessary to allow a mobile user to employ an antenna which does not have to track a satellite, while delivering a certain value of quality of signal (page 1, lines 9 to 15). It would have been clear to the skilled person that this value, expressed as 57.9 dB-Hz on the downlink and 61.7 dB-Hz on the uplink (Table 1), was appropriate for a high quality voice connection.

It is arguable that the skilled person would have inferred from the quality of signal parameter that the "mobile communications service" discussed in D49 was intended to be a telephony service; even if not, the board considers it would have been at least obvious to provide telephony services within such a system.

3.6.6 "Handheld"

Further, in the process of simplification of mobile units, it is clear that handheld units are an ideal. The link characteristics given in D49, and in particular the modest uplink transmission power

required (1.6 W) would clearly have been an incentive to try to produce a handheld mobile unit.

3.6.7 "Omnidirectional antenna"

D49 discloses the use of a mobile antenna which "does not track the direction of the satellite but is constantly facing skywards," in other words an "azimuthally omnidirectional" antenna with a sufficiently large beam width that it does not have to be moved from a vertical direction to follow a satellite. The appellant argues that this is not what is meant by "omnidirectional" as claimed. It is argued that the term as used refers to the rod antenna shown in Fig.1 (element 6) of the patent specification, and that such an antenna is omnidirectional in the sense that it may also have substantially any angle to the vertical. The board is not convinced by this argument; in the absence of any explicit definition in the patent, the question arises as to what the skilled person reading the claim would have understood by the term "omnidirectional". There is no indication in the patent that this term is intended to be limited to a particular type of omnidirectional antenna by a sketched device in one of the figures. Moreover, it would be well known to the skilled person that a rod antenna is by no means entirely omnidirectional.

The board considers that the skilled person, in designing a handheld mobile unit would take into account that it would not generally be held perfectly vertically, and would design it not only to be azimuthally omnidirectional as explicitly disclosed in D49 but also with a beam width appropriate for handheld

mobile use. The skilled person would not understand more than this from the claimed feature that the antenna is "omnidirectional". In the absence of any further indications in the patent, the board considers that this would have been done as a matter of normal design by the person skilled in the art.

3.6.8 "Exchange"

It is commonplace that cellular telephone systems allow calls to be set up with landline subscribers, and it would have been obvious to the skilled person at the priority date of the present patent to provide an interface between the system of D49 and the normal network, i.e. a telephone exchange including an antenna and connected to a fixed telephone station, as claimed.

There are two choices for such an interface: either the satellite being used by a mobile unit is always in view of an exchange, or the satellite must be able to relay the signals from the mobile unit to another satellite. The first option is clearly the simplest, in terms of satellite design at least, and was a conventional solution, as evidenced by the disputed patent itself (specification, page 7, lines 14 to 19, and page 8, lines 9 to 11). Seeking to realise a technically feasible implementation of D49, the skilled person could be expected to make the simplest choice.

The requirements for the exchange antenna are clearly different to those for a handheld mobile. It may, for example, track the satellite. However, the satellite must always be in view, that is it must be above the horizon, and in order to deal with landscape

variations, above a certain elevation which would be determined as a matter of practical experience. There would appear to be no unexpected merit in the choice of 10° elevation claimed. That the propagation delay between exchange and satellite is less than 60 msec then follows directly from geometrical considerations.

3.6.9 The board therefore comes to the conclusion that starting out from the disclosure of D49 and seeking to realise a technically feasible satellite system, the skilled person would arrive at the features specified by claim 1 but not directly disclosed by D49 without using anything more than common general knowledge. The subject-matter of this claim therefore lacks the inventive step required by Articles 52 and 56 EPC.

3.6.10 Claim 15 defines method features corresponding to the apparatus features of claim 1. The arguments above apply *mutatis mutandis* to these features. In addition claim 15 specifies that the omnidirectional antenna of the mobile cellular telephone station has an RF power level of one half watt. D49 specifies an RF power of 1.6 watts. However, the development of technology in the seven years between the publication of D49 and the priority date of the present patent would have led the skilled person to expect that a smaller uplink transmission power might be feasible. The patent indeed states that a signal strength of 0.5 W was sufficient at the priority date, using a conventional satellite, and since the patent also indicates no special problem encountered and discloses no special measures, the board considers that the skilled person implementing D49 at the priority date would be expected to arrive at

a similar transmit power without the exercise of inventive activity.

Hence, The subject-matter of this claim also lacks an inventive step.

4. The appellant's only request is therefore not allowable.

Order

For these reasons, it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

D. Magliano A. S. Clelland