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Datasheet for the decision of 2 September 2022

Case Number: T 3226/19 - 3.5.07

Application Number: 12881596.6

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Title of invention:
Systems and methods for estimating opportunity in a reservoir system

Applicant:
Landmark Graphics Corporation

Headword:
Opportunity estimation/LANDMARK GRAPHICS

Relevant legal provisions:
EPC Art. 56

Keyword:
Inventive step - main, first to ninth auxiliary requests (no)

Decisions cited:
G 0001/19, T 0049/99, T 0154/04, T 1227/05, T 0042/09, T 0489/14, T 1371/16, T 1422/19

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Case Number: T 3226/19 - 3.5.07

D E C I S I O N
of Technical Board of Appeal 3.5.07
of 2 September 2022

Appellant: (Applicant)	Landmark Graphics Corporation 2107 City West Blvd., Bldg. 2 Houston, Texas 77042 (US)
Representative:	Hoffmann Eitle Patent- und Rechtsanwälte PartmbB Arabellastraße 30 81925 München (DE)
Decision under appeal:	**Decision of the Examining Division of the European Patent Office posted on 31 July 2019 refusing European patent application No. 12881596.6 pursuant to Article 97(2) EPC**

Composition of the Board:

Chair	J. Geschwind
Members:	P. San-Bento Furtado
	M. Jaedicke

Summary of Facts and Submissions

I. The appeal lies from the decision of the examining division to refuse European patent application No. 12881596.6, which was published as international application WO 2014/018055.

II. The examining division decided that the subject-matter of the claims of the main request and of claim 1 of the first to ninth auxiliary requests lacked inventive step over a networked computer system. The claimed invention corresponded to a routine implementation of a non-technical scheme for estimating opportunities in a reservoir system.

III. In the statement of grounds of appeal, the appellant requested that the decision under appeal be set aside and that a patent be granted on the basis of the main request or of one of the first to ninth auxiliary requests considered in the appealed decision. All the requests were re-filed with the grounds of appeal.

IV. In a communication accompanying the summons to oral proceedings, the board expressed its preliminary opinion that claim 1 of each of the requests concerned essentially non-technical subject-matter and lacked inventive step.

V. By a letter of reply the appellant provided further arguments in favour of inventive step.

VI. Oral proceedings were held as scheduled. At the end of the oral proceedings, the Chair announced the board's decision.

VII. The appellant's final requests were that the contested decision be set aside and that a patent be granted on the basis of the main request or, in the alternative, one of the first to ninth auxiliary requests, all requests as filed with the grounds of appeal.

VIII. Claim 1 of the main request reads as follows:
"A method for estimating opportunity in a reservoir system, which comprises:

measuring critical risk and critical opportunity of an objective variable for the reservoir system using a computer system by:

building a tornado chart using all intrinsic parameters used to calculate the objective variable, a value for risk and a value for opportunity; and

calculating the critical risk and the critical opportunity using one of the intrinsic parameters from the tornado chart that has a greatest impact on the objective variable,

wherein the critical risk is represented by: $Critical\_Risk = Correl\left[Obj.Var.; Intrins.Param.Major\_\text{Impact}\right]\Big|_{Intrins.Param.@P_1}$, and

wherein the critical opportunity is represented by: $Critical\_Opport = Correl\left[Obj.Var.; Intrins.Param.Major\_\text{Impact}\right]\Big|_{Intrins.Param.@P_{99}}$; and

estimating the opportunity in the reservoir system for the objective variable over different time horizons using the critical risk and the critical opportunity."

IX. Claim 1 of the first auxiliary request differs from claim 1 of the main request in that the following text has been added at the end of the claim:
", wherein the objective variable is primary reserves."

X. Claim 1 of the second auxiliary request differs from claim 1 of the first auxiliary request in that the following text has been added at the end of the claim:

", the method further comprising repeating each of the above steps for each reservoir system in a field, and prioritizing each reservoir system using the critical risk of the objective variable for each respective reservoir system and a corresponding priority code."

XI. Claim 1 of the third auxiliary request differs from claim 1 of the second auxiliary request in that a colon has been added after "further comprising", the word "and" before "prioritizing" has been deleted and in that the following text has been added at the end of the claim:

", and mapping each reservoir system using the corresponding priority code for each respective reservoir system."

XII. Claim 1 of the fourth auxiliary request differs from claim 1 of the main request in that the following text has been added at the end of the claim:

", wherein the intrinsic parameters include at least one of an area, a constant, a reservoir thickness, a porosity, an initial water saturation, an initial volumetric volume factor, and a primary recovery factor."

XIII. Claim 1 of the fifth auxiliary request differs from claim 1 of the fourth auxiliary request in that the text introduced by the second auxiliary request (see section X. above) has been added at the end of the claim.

XIV. Claim 1 of the sixth auxiliary request differs from claim 1 of the fifth auxiliary request in that, apart from minor editorial changes, the text introduced by

the third auxiliary request (see section XI. above) has been added at the end of the claim.

XV. Claim 1 of the seventh auxiliary request differs from claim 1 of the fourth auxiliary request in that the text introduced by the first auxiliary request (see section IX. above) has been added at the end of the claim preceded by the conjunction "and".

XVI. Claim 1 of the eighth auxiliary request differs from claim 1 of the seventh auxiliary request, apart from minor editorial changes, in that the text introduced by the second auxiliary request (see section X. above) has been added at the end of the claim.

XVII. Claim 1 of the ninth auxiliary request differs from claim 1 of the eighth auxiliary request, apart from minor editorial changes, in that the text introduced by the third auxiliary request (see section XI. above) has been added at the end of the claim.

Reasons for the Decision

Application

1. According to the application, the analysis of risk and uncertainty is very important in the assessment and estimation of "potential hydrocarbon opportunity from exploration prospects to development fields" for "preparing the execution of exploitation plans" (see paragraph [0005] of the international publication). In the standard risk analysis, the critical probability values are P1O, P50 and P90 for objective variables such as, for example, primary reserves ("Prim. Res.") and original oil in place ("OOIP"). This choice of the

critical probability values P10 and P90 "is arbitrary and in general overestimates or underestimates the risk and the opportunity to obtain more than the proven value of the objective variable under consideration, which is also generally referred to as the 'opportunity'". It "fails to consider the range of influence of intrinsic parameters such as area, reservoir thickness, formation volume factor, porosity, net-to-gross reservoir thickness and recovery factors on the opportunity" (paragraph [0005]).

1.1 The invention is intended to address such issues. It concerns the estimation of the "opportunity in a reservoir system over different time horizons relative to the critical values of risk and opportunity and corresponding values of an objective variable" (paragraphs [0005] and [0006]).

In order to measure the critical risk and opportunity, in the method according to the invention a tornado chart is built using all intrinsic parameters used to calculate the objective variable, a value for risk and a value for opportunity. Intrinsic parameters are parameters used to calculate the objective variable such as, for example, area (A), a constant (α), reservoir thickness (H), porosity (Φ), initial water saturation (Sw_i), initial volumetric volume factor (Boi) and primary recovery factor (F_r). In the process of building the tornado chart, each intrinsic parameter is correlated with the objective variable to produce a model that represents the correlation (paragraphs [0026], [0036], Figures 5 and 6).

Main request

2. *Inventive step - claim 1*

2.1 In the decision under appeal, the examining division was of the opinion that the need for "estimating the opportunity in the reservoir system for the objective variable over different time horizons using the critical risk and the critical opportunity" was not a technical aim but rather a need for assistance in the context of taking a decision related to the use/ exploitation of a reservoir. This was a managerial and business aim, which was not relevant for assessing inventive step. Paragraph [0004] of the application related to the management of reservoirs. Only paragraph [0041] of the application as published explicitly discussed the use of the estimated opportunity, namely that it could be displayed. No technical effect could be derived from these passages. There was no provision of data applied directly to a technical process since the information provided by the invention was only applied in a decision process. The use of physical characteristics/parameters of the reservoir did not change the nature of the estimation, which was purely mathematical, and did not change the method's apparent purpose of providing managerial assistance. The fact that such a mathematical method stood on the use of physical parameters was not enough to establish any technical character of the scheme underlying claim 1. The examining division cited decision T 154/04, reasons 20.

The examining division considered that the invention did not relate to simulation: rather, it modelled oil quantity variations in the reservoir according to reservoir parameters, and further determined risk/ opportunities correlated with such a variation. No

imitation of the operation of a system or a process was defined.

The examining division further noted that the actual manner of measuring the parameters was not defined in the application as a whole, and the fact that they could have been measured was not enough to confer technical character on the scheme considered. The classification of a reservoir system did not appear to be derivable from the application as published. Moreover, classification of a reservoir in terms of estimated undefined opportunities was not considered technical. In view of that, the examining division considered a notoriously known networked computer system as closest prior art. The only apparent technical problem was the implementation of the mathematical scheme for determining risks and opportunities in the context of the exploitation of a reservoir when starting from the identified closest prior art. The skilled person made aware of such a scheme would implement it as a routine activity at the level defined in claim 1. No technical problem which needed to be overcome in order to implement the non-technical scheme was apparent. Hence, claim 1 was not inventive.

2.2 The appellant argued that claim 1 was limited to a computer-implemented method in which a mathematical method served for numerical simulation for estimating the objective variable and associated opportunity over different time horizons. This was a technical purpose, as a technical parameter, i.e. the objective variable and its associated opportunity, was determined about the reservoir system, which was a technical system. The appellant argued that according to the Guidelines for Examination in the EPO the determination of a technical

variable (i.e. the objective variable and its associated opportunity) from a technical system (i.e. the reservoir system) should be regarded as a technical purpose and the mathematical method serving that technical purpose should be taken into account in assessing inventive step.

The appellant further argued that the claimed method supported the determination of an objective variable of a reservoir system and its associated opportunity through a stochastic simulation in order to extract oil from an oil field more efficiently.

The "opportunity" was a measure of the probability of having certain amounts of the objective variable in the reservoir system which could be used for planning over different time horizons. In order to recover the objective variable from the reservoir system, a drilling process had to be carried out in the reservoir system. The only use for the opportunity determined in claim 1 was therefore to assist in optimising the hydrocarbon recovery for a drilling process, which was a technical purpose. The technical effect of claim 1 which was implied by the further use of the "opportunity" was to optimise the hydrocarbon recovery for a drilling process.

Even if the result of the claimed method was used in planning, this clearly related to planning of a technical process (i.e. oil drilling) and not planning of a business activity. Methods which resulted in an output which could be used in the planning of a technical process were considered to have a technical purpose as shown by the examples of "deriving the body temperature of a subject from data obtained from an ear temperature detector" given in the Guidelines. The appellant further cited decisions T 1227/05, T 49/99

and T 42/09. In the appellant's opinion, the simulation was clearly applied to a specific technical system of an oil reservoir and was therefore not an abstract model with no technical purpose.

2.3 The method of claim 1 results in a numerical value estimated on the basis of parameters of a model of a reservoir system. Criteria for patentability of such a method have been established by decision G 1/19 of the Enlarged Board of Appeal on the patentability of computer-implemented simulations (OJ EPO 2021, A77; see also T 1371/16, reasons 4 to 4.5; T 1422/19, reasons 4.4; T 489/14 of 26 November 2021, reasons 2.4 to 2.7 and 4.5). For the question of technicality dealt with in this case, decision G 1/19 prevails over decision T 1227/05 cited by the appellant. Decisions T 49/99 and T 42/09, also cited by the appellant, rule that "only a purposive use of information modelling in the context of a solution to a technical problem may contribute to the technical character of an invention" (see T 42/09, reasons 2.4).

2.4 According to decision G 1/19, if a claimed process results in a set of numerical values, it depends on the further use of such data (which use can happen as a result of human intervention or automatically within a wider technical process) whether a resulting technical effect can be considered in the inventive-step assessment ("further technical effect"). If such further use is not, at least implicitly, specified in the claim, it will be disregarded for this purpose (G 1/19, point 124).

2.4.1 The Enlarged Board discusses the requirements of a direct link with physical reality and a tangible effect. It recognises the need for harmonisation of the assessment of patentability within a wider group of

computer-implemented inventions, for example with respect to the requirement of a direct link with physical reality (G 1/19, point 62). It states that "Following existing case law and taking into account the relevant legal provisions, the Enlarged Board does not see a need to require a direct link with (external) physical reality in every case". Potential technical effects are distinguished from direct technical effects on physical reality. While a direct link with physical reality is in most cases sufficient to establish technicality, it cannot be a necessary condition (point 88). The Enlarged Board further concludes that "Like any other computer-implemented method, a simulation without an output having a direct link with physical reality may still solve a technical problem" (point 139). The Enlarged Board also clarifies that a tangible effect is not a necessary requirement under the EPC and that it is unclear to what extent the notions of "tangible effect" and "further technical effect" overlap. A criterion based on tangibility is thus not necessary in addition to the requirement of technicality in order to establish patentability of an invention (G 1/19, point 101).

2.4.2 Calculated numerical data reflecting the physical behaviour of a system modelled in a computer cannot usually establish the technical character of an invention, even if the calculated behaviour adequately reflects the behaviour of a real system underlying the simulation. Only in exceptional cases may such calculated effects be considered implied technical effects (for example, if the potential use of such data is limited to technical purposes) (G 1/19, point 128).

2.4.3 The underlying mathematical models of the simulation may contribute to technicality if, for example, they

form the basis for a further technical use of the outcomes of the simulation (e.g. a use having an impact on physical reality) (points 136 and 137).

2.4.4 Decision G 1/19 provides some examples of further technical uses of the numerical data resulting from a simulation, which under certain conditions may be potential uses implicitly specified or implied by the claim. One example is the use of the data in a manufacturing step, which "would of course be an argument in favour of patentability" (point 134). Another example of a further technical use is the use of the data in controlling a technical device, which can be recognised if the resulting numerical data is specifically adapted for "the purposes of its intended technical use", i.e. for controlling a technical device (point 94). In that case, the data is considered to have a technical character because it has the potential to cause technical effects. Either the technical effect that would result from the intended use of the data could be considered "implied" by the claim, or the intended use of the data (i.e. the use in connection with a technical device) could be considered to extend across substantially the whole scope of the data processing method claimed (point 94). These arguments cannot be made if claimed data or data resulting from a claimed process has relevant uses other than the use with a technical device (point 95).

2.4.5 In addition, G 1/19 confirms the technical nature of measurements in view of them being "based on an interaction with physical reality at the outset of the measurement method". The same applies to indirect measurements, for example the measurement of a specific physical entity at a specific location by means of measurements of another physical entity and/or

measurements at another location. The Enlarged Board rules that "Even though such indirect measurements may involve significant computing efforts, they are still related to physical reality and thus of a technical nature, regardless of what use is made of the results" (G 1/19, point 99).

2.5 In the present case, claim 1 specifies a calculation of numerical data concerning the opportunity in a reservoir system for an objective variable over different time horizons, but does not specify any further use of the calculated data. In particular, claim 1 does not specify that the numerical data obtained, the opportunity in the reservoir system over different time horizons, is used to determine a technical oil drilling process, nor how the opportunity data relates to technical parameters of a technical process. The result of the claimed method cannot be used for optimising the hydrocarbon recovery for a drilling process without further cognitive processing by a human expert in the context of taking a decision related to the use or exploitation of a reservoir. Therefore claim 1 does not limit its subject-matter, either implicitly or explicitly, to a further technical use of the calculated numerical data. Other uses, for instance in management, are also within the scope of the claim.

2.6 The appellant's argument that the claimed method had a technical purpose because it determined a technical variable from a technical system could only hold if the method were considered a measurement method. In this regard, the appellant argued that the claimed method used statistical models to estimate the "opportunity" on the basis of physical measurements of a reservoir system. The intrinsic parameters were not abstract. It

was inherent in the claim that measurements were performed in a real-world reservoir. The opportunity estimated by the claimed method was a measure of the probability of having certain amounts of the objective variable in the reservoir system and provided information about the accuracy and/or reliability of the measurements.

2.7 The board does not find these arguments convincing. The claimed method does not include actual steps of measuring "based on an interaction with physical reality at the outset of the measurement method". Nor does it include either some form of indirect measurement of a physical entity based on another physical entity (G 1/19, point 99). Instead, the estimation of the opportunity in the claimed method is based on "intrinsic parameters" which are not further specified in the claim. The calculated result is not used for estimating the accuracy or improving the reliability of the measurements, but rather for performing sensitivity analysis, for example for business purposes. Therefore the claimed method cannot be considered a measurement method either.

2.8 In its submissions, the appellant advocated the use of the COMVIK approach, according to which features which do not make a technical contribution are given to the skilled person as a constraint to be met. The computer implementation of the method for estimating opportunity is described in the claim only in terms of non-technical features concerning the mathematical calculations and the generation of a tornado chart, which constitutes presentation of information. Besides mentioning that a computer is used, the claim does not provide any details of the technical implementation. The board agrees with the examining division that the

implementation of the non-technical scheme of estimating opportunity in a computer system at the conceptual level of claim 1 is straightforward.

2.9 Therefore the main request does not meet the requirements of Article 56 EPC.

Auxiliary requests

3. Claim 1 of each of the auxiliary requests includes the features of claim 1 of the main request and one or more of the following features:

(a1) the objective variable is primary reserves;

(a2) repeating each of the above steps for each reservoir system in a field, and prioritising each reservoir system using the critical risk of the objective variable for each respective reservoir system and a corresponding priority code;

(a3) mapping each reservoir system using the corresponding priority code for each respective reservoir system;

(a4) the intrinsic parameters include at least one of an area, a constant, a reservoir thickness, a porosity, an initial water saturation, an initial volumetric volume factor, and a primary recovery factor.

In particular, claim 1 of each of the first to ninth auxiliary requests differs from claim 1 of the main request in that it additionally specifies the following feature(s) in the order given below:

- first auxiliary request: feature (a1);
- second auxiliary request: features (a1) and (a2);
- third auxiliary request: features (a1), (a2) and (a3);
- fourth auxiliary request: feature (a4);

- fifth auxiliary request: features (a4) and (a2);
- sixth auxiliary request: features (a4), (a2) and (a3);
- seventh auxiliary request: features (a4) and (a1);
- eighth auxiliary request: features (a4), (a1) and (a2);
- ninth auxiliary request: features (a4), (a1), (a2) and (a3).

4. *Inventive step - claim 1 of auxiliary requests*

4.1 The appellant argued that the additional features made a technical contribution and therefore should be taken into account for inventive step.

4.1.1 With regard to (a1), the appellant argued that the skilled person would understand that the "primary reserves" related to primary oil reserves in the reservoir system. Claim 1 of the first auxiliary request therefore clearly did not relate to a business method or abstract information modelling, as the method was clearly limited to a specific type of technical system which produced as output a technical variable relating to the technical system. It was clearly implicit in the claim that the determination of the opportunity in the reservoir for the primary reserves, i.e. the opportunity to obtain more than the proven value of the primary reserves from the reservoir system, was limited to the further use of recovering the primary reserves from the reservoir system through a drilling process in an optimised manner, which was technical.

4.1.2 The specification of the intrinsic parameters in feature (a4) as specific technical parameters of the oil reservoir clearly limited the method to a technical system. The determination of a technical variable from

technical parameters derived from a technical system could not be considered to be a business method or abstract information modelling. The fact that the output of such a method could be used in a planning activity for a technical process of oil drilling was not a valid reason to reject the claim on the basis of it relating to a business method. The Guidelines gave a number of examples of technical purposes such as "deriving the body temperature of a subject from data obtained from an ear temperature detector". Similarly, deriving the objective variable and associated opportunity of an oil reservoir from specific technical parameters (which are intrinsic to the reservoir and implicitly measured) should be considered a technical purpose.

4.1.3 The appellant further argued that with features (a1) and/or (a4) the claim concerned an indirect measurement of the amount of oil in a reservoir, or a volume calculation. Features (a1) and (a4) limited the calculation of the claim to a physical measurement, which was technical according to decision G 1/19. The only way to obtain the intrinsic parameters was by measurement.

4.1.4 According to the appellant, additional features (a2) further assisted the user in performing the technical task of efficient extraction of oil.

4.1.5 The appellant argued that mapping each reservoir system using the corresponding priority code, as specified in (a3), assisted the user in performing a technical task, namely the efficient extraction of oil, and therefore served a technical purpose. The further use of this map was limited to determining drill plans for a hydrocarbon field which would optimise hydrocarbon recovery for a drilling process. It was implicit in the

prioritisation of the reservoir systems and the determination of the opportunity for each reservoir system that the further use of the output was purely for the purposes of optimising hydrocarbon recovery for a drilling process.

4.2 With respect to feature (a3), the board notes that according to paragraph [0034] each reservoir system in Figure 3 is mapped in a geographic map using its corresponding gray scale priority code to illustrate drilling and production priorities and how the intrinsic parameters for area and reservoir thickness that cause a greater impact on the objective variable are distributed for risk mitigation purposes.

4.3 In the board's opinion, none of features (a1) to (a4) restricts the claimed method to a further technical use of the estimated opportunity in the reservoir system. Even if the ultimate goal of the estimation is planning an oil drilling process, any technical decision regarding the drilling process is taken only indirectly by human experts possibly based also on non-technical business criteria.

4.4 Even though more technical information is mentioned in features (a1) to (a4), these features do not restrict the scope of the claim to specify a measurement method either.

The opportunity calculated by the claim, even in the presence of any combination of features (a1) to (a4), cannot be considered a direct or indirect physical measurement. The intrinsic parameters are only vaguely described. It is not specified, for example, what the constant is, or which area is used. Contrary to the appellant's arguments, the intrinsic parameters of feature (a4) do not have to be measured parameters and

none of the claims 1 of the auxiliary requests specifies or implies a measuring step. The method of claim 1 of these requests is thus not comparable with the temperature measurement example mentioned by the appellant.

4.5 In view of the above, none of the features (a1), (a2), (a3) and (a4) alone, or any combination thereof, overcomes the inventive-step objection raised above for the main request. Therefore the subject-matter of claim 1 of each of the auxiliary requests lacks inventive step and none of the first to ninth auxiliary requests meets the requirement of Article 56 EPC.

Concluding remark

5. Since none of the requests on file is allowable, the appeal is to be dismissed.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chair:

S. Lichtenvort J. Geschwind

Decision electronically authenticated