

Post-Editing of Aviation Metrology Technical Texts from the Perspective of Functional Translation Theory

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Industrial metrology constitutes the measurement foundation of modern industrial manufacturing systems. In the aviation industry, metrology serves as an indispensable technical support throughout the entire production and maintenance process. Therefore, the translation quality of aviation metrology technical texts deserves particular attention. Guided by Functional Translation Theory, this paper systematically constructs a research framework for the post-editing of aviation metrology technical texts from the perspectives of terminology and syntax. By analyzing typical problems in machine translation (MT) output and exploring how the principles of Skopos, coherence, and fidelity can guide post-editing practice, this study aims to provide reference and insight for translators engaged in technical translation in this specialized field, thereby improving translation quality.

Keywords: functional translation theory, machine translation post-editing, aviation metrology, technical translation

Introduction

As an important branch of industrial metrology, aviation metrology involves measurement accuracy at the micron level, which is directly related to personal safety and the stability of the global aviation supply chain. Accordingly, such texts often carry regulatory force. Any translation error may lead to component scrapping, flight accidents, or even trade barriers. However, at present, research on the translation of industrial metrology texts remains extremely limited. The author searched the CNKI database using the keywords “metrology” and “translation” and obtained 39 results (as of September 27, 2025). A search using “industrial metrology” and “translation” yielded no results. Meanwhile, Machine Translation Post-Editing (MTPE) has gradually become an important working mode for technical translators. It can therefore be seen that conducting research on the post-editing of aviation metrology technical texts is of considerable practical and theoretical significance.

Overview of MTPE in Aviation Metrology Technical Texts

To accurately understand MTPE, it is first necessary to clarify the definition of Machine Translation (MT). According to ISO/DIS 17100:2013, “MT” refers to “the use of computer systems to automatically translate text or speech from one natural language into another.” According to ISO 18587:2017, “post-editing (PE)” refers to

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“the process of editing, modifying and/or correcting pre-translated text, including checking and correcting MT output” (Cui, 2014). The competence required for MTPE refers to the knowledge system and cognitive literacy necessary to process and modify the original output of MT according to specific purposes and requirements (Feng & Liu, 2018).

MT has been increasingly applied in the translation industry. However, the quality of MT output still differs from that produced by professional translators. According to a report released by CSA Research in 2021, among 221 language service providers surveyed, 89% and 52% respectively provided full post-editing and light post-editing services to clients (Lommel & Pielmeier, 2021). This indicates that post-editing has become a mainstream service provided by language service providers. From the perspective of Functional Translation Theory, the core competence required of technical translators in MTPE lies in processing MT output in a function-oriented manner according to the intended communicative purpose of the translation, ensuring both accurate transmission of information and effective technical communication.

Aviation metrology technical texts are typical informative texts characterized by a high density of specialized terminology and complex nested sentence structures. DeepL, as a widely used professional MT engine, enjoys considerable industry influence and a broad user base. However, in practice, it has been observed that when translating aviation metrology technical texts, DeepL frequently produces inaccurate terminology, expressions inconsistent with industry conventions, neglect of contextual meaning, and unsatisfactory pragmatic effects. From the perspective of Functional Translation Theory, these problems can be attributed to deficiencies in purposefulness, coherence, or fidelity in MT output. The following sections analyze typical MT problems and explore corresponding post-editing strategies considering the three principles of Functional Translation Theory.

The Theoretical Framework of Functional Translation Theory

Since the 1970s, under the promotion of German academia and the translation community, the modern school of Functional Translation Theory has gradually developed through theoretical research and practical exploration. German scholar Katharina Reiss first proposed text typology theory, arguing that texts can be classified into four types according to their communicative functions: content-focused, form-focused, appeal-focused, and audio-medial texts. Different text functions determine the type of equivalence to be achieved in translation (Feng, 2023).

In 1984, Hans J. Vermeer proposed Skopos Theory on this basis, holding that translational action is determined by the purpose of translation, and that the communicative purpose of the target text is decided by the initiator of the translation process—namely, “the end justifies the means.” In the same year, Justa Holz-Mänttär (1984) put forward the theory of translational action. Skopos Theory and translational action theory reinterpreted the nature of translation, shifting the focus from “text-centeredness” to a social and cultural activity centered on human agents (Feng, 2023), thereby marking the formal establishment of Functional Translation Theory. Subsequently, Christiane Nord (1990) summarized various academic viewpoints within Functional Translation Theory and proposed the principle of “function plus loyalty,” bringing the theory to maturity.

The primary principle of Functional Translation Theory is to realize the expected function and purpose of the translation within the target culture. The core function of aviation metrology technical texts lies in accurately and clearly conveying technical information, operational procedures, and safety requirements, thereby serving aviation manufacturing and maintenance practices. Therefore, Functional Translation Theory provides clear guidance for the post-editing of such texts. Translators should prioritize the accurate transmission of technical

information. While remaining faithful to the technical content of the source text, they must ensure that the translation conforms to professional expression norms in the aviation field and the cognitive habits of industry readers, to truly achieve accuracy and effectiveness in technical communication.

Problems in Terminology Processing in MT

Terminological Mistranslation and Conceptual Reconstruction

Terminology serves as the carrier of specialized concepts and is used to describe scientific and technical notions within specific professional fields. The accuracy and standardization of terminology translation constitute important criteria for determining whether the translation quality of technical texts meets professional standards (Gu & Leng, 2024). Aviation metrology technical texts contain many highly specialized terms. However, MT systems can only rely on existing corpora and terminology databases for matching and often fail to distinguish polysemy or identify industry-specific meanings.

Example 1: The ball bar is used to check the volumetric accuracy of the CMM.

DeepL translation: 球杆用于检测坐标测量机的体积精度。

Post-edited version: 使用球杆仪检测三坐标测量机的空间体积精度。

In this case, DeepL translated “ball bar” literally as “球杆,” which is clearly inconsistent with the technical context and violates the principle of purposefulness. According to the Skopos principle, terminology translation must serve the professional function of technical texts and accurately convey technical information. After consulting terminology resources and conducting searches, the correct translation “球杆仪” was identified. This refers to “a specialized instrument used for rapid evaluation and diagnosis of machine tool performance.” The corrected translation restores its identity as an instrument and ensures that the text fulfills its intended operational function.

Example 2: Stylus qualification must be repeated after any probe crash.

DeepL translation: 探针发生碰撞后, 必须重新进行笔尖认证。

Post-edited version: 探针一旦碰撞, 须重新认证测针。

Here, DeepL adopted the general translation “笔尖,” which is inappropriate in this professional context and fails to faithfully reproduce the technical concept. Consultation of relevant enterprise resources confirmed that the standard professional term is “测针,” which refers to “a core component used in coordinate measurement.” The corrected terminology accurately restores the specialized concept in metrology and aviation contexts, ensures functional equivalence between the source and target texts, and prevents technical misunderstandings caused by terminological inaccuracies.

Neglect of Context and Terminology Adaptation

MT essentially performs formalized and procedural processing of bilingual description, comparison, and matching. Its constraints are typically limited to lexical or sentential context and rarely extend to paragraph-level or situational context (Hu & Li, 2016).

Example 3: The beam hardening correction is activated to improve dimensional accuracy.

DeepL translation: 已启用光束硬化校正功能以提升尺寸精度。

Post-edited version: 开启射束硬化修正, 尺寸结果更准确。

In this example, DeepL translated “beam” as “光束,” a general physics term that is inappropriate in the context of metrology. In measurement science, the term refers specifically to “an X-ray beam.” The corrected

translation ensures terminological precision and scientific accuracy, aligning with the professional knowledge background of technical readers.

Under the guidance of Functional Translation Theory, post-editing terminology in aviation metrology technical texts should not merely correct lexical errors, but should reconstruct functional accuracy. The ultimate objective is to achieve zero loss in technical meaning and communicative function.

Problems in Syntactic Processing in MT

Technical texts are characterized by rigorous logic, complex nested structures, frequent nominalization, and extensive use of passive voice. MT systems often lack contextual judgment and pragmatic adjustment capabilities when handling such structures, resulting in disordered word order and semantic ambiguity. Functional Translation Theory emphasizes that translation should be guided by the intended communicative function of the target text rather than rigid formal equivalence.

Mechanical Translation of Nominalization

English technical discourse favors static nominal structures to enhance objectivity and information density. MT systems often mechanically reproduce such structures without considering communicative effectiveness.

Example 4: The verification of the step gauge shall be carried out before each use.

DeepL translation: 每次使用前均应进行阶梯规的验证。

Post-edited version: 每次使用前须验证步距规。

The post-edited version converts the nominal structure into a more direct verbal structure, highlighting the core action and strengthening directive clarity. According to Skopos Theory in functionalist translation theory, translation strategies should be determined by the communicative purpose of the target text. The purpose of this sentence is to emphasize the necessity of the operation of “verification.” Therefore, in post-editing, the noun was directly transformed into the verb “verify,” thereby releasing the core instruction from its static nominal packaging. This adjustment effectively realizes the dynamic directive function of the original text and directly and powerfully fulfills the technical and communicative functions of an aeronautical metrology technical text.

Example 5: The establishment of the coordinate system shall be carried out by using three datum features.

DeepL translation: 坐标系的建立应通过使用三个基准特征来完成。

Post-edited version: 须用三个基准特征建立坐标系。

DeepL’s processing strictly adheres to the static noun structure of the source language, but by packaging the main information as a noun, it weakens the core action and results in a cumbersome sentence. The post-edited version, by converting the noun into the verb “establish,” reconstructs the subject-predicate structure of the sentence. This not only retains all the technical information intact, but also places the core task of “establishing the coordinate system” at the focal point of the sentence, ensuring that the communicative function is maximized.

Rigid Translation of Passive Voice

Example 6: In the event that the automated loading system is stopped by an emergency signal, the current measurement cycle will be suspended and the part being inspected has to be removed manually by the operator before the system can be restarted.

DeepL translation: 一旦自动上下料系统被紧急信号停止, 当前测量循环将被暂停, 且正在检测的零件在系统被重启前须被操作员手动移除。

Post-edited version: 若紧急信号导致自动上下料系统停机, 当前测量循环随即暂停, 操作员须手动取出待检零件后, 方可重新启动系统。

When DeepL processes this sentence, it blindly mimics the English sentence structure for the Chinese translation, resulting in multiple layers of passivity within one sentence, which causes vague instructions and logical confusion. The principle of fidelity in functional translation theory is not about slavishly following the source language, but staying true to the core information and communicative intent of the original text. While the MT may appear to correspond word-for-word, its rigid syntax undermines the accurate transmission of technical information. The author believes that post-editing, with the primary task of restoring coherence, is necessary. This involves organizing the sentence, clarifying the agent, recipient, and verb, consciously converting passive voice constructions into active voice, optimizing logical connectors, and reconstructing a logical sequence that aligns with the cognitive habits of the target language readers, ensuring the effective achievement of the communicative purpose in the translation.

Logical Ambiguity in Long Sentences

Example 7: The measurement data that are collected by the CT system, which is equipped with a high-resolution detector and which rotates the workpiece during scanning, are processed by software that reconstructs the three-dimensional geometry and that has been validated for accuracy using certified reference parts.

DeepL translation: 配备高分辨率探测器的CT系统在扫描过程中旋转工件所采集的测量数据, 由经过认证参考部件验证精度的软件进行处理, 该软件可重建三维几何结构。

Post-edited version: CT系统配备高分辨率探测器, 扫描时同步旋转工件以采集数据; 所得数据由专用软件处理, 重建三维几何模型。该软件已通过认证标准件验证, 确保重建精度可靠。

The sentence contains two non-restrictive relative clauses introduced by “which,” embedded between the subject and verb structure. The MT engine compresses these three relative clauses into a single sentence, which results in a misalignment between the subject and verb, leading to logical confusion and violating the expression norms of technical texts. Consequently, the translation fails to effectively convey the information. By adhering to the purposive principle of “result determines the method,” post-editing is necessary to split the long sentence, adjust the word order, and use active imperative sentences to highlight the agent. This approach explicitly presents the implicit logical structure of the original text, ensuring that the technical description is clear and accurate.

Conclusions

In the context of rapid artificial intelligence development, MTPE strategies have become an important research focus in translation studies. Technical texts belong to informative texts, and their translation must adhere to the principles of fidelity, accuracy, and fluency. Guided by Functional Translation Theory, this paper constructs a three-dimensional framework centered on purpose, coherence, and fidelity to provide clear guidance for decision-making in the post-editing of aviation metrology technical texts.

In the era of AI-assisted translation, MTPE remains an effective means of improving translation efficiency and quality. The core value of translators lies in identifying functional deficiencies in MT output and implementing precise functional repair under theoretical guidance. Future research may further explore how to cultivate translators' functional judgment ability within human-machine collaborative models, thereby continuously enhancing the quality and efficiency of technical translation in specialized domains.

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