

**ENGLISH FOR ENGINEERING AT DEFENCE INDUSTRY: A
LINGUISTIC METAMORPHOSIS?**

*Bahasa Inggris untuk Bidang Teknik pada Industri Pertahanan: Sebuah Metamorfosis
Linguistik?*

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Abstrak: Banyak para teknisi yang kurang piawai dalam Bahasa Inggris. Berangkat dari masalah tersebut, penelitian ini menelisik kelangsungan Bahasa Inggris untuk Teknik Mesin. Berbagai sampel pun (kemudian) dihadirkan langsung dari PT. PAL Indonesia (Persero), sebuah perusahaan BUMN pembuat kapal perang, berdiri >35 tahun di Kota Surabaya. Mereka, para responden, betul-betul mengalami dilema dan kesulitan lantaran antara Bahasa Inggris Umum (GE) dan Bahasa Inggris Teknik (TE) sangat bertolak belakang. Metode Analisis Eksplorasi atau EFA kemudian digunakan dan, diharapkan kian memper-apik 'Fokus Studi Bahasa Inggris' nantinya; begitu juga dapat menata-kembali pelbagai pondasi atau bidang-dasar pendukung Bahasa Inggris untuk Teknik seperti berikut: (i). Penerjemahan, (ii). Rantai Pasok, (iii). Dokumen Operasional/ -Manual, (iv). Standar Prosedural Kerja, dan (v). Orientasi Analisa Barang beserta Kegunaannya. Pemakaian Bahasa Inggris di bidang-bidang dasar Bahasa Inggris untuk Teknik tersebut seringkali (masih) membingungkan para teknisi antara grammar-nya, struktur-nya, maknanya, atau prinsip-kebahasaannya sudah benar atau belum; oleh sebab itu, fokus-ilmu linguistik (Bahasa Inggris untuk Teknik) amat membantu para teknisi guna keberlangsungan pembelajaran Bahasa Inggris mereka dan melebarkan lini ilmu Bahasa Inggris untuk Tujuan Tertentu (ESP).

Kata Kunci: English for Engineering, ESP, Linguistic, Technical English

Abstract: Innumerable flock of engineers does not conceive English language adeptly. This research scrutinizes linguistic disciplinarian as regards English for Engineering. Numerous samples have been mustered from PT. PAL Indonesia (Persero), the >35-year state-owned warship-building industry in Surabaya. They, the respondents, are in

dilemma and hardship since General English (GE) poles apart from Technical English (TE). Exploratory Factor Analysis or EFA method transfigures the 'English subject' on to focal point, then; so does it reorients these clusters of English for Engineering as pioneer of: (i). Translations, (ii). Supply Chain, (iii). Operation Manual Documents, (iv). Standard Operation Procedures, and (v). Object-oriented Analysis and Design/ OOAD. Foregoing multivariate language's scope in English intermittently mystifies the engineer whether the grammar, structure, meaning, or the principle is common or not; a specific-based linguistic (English for Engineering) can expedite both technicians' advance English learning furtherance and broaden the significance of English for Specific Purpose (ESP), later on.

Keywords: English for Engineering, ESP, Linguistic, Technical English

INTRODUCTION

Medieval era, intensive English learning solely focused on 'literature' area—it thus bring forth conspicuous litterateur such as William Shakespeare, Fyodor Mikhailovich Dostoyevsky, Leo Tolstoy, Franz Kafka, Charles Dickens, Victor Hugo, Mark Twain, Miguel de Cervantes, et cetera. Nor is defeated; neither unspoken by late 5th – 15th centuries AD, meantime, the English language remains spoken amidst downtrodden Anglo-Saxon under authority of French Norman (Zare Behtash et al., 2017). Similar to that, Henry of Huntington revered to be renowned twelfth-century chronicler as he fought with delineating '*English can differentiate the characteristic between humans contrasted to other animals*'. English heavily transformed in both *form* and *vocabulary* against what it had been in 1066, afterward, its journey had not limited to the history of British Isles and of North America; however, it is globally encompasses: (i). Indian English, (ii). Caribbean English, (iii). West African English, and so forth. A quantifiable data measures English has uttered by >380 million people across the United Kingdom, the United States; followed by Chinese with 1.3 billion; Spanish, is in 330 million people; 180 million of Portugese; Russian by 175 million; German with 110 million; 80 million of French; others, Italian are 65 million.

Studying the annals of English language led people to be 'history-savvy'. Regardless of breadth knowledge, biggest prosperity of English language is indicated by

its suitability to enter ‘cross-disciplinary’ realm. With carefully designed, post-medieval English language comprises ‘other fields’ attention. Notably in defence industry, where plentiful engineering-based science lies, dearth amount of professionals’ English proficiency is a worriment. Trouble comes as technicians and/ or engineers met the structure-homogeneity of General English (GE) and Technical English (TE) at odds. The ‘access-made’ driven by specialty of linguistic to link English for industrial needs thus far goes exceptional—per Michael Dressman (2007) via his ‘*Cross-disciplinary Approach*’ to linguistic, asserted that language usage ‘is what miscellaneous area’ inextricably bound up (engineering, history, economic, political, science, literature, and so on).

English for engineering at PT. PAL Indonesia (Persero) assists technicians understanding binary/ -dual complexities; research conveyed by Stavroulla (2021) brought critical literacy that Technical English (TE) as part of English for Engineering can flourish the English for Specific Purpose (ESP).

Albeit it would be effortful, ESP in English for Engineering wrought up engineers by shifting their ‘communicative landscape’ or, either forms both multimodal ability and human semiosis (Lim, 2020). Features overtness of English for Engineering is forthright ones than GE. Explicit systemic of English for engineering here is accentuated within *Exploratory Factor Analysis* (EFA) scheme. Subsequently, EFA can add English for Engineering (EFE) into latest group-of-subject of ESP as follows: (i). English for Engineering/ EFE, (ii). English for General Purposes/ EGP, (iii). English for Academic and Occupational Purposes/ EAOP, (iv). English for Academic Purposes/ EAP, (v). English for Occupational Purposes/ EOP, (vi). English for Science and Technology/ EST, et cetera. Besides them, ESP generally classified to: (i). English as Restricted Language/ ERL, (ii). English for Academic and Occupational Purposes/ EAOP, and (iii). English with Specific Topics/ EwST (Salmani-Nodoushan, 2020; Whyte, 2017).

English for Engineering allows practitioners obtaining field outcome within

linguistic-based in their daily in-site work; majority of scholars has actuate English for Specific Purpose as Modern Foreign Language/ MFL too; likewise, the English praxis (table. 1, table. 2) at PT. PAL Indonesia (Persero) has succeeded of transmitting technicians to understand TE’s speaking, reading, writing, and practical or SRWP skills.

Table 1. Martin Hewing’s (2002) skill format of ESP

[1] Forms of Technical English Basic Skill : Speaking, Reading, Writing, and Practical

Part(s)	Basic	Approval
Speaking	Practice unfamiliar words;	+
Reading	Read both GE and TE;	+
Writing	Enhance and improve intrinsic context; provide factual data; and	+
Practical	Improve attention and reorient the utility.	+

Table 2. Integrated character of ESP by Tamas Kiss and Ken Mizusawa (2018)

[2] Forms of Technical English Derivative Skill : Extemporaneous, Brevity, Churning, and Consistency

Part(s)	Basic	Approval
Extemporaneous	Practice advanced academic/ non-academic words;	+
Brevity	Concise and straightforward in writing;	+
Churning	Consistent in process of understanding different base of English studies; and	+

Consistency	Improve attention and reorient the utility.	+
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Importance of specified-technical-vocabulary building for example: ^[1]Accelerating > Construct, ^[2]Achieve > Construe, ^[3]Benefit > Diagnostic, ^[4]Build > Dialup, and others have to be done. The more specific the merrier, in other words, an observation of ‘English for Engineering’ for ‘Professional Development’ or PD shown by Eun Gyong Kim *et al* (2021) coined its final appliance at practical-mill (especially defence industry) that, no absolute Technical English ever exist, but ‘trial and error’ is.

THEORETICAL REVIEW

English for specific purpose, in essence, acquires initiative pathway to boost the swath of English itself onto limited critical and/ or attitude of science (O’Hallaron et al., 2015). In classroom, professionals are accustomed to earn both textual and non-textual General English—one aspect, ‘a practical job’, later maximizes their intuitive/ -cognitive to naturally reshape the genuine structure of General English to Specific English (specifically English for engineering in this case).

As where Selda Özer (2020) spotlight the end-of-task of the Foreign Language Learning Effort Scale (FLLES), technical English is used to ramifies studies’ substantive. It contains English for Engineering’s writing rule as preliminary fundamental:

*Sentences

Rule 1 : Short, concise, maximum 20 words each sentence, write instructional needs only (unless other actions are necessary);

*Verbs

Rule 1 : Write instruction as ‘imperative’ or command form;

***Statements**

Rule 1 : Divide the form of command statement with comma;

This means, the critical genre analysis for technical English emphasizes ‘interdiscursive aspect’ for professionals (Xia, 2020). Moreover, a hundred-percent-use of mechanical/ -technical English would not relinquish possession of the origin of English. In Majed Ali’s (2015) notion, he considered that cognitive traits, cultural integration, multi-lingual, and ‘tolerance to ambiguity’ may bloom learning attitude in English for Engineering.

For the precise characteristics of Technical English, there are: (i). Attain specific needs in conditional, (ii). Underlining method and activities of the ‘disciplinary’ it serves, and (iii). Centralize language’s intrinsic components (grammar, lexis, and register), skills, discourse, and the genre. As its ‘taxonomy’ of technical English vocabularies, it would be organized too; the vocabulary of quality (reliable, low-cost, affordable, etc); for manuals (fasten, perform, supply, fit, etc).

RESEARCH METHOD

In *Exploratory Factor Analysis* or EFA, respondents collected from PT. PAL Indonesia (Persero) arrived from various backgrounds such as apprenticeships, temporal workers, permanent workers, and others. They are willing to be interviewed. Their concern pertaining to English for engineering needs has been processed via simple ‘numeric covariance determinant’ step. Data shows best deal revealed by informants; apprentices’ age range began with 19 y.o – 22 y.o, from 1 to 10, their answers are ≥ 7 ; followed by temporal worker, since most of them are not came by same major background but, they acknowledge that English for Engineering remains important, at the ages range of 24 – 27 y.o, their satisfaction range is ≥ 5 ; especially for permanent workers, one reason quoted by them express 80% of engineers are lack of English communication, from 27

to >30 y.o, their needs of technical English are ≥ 9 .

To hasten the research methodology, within EFA, the strategy named *Non Probability Sampling* is used; means, entire element of respondent is limited (only whoever worked at PT. PAL Indonesia in this case). While the *Accident Sampling* is utilized too as defining ‘truer possibility’ of the aim of the research; below is the formula to work on it then:

$$n = \frac{Z}{(\text{moe})}$$

Detail:

n = samples in total

Z = level of English for Engineering needs by respondents (*max.* 95% = 1.96)

moe= *Margin of Error* or stated the importance of respondents’ argument

Most of respondents are allocated for *premier data*. The questionnaire given is also restricted, so does informants’ answer would be focused on Question and Answer Section deliberating the English for engineering needs at PT. PAL Indonesia (Persero). The response of theirs has been systemized on to ‘variable principle’ checklist as follows: (i). X^1 : EFE Needs, (ii). X_2 : EFE prospects, (iii). X_3 : EFE importance, (iv). Y : Further Sustainability, (v). Z : EGP as EFE, (vi). Z_1 : EAOP as EFE, (vii). Z_2 : EAP as EFE, (viii). Z_3 : EOP as EFE, and (ix). Z_4 : EST as EFE.

Table 3. *Exploratory Factor Analysis* or EFA on English for engineering needs conveyed by respondents

PFA	RCC	A	B	C	D	E	F	G	H	I	
		X^1	X^2	X_3	Y	Z	Z_1	Z_2	Z_3	Z_3	$n = \frac{1.96}{(0, 2)}$

RNC	19-22 y.o	Y	Y	Y	Y		Y	Y			*) Unfilled table: respondents are doubt ($n = 8$) **) Y table: Agree/ -Yes ($n = 17$) ***) N table: Disagree/ -No ($n = 2$)
	24-27 y.o		Y	Y	N				N		
	27 to >30 y.o	Y	Y	Y	Y	Y	Y	Y	Y	Y	Result: EXCELLENT.

- PFA = Point-focused Attributes
- RCC = Respondents' Checklist Catalogue
- RNC = Respondents' Needs Checklist
- A = English for Engineering Needs
- B = English for Engineering Prospects
- C = English for Engineering Importance
- D = Further Sustainability
- E = EGP as English for Engineering
- F = EAOP for English for Engineering
- G = EAP as English for Engineering
- H = EOP as English for Engineering
- I = EST as English for Engineering

RESULT AND DISCUSSION

English is more than 'knowledge'. Every 'needs' calls to bring English backward to reflect multi-relationship amidst subject English with a motley disciplinary. Praxis that is relevant to multiform science keenness confers English language the taste of core attention. At this point, I dealt with *mutatis-mutandis* principle, that, "all necessary changes having been made". Not least of English importance be gauged by *vis-à-vis* or comparable significance such as English for engineering at Translation, English for engineering at Supply Chain, English for engineering at Operation Manual Document,

English for engineering at Standard Operation Procedures/ SOP, and English for engineering at Object-oriented Analysis and Design/ OOAD.

English for Engineering at Translation

Pei-Shu (2021) speculates the *Technology Acceptance Models/ TAM* usage is efficient, and there is international standardization in English for Engineering at translation named *Simplified Technical English* or STE (ASD, 2015). Below are the illustrations of STE and non-STE usage (from onboard and respondents):

STE Vocab		Translation		Action Needed		
Vs.		Technical	General	[1] Oxford-based*	[SUB]	
Non-STE Vocab		English (for STE)	English (for Non-STE)	[2] Common	=	
				[3] Recognizable	[AUX]	
Male	Stainless	Vs.	Sambungan	Besi Panjang	[1]	Yes.
Straight	Stainless		Besi			
Executions		Vs.	Pemeriksaan	Inspeksi	[1], [3]	Yes.
Inspection						
Pin	Assignments	Vs.	Himbauan	Catatan	[2], [1]	Yes.
Note						
Power	Enable	Vs.	Tuas	Kecakapan	[2]	Yes.
Power	Enable		Kontrol			
Panel	Illumination	Vs.	Lampu Bias	Lampu	[2]	Yes.
Lamp						

*) Translation analysis

“Technical English” Part of Speech	Similarity Index
Panel/ -illumination = Lamp ^(noun)	±
Power ^(noun) Enable ^(verb)	+
Pin ^(noun) = Note ^(noun)	+

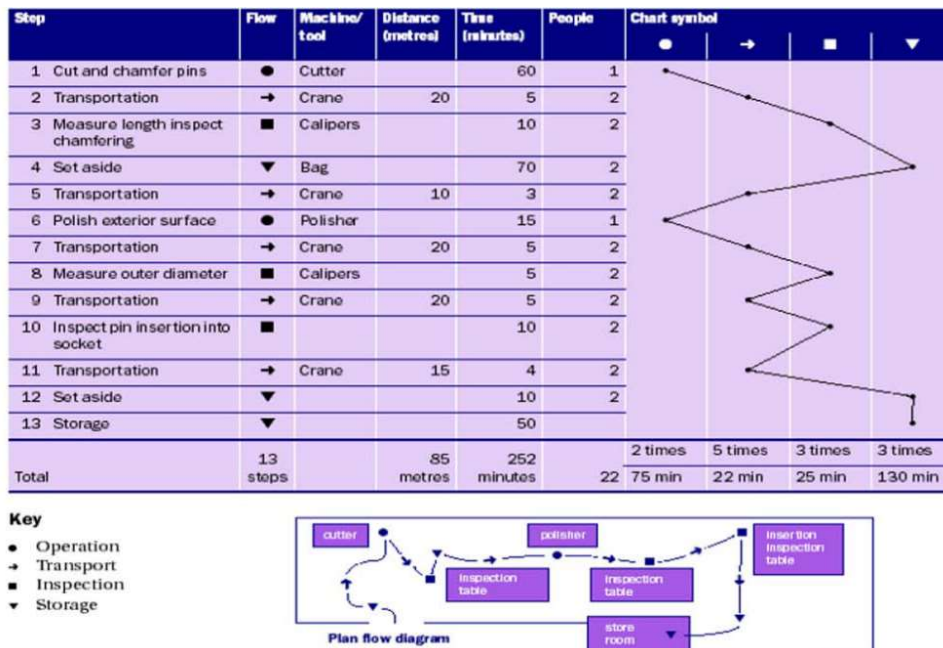
Execution ^(noun) = Inspection ^(noun)	+
Male ^(adj.) = Straight ^(adv.)	-

English for Engineering at Supply Chain

Good industry performs good communication. At PT. PAL Indonesia (Persero) where supplier came across the globe, miss communication may lead ‘cost disarray. English for Supply Chain synchronizes two-party communication in specific style-of-language. Dr. Dawei Lu (2011) dismantles English usage as its finest at Supply Chain has set ‘transactional commercial flow’ adequacy by persuading customer orientation.

Figure 1. Dr. Dawei Lu of Supply Chain Mapping Process

Success etiquette of descent English conversation has standardized within *Supply Chain Operations Reference/ SCOR* glossary (Branch & Branch, 2012), example: *Account Receivable* (A/R), it must be *Receivable Accounts* but, due to technical needs, it’s




inversed. *Accounts Payable* (A/ P), it must be *Payable Account* but, same as foregoing case.

English for Engineering at Operation Manual Document

This section focuses the language intrinsic aspect to make information well-delivered. Operational Manual Document juxtaposes real-work situation and written regulation on a firm. At PT. PAL Indonesia (Persero), mastering bilingual skill (*or*: Foreign language) is mandatory; since plenteous provided-information has tightly written in English but, remain heeds the Technical English (Kornieva & Vashchylo, 2021).

Engineering English, as Julius *et al* (2020) outlined it, recently has shifted on to ‘dominant status’ in English for International Language of Science/ EILS. Since engineering grouped as pure science, off so, the SOP existence within concise and clear conveyance must be procured. As succinct as possible, a manual document in Technical English must adhere to relevant engineering professional context. Manual document is tagged as linguistic acquisition. Below for the example, cited from warship equipment from PT. PAL Indonesia (Persero):

Figure 2. Warship Electrostatic Discharge (ESD) Console Manual

 **CAUTION**

LCD/LED screens are fragile. Use caution when handling

1. Open the Service Console
2. If the system is running, switch off the Service Console using the power button to prevent any unintended actions during maintenance
3. Clean the keyboard and screen using a soft cloth, if necessary use a mild detergent. If necessary, use a soft brush for cleaning the keyboard
4. Turn the Service Console back on
5. Close the Service Console and slide it back in place after cleaning



English for Engineering at Standard Operation Procedures/ SOP

A brief instructions totally close to Safety Induction protocol, procedurally, Standard Operation Procedures or SOP unified/ and or is integrated with Occupational Health and Safety preparedness. Nor authored as detail as it is, but the SOP (in technical English form) must comply definite task instruction and liken by ‘extratextual’ command—so does the instruction given must ‘verbalize’ the message undoubtedly, example:

Figure 3. Safety Definition

DANGER
When the DANGER notification is used, failure to comply with the described instructions may cause serious personnel injury or death, or severe and irreparable property damage.

WARNING
When the WARNING notification is used, failure to comply with the described instructions may cause serious personnel injury or extensive and possibly irreparable property damage.

CAUTION
When the CAUTION notification is used, failure to comply with the described instructions may result in moderate personnel injury or moderate property damage.

NOTICE
The NOTICE notification is used for instructions of special importance that does not relate to potentially hazardous situation.

Figure 4. Technical English for Safety Infographic

WARNING WARNINGS, CAUTIONS AND SAFETY INSTRUCTIONS **SAFETY FIRST** **CAUTION** AUTHORIZED PERSONNEL ONLY

WARNING ACCESSING THE ANTENNA INSTALLATION **CAUTION**

Only access for authorized personnel.
Always use the safety switch to stop transmission and the rotating antenna, before accessing the antenna platform. A rotating antenna may cause injury or even death.
Always wear climbing harness when accessing a radar tower. Observe and follow local safety regulations. Inform the relevant people of the work to be performed.

WARNING MAINTENANCE OF THE RADAR SYSTEM **CAUTION**

Never stand in front of an open-ended waveguide or coax from which power may be radiated. The transceiver produces non-ionising electromagnetic radiation. On a non-faulty system, only the antenna radiates. Radiation could be dangerous for the human body and precautions should be taken.
High voltage may be present at several points of the equipment, even with equipment switched off. Observe and follow all electrical safety precautions. These voltages may cause injury or even death.
Antenna, transceiver, computers and instruments must be connected to the same electrical protective ground.
Always use ESD (Electrostatic Sensitive Device) precautionary procedures when handling ESD marked modules. The equipment contains components sensitive to damage by electrostatic discharge. Wrist strap connected to earth bonding point must always be used when handling unshielded electronics. Modules must be stored in static shielding packaging (EIA-541). Module repair must be done on a ESD workstation, by qualified personnel.
Use only non-magnetic tools when working with magnetrons.

In no event, Terme AS shall be held liable for any direct, indirect, punitive, incidental or consequential damages whatsoever arising out of or connected with the use or misuse of its products.

English for Engineering at Object-oriented Analysis and Design/ OOAD

Among fifth advantageousness of English for Engineering, the OOAD serves a significant platform of ‘safety work’ enclosed with *Mutual Recognition Arrangements/* MRA significance; skilled workers have to seriously pay attention to work instruction by reading the guidance; hereby, the role of English for Engineering had to shed light on the guidance without any doubt. OOAD equals to object-direct assistance. Example:

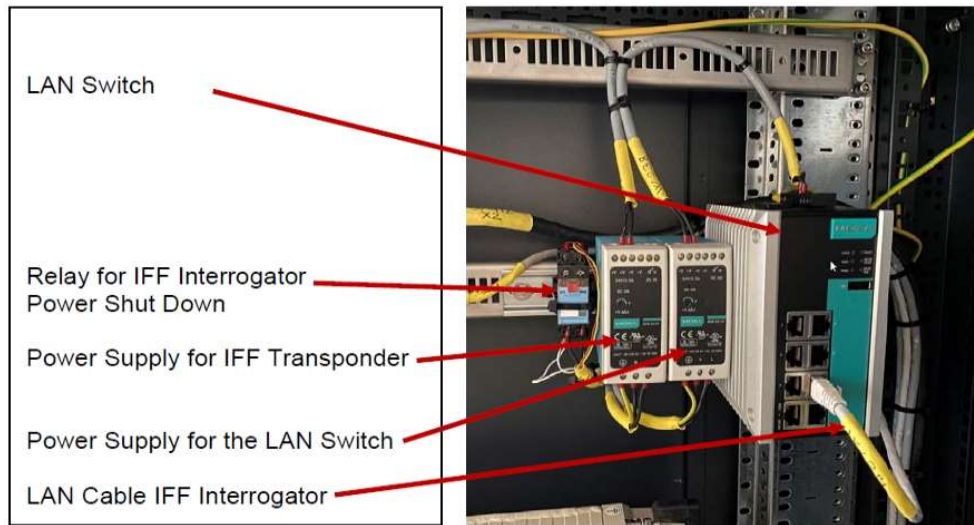
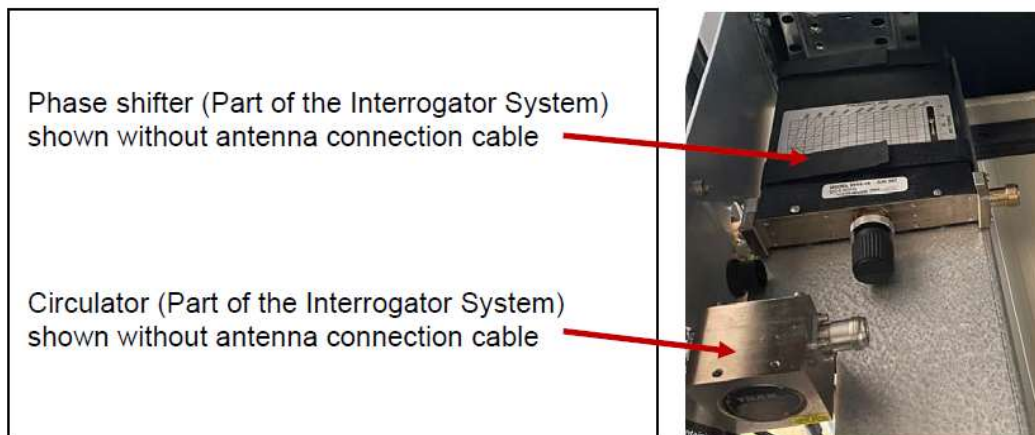


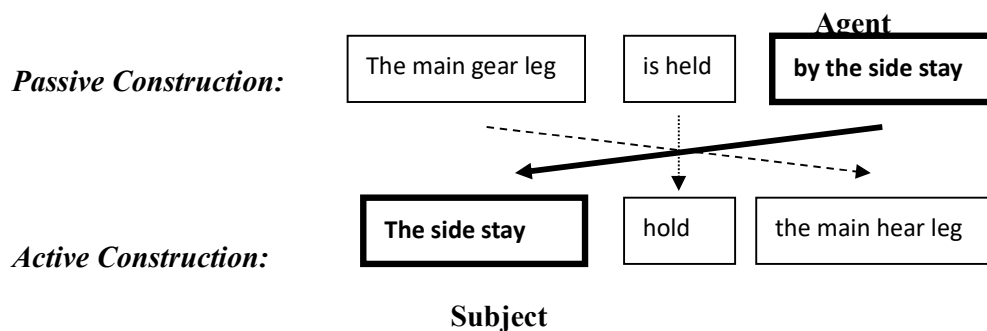
Figure 5. Object-oriented Analysis and Design within Technical English usage



CONCLUSION

Using limited linguistic acceptance matures the significance of insight too; in essence, that is how the concept of *Mutual Recognition Arrangements* (MRA) meant to be (Kaowiwattanakul, 2020). English for engineering invites rigorous discussion where the origin rules of English seems to be ‘disobeyed’—in fact, the principle has grown ever since the variety of knowledge arrived. Standard of English for engineering, likewise, has been heightening within soulful ethic of engineering itself. She, Christy Peter (2017), assures since late eighties, English linguistic has intended for professional needs.

A handbook written by Kathleen Bogue (1978) criticizing ‘Teaching Technical English’ to professional warned noticeable TE difference of two: (i). Meaning-special-given to them are not basic anymore, (ii). General English is in dearth of use there. For some machinery terminology, technical English does not ‘extravagant’ in use of vocabularies; everything goes ‘forthright’, these are the ‘how-to’ of technical English:



Rule I. Technical Verbs

Using verbs as ‘technical verb’ category is acceptable

Definition: it specifies technical and operational contexts/ **Correct Example:** Manufacturing Process e.g. Drill, Grind, Mill, Ream, Flame, Insulate, Remetal, Crimp,

Rivet, etc.

Rule II. Noun Clusters

Write noun clusters no more than three words

Definition: in TE, when words link up different ways, ambiguity occurs/ **Correct**

Example: Runaway light connection (3 words/ “connection” as the main noun)

Rule III. Articles and Demonstrative Adjectives

Use an article (the, a, an) or demonstrative adj. (this, these) before noun

Definition: in can show where the noun and noun phrase actually is/ **Correct Example:**

Turn **the** shaft assembly, **This** manual tells how to service the warship-maingun

Rule IV. Verbs

Use the “-ing” form of verb as modifier in a technical name only

Definition: Words end by “-ing” notifies different usage in a sentence (different parts of speech). They shall be part of verb to express a present activity/ **Correct Example:** An *opening* missile can be dangerous

Rule V. Active Voice

Active Voice is mandated for procedural writing, use it as much as wisely.

Definition: Use only Active Voice in technical English especially in procedural writing/

Correct Example: The side stay holds the main gear leg

*) *Note:* entire samples of technical English above based on the ASD-STE 100 (ASD, 2015; Etteplan, 2018) international standardization regulates the English use for military heavy-machine building e.g. Tank, Warship, Fighter Plane, etc.

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