ESE

THE DEVICE FOR A MODERN ANSWER TO LIGHTNING PROTECTION?

Z. A. Hartono and I. Robiah
December 2009

Introduction

This article was written in response to an advertorial (**ESE: The device for a modern answer to lightning protection**) placed in The Sunday Star on October 4, 2009, by an anonymous proponent of the early streamer emission (ESE) lightning protection system (see advertorial next page). Some of the content of the advertorial was found to be misleading and seemed to be targeted at the general public who are largely uninformed about lightning protection matters.

The advertorial seemed to be an attempt to defend and promote the ESE air terminals (i.e. lightning rods) which have already been scientifically discredited and regarded as dangerous to public safety more than a decade ago. This danger was highlighted again in a warning issued by the International Conference on Lightning Protection (ICLP) in 2005.

http://www.iclp-centre.org/warning.html

The advertorial also seemed to be an attempt to get public recognition of the French ESE standard, NFC 17-102, which failed to meet the International (IEC) lightning protection standard and most recognized national lightning protection standards around the world. After failing to get the non-scientific ESE standard recognized by the IEC, the vendors have now claimed that it is a different standard to that of the IEC.

This article will address some of the misleading statements and claims made in the advertorial and will also highlight some of the recent and past failures of the ESE air terminals that have not been reported before.

Z. A. Hartono and I. Robiah

E-mail: zahartono@gmail.com, hartono@pc.jaring.my

Phone : 60-12-3059971

ADVERTORIAL

ESE: THE DEVICE FOR A MODERN ANSWER TO LIGHTNING PROTECTION

What quarrels and passions have inspired men as to what to do to protect themselves from lightning, long feared as one of the Gods' instruments of vengeful anger!

Today, lightning, widely recognized as the weather phenomenon essential for balancing the earth's electrostatic field, remains still feared for the magnitude of the destruction it generates. It has become an economic issue which few activities around the world can escape from, nor avoid seeking more efficient ways to protect themselves from its potential harm.

From offers to the Gods of antiquity to Abbot Nollet's stick or to Mr Franklin's primitive rod in the 18th century, the sometimes chaotic evolution of scientific knowledge in the modern period saw the emergence of the technology of active lightning conductors (ESE) whose efficiency is enhanced by electronic devices.

It remains that no one can yet model lightning and get an exact projection of the real space of the atmosphere's parameters, of the profile and the nature of the soil under storm. It therefore remains part of the "secret of the Gods!"! The reference works show that there exists no zero risk protection and that, at best, the calculated efficiency of a "perfect" installation stands from 80% to 98%.

An installation must be as perfect as possible for, indeed, the efficiency of a lightning protection system depends on the efficiency of its air-termination system (the lightning conductor) but also the configuration of its down-conductor system as well as the quality of the earth-termination system. Like a chain, it is only as strong as its weakest link. A specialist's knowledge and intervention are needed to identify where and how the lightning protection system should be implemented.

And trying to search for an aesthetic balance for forests of lightning conductors, Franklin rods or catenary wires is not a guarantee of efficiency, far from it.

One may have seen recent controversial statements in the press which appear as concerted actions against active modern lightning conductors (ESE), using sometimes misleading arguments, even going as far as quite maliciously blaming these devices for lack of efficiency without mentioning some blatantly obvious failure in the installation, or attributing lightning damages to an ESE device when a building did not even have a lightning protection system....

This reflects the continuation of the usual argument between ancients and moderns through the ages, where conservatism often finds its motivation in the protection of economic interests or power at the expense of the general interest.

It is not important, it's a law of its own from generation to generation: progress stands for itself. Over a hundred years ago, some forecasted with certainty sudden death to those who went through a tunnel on a steam train. Today, who would refuse to get assisted brakes for their car, even if only to gain 1 or 2 meters of braking distance when having a car crash?

What one should conclude?

E.S.E.: 20 years of experience around the world

All existing lightning protection standards are based on experience. Regarding ESE air terminals, these Lightning Protection Systems have widely proved their usefulness. The large experience coming from the several hundred thousands of installations working all over the world shows that they efficiently protect all kind of structures and open areas.

In 1986, first year of available statistics, the number of installed ESE was close to 4,000. In 2008, the cumulated number of installed units is about 360,000. These figures show the long experience and proved efficiency of ESE systems.

The protection against lightning of a wide range of buildings and open areas is achieved by ESE all over the world:

- Public and administrative buildings including the European Parliament in Strasbourg
- Industrial plants including high risk facilities
- High rise office and residential buildings
- Open areas: golf courses, outdoor swimming pools, stadiums, leisure parks
- Historical and Cultural buildings
- Religious buildings (churches, mosques)
- Telecommunication installations
- Defence and army buildings

ESE systems represent even the most important lightning protection systems used in more than 50 countries:

- In Asia: India, China, Indonesia, Malaysia, Thailand, Japan, Australia, South Korea
- In Europe: France, Spain, Portugal, Czech Republic, Slovakia, Romania, Bulgaria, Croatia, Greece, Great Britain, Belgium.
- In Middle East: Turkey, Iran, Kuwait, Emirates, Lebanon.
- In America: Mexico, Caribbean, Equator, Peru, Bolivia, Chile, Argentina, Paraguay, Venezuela, Costa Rica
- In Africa: all the countries of Northern and Western Africa.

In all these countries, more than 50% of the installed LPS are based on ESE systems. And the growth in the volume of ESE sales shows the acknowledgement of the efficiency of those devices on those markets.

The NFC 17-102 French Standard compliant with the IEC 62305

Indeed, two different standards exist with different scopes. The requirements of the ESE standard NF C 17-102 do not conflict with the requirements of the EN 62305. Furthermore, in many cases, the security measures for ESE installations are even tighter.

In opposition to recent publications, we can confirm there is no conflict between the French standard NFC-102 and the IEC/EN standard 62305 which have been also mentioned by Cenelec to ICLP committee.

The ESE standards is defined mainly as a product standard while the EN/IEC 62305 standard is an installation standard.

The NFC 17-102 standard has thus not been withdrawn on the 1st of February 2009.

Besides, ESE devices have proved their efficiency and offer a high level of security which led to a worldwide deployment of this technology.

FOR FURTHER INFORMATION, PLEASE FORWARD YOUR ENQUIRY TO ese.questions@gmail.com

1. Response to the advertorial

The following is our response to some of the misleading statements and claims made in the advertorial.

1.1) Modeling the lightning behavior [Column 1, paragraph 4]

The advertorial states that "*It remains that no one can yet model lightning and get an exact projection of the real space of the atmosphere's parameters, of the profile and the nature of the soil under the storm. It therefore it remains part of the "secrets of the Gods!"!*"

This statement is misleading since lightning scientists have made significant progress in modeling the lightning interception part of the lightning flash i.e. just before it strikes a building. For the past few decades, scientists have developed (mathematical) models to simulate this behavior of lightning but they lacked the means to verify the accuracy of these models. Due to the very low lightning activity in their respective countries, and hence the low rate of lightning caused damages, these models could not be verified using real lightning strikes.

Recently, scientists in Sweden had developed a new model[1] (known as the Physical Leader Inception Model) and had compared it against the large lightning strike damage data collected in Malaysia. The good agreement between this new model and the field data is a major breakthrough in lightning modeling techniques and this will lead to a further improvement of the existing protection methods for buildings worldwide.

This new finding has also helped to confirm a new air terminal positioning method which was developed in Malaysia in 1995 and later became known as the Collection Surface Method (CSM). The CSM, which provided the correct placement method for Franklin air terminals on the high risk parts of the roof, has recently been included in the new international IEC62305 standard (published in 2006). A recent study[2] also suggested that the use of the CSM, in conjunction with existing air terminal

[1] Becerra et al, "Striking distance of vulnerable points to be struck by lightning in complex structures", International Conference on Lightning Protection, Kanazawa, Japan, 2006,
[2] Dudas, J and Dudas, M, "Software for lightning protection system diagnosis according to IEC 62305", International Conference on Lightning Protection, Uppsala, Sweden, 2008.

positioning methods mentioned in the IEC62305, can provide up to 98% protection against lightning strikes and at a very economical cost.
http://www.svodice.cz/docs/ICLP2008Paper10-3.pdf

By making a sweeping statement that no one can yet model the lightning behavior, the advertorial hopes to keep the public and the professional community ignorant of the scientific progress in this field which has greatly improved the conventional method of protecting buildings against direct lightning strikes.

1.2) Controversial statements against ESE [Column 1, last paragraph]

The advertorial also made a reference to "controversial statements" about the ESE performance which appeared in the press recently.

However, these statements can be considered controversial if they were made more than a decade ago when not much was known then about the field performance of ESE systems. They are no longer controversial now since the scientific debate about the ESE systems virtually ended in 1999 when the National Fire Protection Association (NFPA) upheld its rejection of the draft American ESE standard (NFPA781) which was developed by the ESE vendors.

The NFPA had, in 1995, rejected the draft NFPA781 standard when a study conducted by the National Institute of Standards and Technology (NIST) did not find any scientific evidence to support it. However, the NFPA was forced to re-open the study in 1998 when the ESE vendors took legal action against them.

In 1999, the NFPA received substantial new field data on the failures of ESE air terminals from universities and independent researchers from the USA and around the world. Based on these new data, the NFPA upheld its earlier rejection of the ESE standard and the situation remained the same until today.

The above information can be found in a comprehensive review[3] made by Professors Martin Uman and Vladimir Rakov who found no evidence in scientific publications that can support the validity of the ESE air terminals. On the other hand,

[3] Uman, MA and Rakov, V, “A critical review of non-conventional approaches to lightning protection”, Bulletin of the American Meteorological Society, December 2002.

these professors also pointed out (see page 1817 of the paper) the failures of the ESE lightning conductors under real lightning conditions obtained from Malaysia.
http://www.lightningsafety.com/nlsi_lhm/Uman_Rakov.pdf

By claiming that the recent press statements about the ESE air terminals were controversial, the advertorial hopes to mislead the public into thinking that the ESE air terminals were still under scientific investigation and debate by vendors and scientists. The fact is that the ESE air terminals have already been scientifically discredited and rejected. Furthermore, ESE vendors in the USA have been legally barred by court action from declaring that the protection zone of the ESE rod is greater than that of the Franklin rod, something which the public is still unaware of even in the scientifically advanced western world, what more those in the developing and third world countries.

1.3) Claims that ESE systems constitute more than 50% of installed lightning protection systems in selected countries in Europe, Americas, Asia, Africa and Middle East [Column 3, paragraph 2]

The above claim is perhaps the most misleading claim of all. This is because Japan, one of the countries mentioned, is well known for its very strict adherence to technical standards and had not installed the ESE on such a wide scale as claimed in the advertorial.

Our studies of Japanese lightning protection practices show that most Japanese high-rise buildings have been installed with one or more pole mounted air terminals that, from a far distance, looked like those seen in Malaysia. However, when observed using a binocular, these air terminals were actually pole-mounted Franklin rods instead of the ESE lightning conductors (see photos next page).

These studies were conducted in several major cities like Tokyo, Yokohama, Kyoto, Osaka and Kobe and had been partially published in a conference paper[4]. The studies show that the use of ESE air terminals in Japan is less than 1% and not as claimed in the advertorial.

[4] Hartono, ZA & Robiah, I, "Location factor and its impact on antennae safety with refernce to direct lightning strikes", IEEE Region 10 (TENCON) Conference, Kuala Lumpur, Malaysia, 2000.

Above: These photographs show pole-mounted Franklin rods which complied with the Japanese standard. The very first photograph (top left) in the study was taken in Tokyo in August 1987.

We have also made similar studies of buildings in London and a few other cities in the UK and have found that the use of the ESE air terminals there is less than 50%. In addition, the feedback we received from lightning experts in some Latin American countries mentioned in the advertorial revealed that ESE air terminals made up less than 50% of the installed LPS in those countries.

Hence the advertorial have actually made a maliciously false and misleading statement in order to hoodwink the public and professionals into thinking that scientifically advanced countries like Japan and the UK will use the ESE air terminals on a large scale. By making such claims, the ESE vendors hoped to trigger a herd mentality among the less informed public and professionals in developing and third world countries in order to boost their sales.

1.4) Claims about the validity of the French ESE standard, NFC 17-102 [Column 3, paragraph 4]

With regard to the brief statements on the ESE standard, NFC 17-102, the advertorial seemed to be trying to confuse the public and professionals who are uninformed on this issue. It mentioned that the ESE standard is "defined mainly as a product standard" and that it is not in conflict with the IEC standard which it claimed to be an "installation standard".

What the advertorial failed to clarify is that the ESE standard also contains an installation method which is directly in conflict with the installation method found in the IEC standard. The ESE standard recommends that one ESE air terminal be installed centrally on the roof to protect the entire building and it is this installation method that is in conflict with the method recommended in the IEC standard. The ESE method is also in conflict with the known Physics of lightning protection.

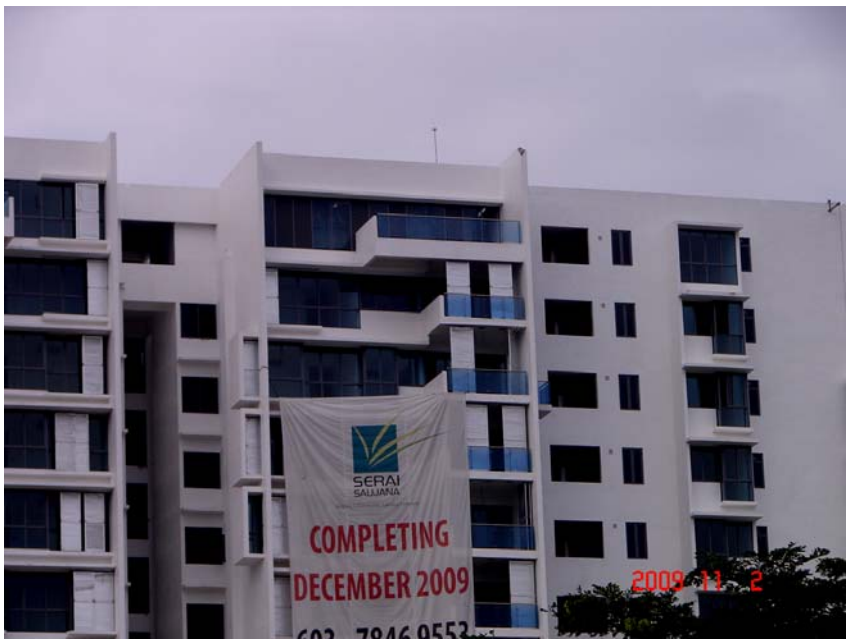
In the past, this ESE installation method had been used by the ESE vendors as their main selling point to thousands of gullible architects, engineers and building owners. The method is based on the unproven assumption that a single ESE air terminal provides a much larger protection zone than the Franklin rod. It is this successful marketing tactic that had led to the sale of thousands of ESE air terminals, mostly in developing and third world countries, for the past two decades.

However, this marketing technique has been barred in the USA when the ESE vendors were prohibited from portraying that the ESE air terminal has a much bigger protection zone than the Franklin rod.

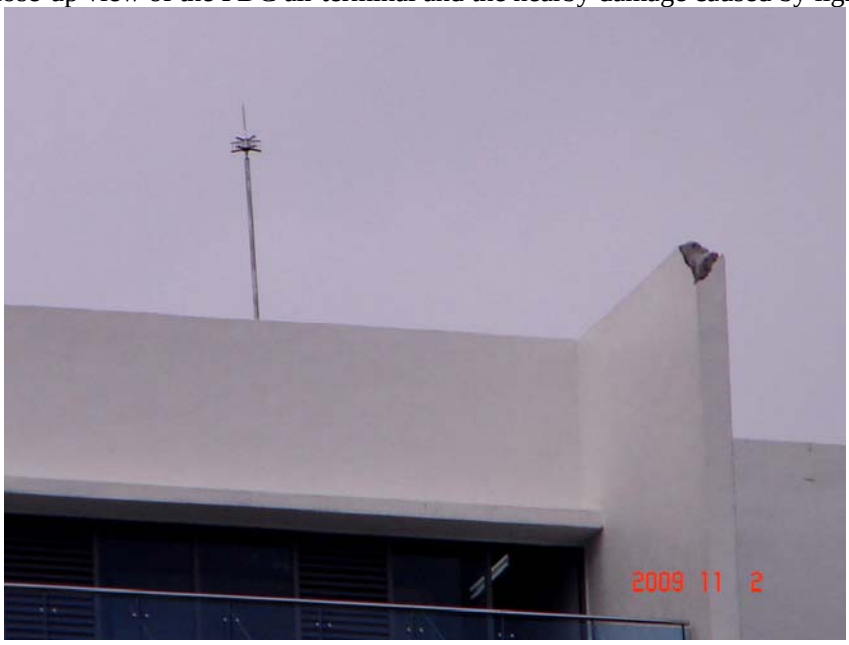
Readers can obtain this information and others like it from the following websites:
http://www.lightningsafetyalliance.com/education.html
http://www.lightningsafety.com/nlsi_lhm.html

Of immediate concern to all Malaysians is the high failure rate of the ESE air terminals. In the Klang Valley area, there are now more than a hundred buildings that have been struck and damaged by lightning even though they have been installed with one or more ESE air terminals that conformed to the NFC 17-102 standard.

Some of the new uncompleted buildings have even been struck and damaged by lightning within a year of the ESE air terminal installation, with the damage located well within the claimed protection zone of the air terminal as the example below shows.



Above: The Serai Saujana Condominium which was installed with the PDC air terminal.
Below: A close-up view of the PDC air terminal and the nearby damage caused by lightning.

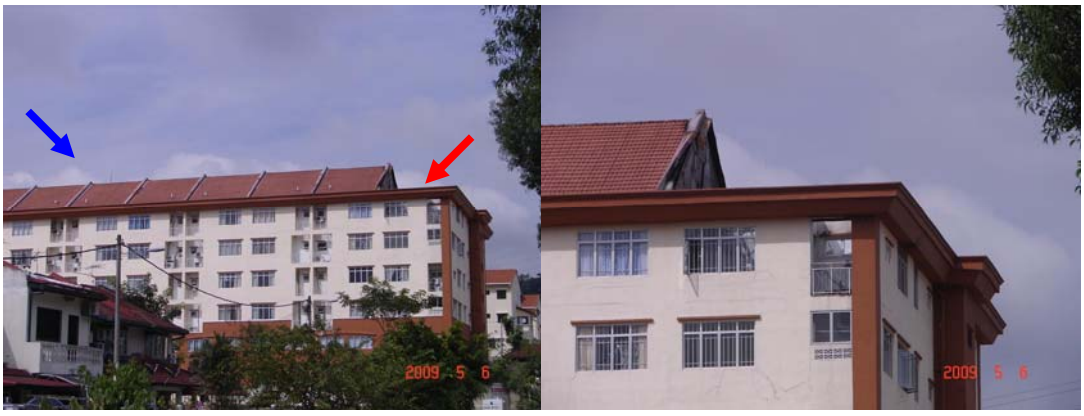


2. Worrying trends in ESE air terminals failures

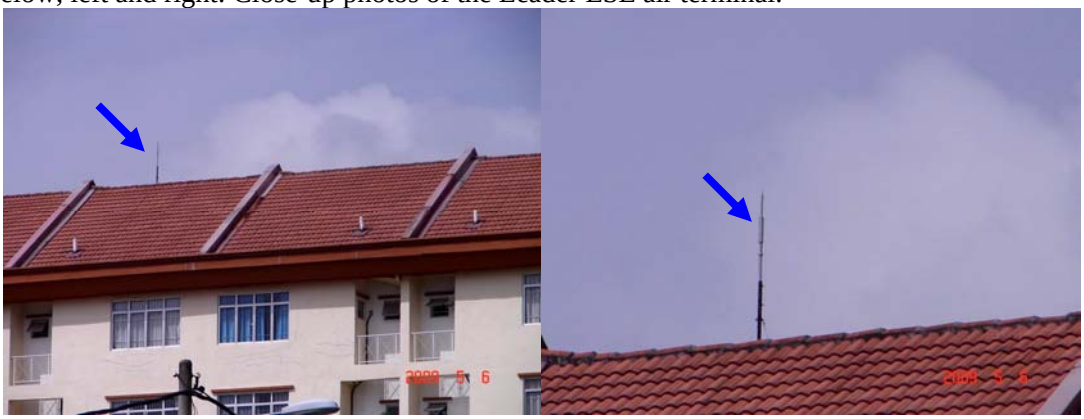
With more ESE air terminals being installed around the country, more buildings are being struck by lightning every year, some with severe consequences.

2.1 Fire damage

Earlier this year, the Amandari Condominium was struck by lightning which resulted in three top floor units being badly damaged by fire. One unit had its roof complete destroyed. This incident was also reported in newspaper.
http://thestar.com.my/metro/story.asp?file=/2009/5/5/central/3827332&sec=central



Above left: The damaged units (red arrow) are located about 30m from the ESE air terminal (blue arrow) in the above photos.
Above right: A close-up picture of the damaged units.
Below, left and right: Close-up photos of the Leader ESE air terminal.



Many other lightning incidents where the ESE air terminals were used were not reported in the news media simply because the damages were not life threatening. This

does not mean that they can be ignored. To see more photographs of ESE failures, please refer to our reports which have been posted on the following websites:

http://www.ground.co.kr/PGS_forum/forum_20090819.html

http://www.ground.co.kr/PGS_forum/forum_20090819_1.html

http://www.ground.co.kr/PGS_forum/forum_20090924.html

http://www.ground.co.kr/PGS_forum/forum_20090930.html

http://www.lightningsafetyalliance.com/documents/streamer_emission.pdf

http://www.lightningsafety.com/nlsi_lhm/ACEM_Journal_Q1_2007.pdf

http://www.lightningsafety.com/nlsi_lhm/early-streamer-emission.pdf

http://akihito-shigeno.com/files/Hartono_ICLP2008_1_.pdf

Some of the above reports have also been translated into other languages for the benefit of the non-English speaking professionals and public. For example:

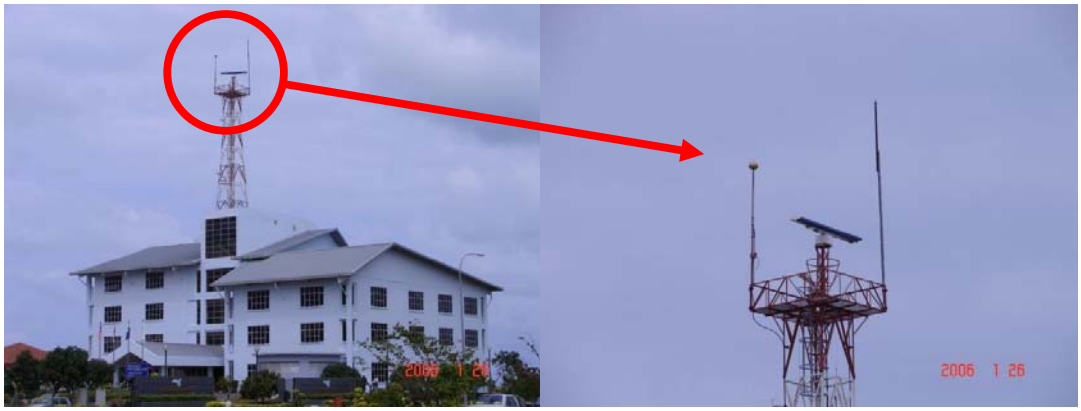
http://www.dehn.de/design07_frame/pdf/ds_es/sp_longterm.pdf

http://www.dehn.de/design07_frame/pdf/ds_es/acem07.pdf

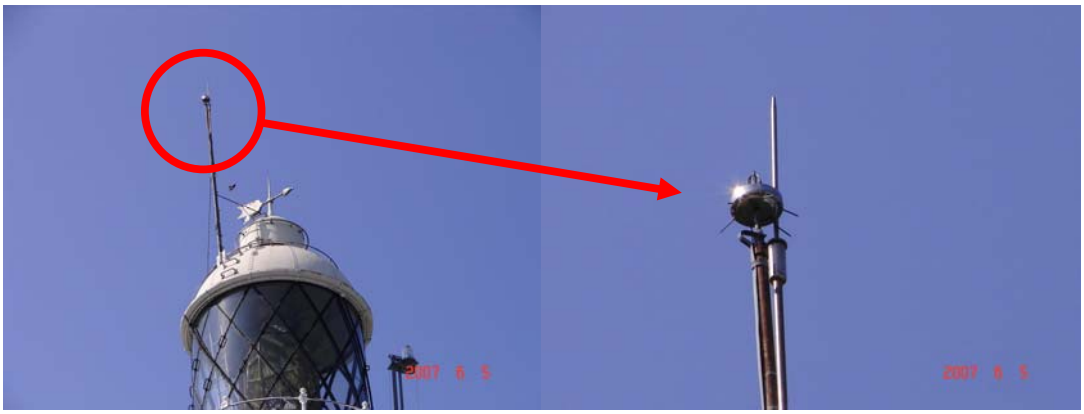
http://ah.com.pl/plik.php?id=20

2.2 Two different ESE air terminals used at the same site

Some of the failures of the ESE air terminals can be inferred when two of these terminals were used at the same site. In some cases, they were installed right next to each other. However, the non-expert may not realize this even though he can see them.



Above: A Dynasphere and an EF air terminal at a radar facility in Kertih, Terengganu.



Above: A Prevectron and a Pulsar at a lighthouse in Tanjung Tuan, Negri Sembilan. Both air terminals complied with the NFC 17-102 standard.

The logic here is that if the second ESE air terminal was installed, then it goes to show that the first ESE air terminal installed had failed to protect the site. The question is which air terminal was installed first? (Hint: The second ESE air terminal is usually installed higher than the first!).

The above examples show that poor understanding of the lightning protection principles and standards have led some end users to be deceived into using two ESE air terminals at the same time in order to “protect” their assets.

2.3 One ESE air terminal replaced by another

In some cases, one ESE air terminal was replaced with another ESE air terminal for the same reasons. However, the casual observer may not realize this since this change may take years to happen, unless he has a photographic memory (or a simple photograph).

In the case shown below, a Dynasphere air terminal at the KL International Airport (KLIA) radar site was replaced with an EF air terminal several years later. As already shown in one of our earlier reports, replacing one ESE air terminal with another will not stop lightning from striking the structure a second time.

Top picture: The KLIA radar station in 2002 with the Dynasphere air terminal.
Bottom picture: The same station in 2007 with the EF air terminal.

3. Summary

The advertorial published last October clearly shows that the ESE vendors will resort to deception and data manipulation in order to boost their sales of these dangerous but profitable air terminals. Those who drafted the advertorial were either ignorant of the science behind lightning protection or had the intention to deceive the public who generally have a low understanding of lightning protection matters.

The ESE air terminals have been repeatedly proven to be a gross failure in numerous situations in this lightning prone country for nearly two decades. Unfortunately, some of the users (general public, professionals and the government agencies) have failed to recognize this fact as shown by their replacement of one failed ESE air terminal with another ESE air terminal.

These users have been repeatedly duped by the ESE vendors because of their ignorance of lightning protection standards issues. In some cases, engineers who initially doubted the ESE principle finally succumbed to the scam when professors from a local public technical university were called in by the ESE vendors to support their marketing effort.

Besides causing millions of Ringgit in losses through purchase of the ESE air terminals and their consequent damages, the ESE air terminals are a known danger to the public and infrastructure for more than a decade. This fact should be recognized by the government agencies related to public safety.

It is a well known fact that people are terrified of lightning, especially when it strikes very close to them. Hence the ESE vendors and their proponents, who knowingly expose people to lightning by promoting, recommending and/or selling their safety-challenged air terminals, should be regarded as “terrorists”. They are fully aware of the ESE failures in this country ever since photographs of these failures have been presented in several technical seminars and conferences since 1993.

In order to safeguard the public from future lightning danger, the government should immediately stop the sales of all ESE air terminals and initiate a total product recall on them since they have already caused many life threatening damages and fires to various private and public buildings around the country.