

# **Advisory Opinion**

## **Fostering a Sense of Reassurance in Engineering Systems**



**27 September 2023**

**Science Council of Japan**

**Joint Subcommittee on Safety, Security, and Risk  
Assessment for Engineering Systems  
of the Committee on Comprehensive Synthetic  
Engineering and the Committee on Mechanical  
Engineering**

This Advisory Opinion is issued in accordance with the outcome of the deliberations of the Joint Subcommittee on Safety, Security, and Risk Assessment for Engineering Systems of the Committee on Comprehensive Synthetic Engineering and the Committee on Mechanical Engineering, Science Council of Japan.

Joint Subcommittee on Safety, Security, and Risk Assessment for Engineering Systems of  
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Mechanical Engineering

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This English version is a translation of the original written in Japanese.

## Executive Summary

### 1. Background

The recent social situations such as abnormal weather conditions, invasion from other countries, threats to use nuclear bombs, harmful rumors after the Fukushima accident, and the COVID-19 pandemic have created a strong sense of anxiety. On the other hand, in the social implementation of new technologies such as autonomous driving in road traffic and measures to suppress global warming, their technologies and measures must be in an acceptable form for society.

In The Science Council of Japan, the Subcommittee on Safety, Security, and Risk Assessment for Engineering Systems (hereinafter referred to as the "Subcommittee"), which is a joint subcommittee of the Committee on Comprehensive Synthetic Engineering and the Committee on Mechanical Engineering, established a new working group on the Studying a Sense of Reassurance for Engineering Systems in the 24<sup>th</sup> term and has been discussing various aspects of "sense of security," in particular.

### 2. Current Situation and Problems

As is often said "Anzen Anshin" or "Anshin Anzen" in Japanese, "Anshin," which means "reassurance" or "sense of security" is often used together with "Anzen" which means "safety" or "safe and secure." However, in engineering and its related fields, while there have been a lot of discussions on the importance of "Anzen," there have been fewer on "Anshin" in comparison; there are even rough arguments that if "Anzen" is ensured, "Anshin" should be assured as well. On the other hand, the reality is that engineering systems will not be accepted by society if they are not reassuring or if they do not provide a sense of reassurance. Therefore, it is considered extremely important from the viewpoint of social acceptance of engineering systems to face head-on the question of "what is reassurance" or "what is a sense of reassurance". Therefore, this subcommittee has recognized this as a social issue and has been discussing and deliberating on it.

In the 24<sup>th</sup> term, in order to clarify the relationship between the sense of reassurance for engineering systems and society, we first attempted to clarify the relationship between "safety" and "reassurance," which had been unclear from the perspective of "safety." Next, we discussed the systematization of "reassurance" including perspectives different from the "safety" perspective, clarification of the relationship between "reassurance" and "sense of reassurance," and further clarification of elements essential to such relationship with society. The results were published on August 25, 2020, as a report, "The Sense of Reassurance and Society for Engineering Systems", in which the following two points were concluded.

**1) It is necessary to systematically organize the structure of "reassurance" in order to discuss "reassurance" for engineering systems.**

**2) It is necessary to clarify the elements to realize a society where people feel a sense of reassurance.**

In response, during the 25th term, we discussed and deliberated on these issues from the perspective of "reassurance" and summarized the results in this advisory opinion.

A sense of reassurance is defined here as "the feeling that an individual feels reassured." The term "reassurance" is closely related to "safety," and has been a requirement of the "society to be aimed for" continuously since the Second Basic Plan for Science and Technology. Therefore, "sense of reassurance," which is the feeling of "reassurance," is a socially important sensitivity. However, because it is a sensitivity, the number of studies on "reassurance" and "sense of reassurance" in engineering and its related fields is significantly less compared to that of "safety." Such "reassurance" and "sense of reassurance" have the following characteristics that are specific to the sensibility or unique to the sense of reassurance.

- 1) Feelings of reassurance and feelings of anxiety (how one feels reassurance and anxiety) vary from person to person due to individual subjective emotions;**
- 2) While it is important that the sense of reassurance/anxiety be within a "well-balanced" range, this may not be the case.**
- 3) A (or an excessive) sense of reassurance and anxiety tends to spread to others.**

Based on these matters, this Subcommittee discussed and deliberated on the proposals in the above-mentioned report regarding ;(1) how to address "a sense of reassurance," (2) modeling of "a sense of reassurance," and (3) elements that constitute "a sense of reassurance," with engineering systems as the subject.

### **3. Contents of this Advisory Opinion**

- 1) The above-mentioned characteristics should always be kept in mind when discussing sense of reassurance and a sense of anxiety.
- 2) In modeling to clarify the structure of a sense of reassurance, a bottom-up approach should be used together with a top-down approach to clarify the individual components of a sense of reassurance and the basic framework of a sense of reassurance common to engineering systems (especially, new technologies).
- 3) It is a prerequisite for an appropriate sense of reassurance that the engineering system has achieved its safety goals, and the following components required for fostering a sense of reassurance in the engineering system should be realized based on the collection, transparency, and appropriate disclosure of safety-related information.

- (i) Easy-to-understand interfaces to reduce unknown factors in risk perception and explanation of system shortcomings regarding usability from the user's perspective.
- (ii) A friendly interface to reduce the fear factors in risk perception
- (iii) Fostering a sense of trust in the person in charge, the engineering system, and its manufacturer or brand
- (iv) Proactive knowledge sharing by the recipient of the knowledge
- (v) Information literacy, including asking oneself about whether the recipient's sense of reassurance is really based on correct knowledge and rational evidence
- (vi) Regular inspection and maintenance, support system for users
- (vii) Development of laws, compensation system, and judicial system
- (viii) Reduction and elimination of social, economic, and political factors that increase anxiety factors

Stakeholders of engineering systems (companies, relevant ministries and agencies, local governments, and citizens) should consider the above-mentioned aspects on not only "safety" but also on "reassurance" when designing, implementing, and using engineering systems; provided, however, as (viii) is beyond the scope of this opinion, it is not addressed here.

Additionally, as stated in the Basic Plan for Science and Technology (Innovation), a safe and secure society should be pursued, but the negative aspects and disadvantages of this pursuit must also be considered, which is an issue for the future.