Chapter 2 – TERMS AND DEFINITIONS DESCRIBING CORROSION FATIGUE AND ENVIRONMENTALLY ASSISTED CRACKING

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2.1 INTRODUCTION

For several years the author and his colleagues have explored and promoted a holistic approach to life assessment of corroded and non-corroded structural components. The philosophy considers the structural integrity of parts in a broad – cradle to grave – approach where all impacting factors are taken into account. Along this journey it has been found that established terms and definitions do not always adequately describe the conditions being considered, and for this reason some new and some modified concepts have been developed. This chapter presents the authors latest thinking on this topic, but before tackling the many intricacies of corrosion fatigue and environmentally assisted cracking of structures it would be informative to review the origins of holistics. Some of the early concepts have been described by Reference [1] where many of the following ideas have been formulated.

"Ironically, scientific insights into the brain's holistic talents – its right-hemisphere capacity to comprehend wholes – raise serious questions about the scientific method itself. Science has always tried to understand nature by breaking things into their parts. Now it is overwhelmingly clear that wholes cannot be understood by analysis. This is one of those logical boomerangs, like the mathematical proof that no mathematical system can be truly coherent in itself."

"The Greek prefix syn ("together with"), as in synthesis, synergy, syntropy, becomes increasingly meaningful. When things come together something new happens. In relationship there is novelty, creativity, and richer complexity. Whether we are talking about chemical reactions or human societies, molecules or international treaties, there are qualities that cannot be predicted by looking at the individual components."

"Half a century ago in Holism and Evolution, Ian Smuts tried to synthesize Darwin's evolutionary theory, Einstein's physics, and his own insights to account for the evolution of mind as well as matter."

"Wholeness, Smuts said, is a fundamental characteristic of the universe – the product of nature's drive to synthesize. "Holism is self-creative, and its final structures are more holistic than its initial structures." These wholes – in effect, these unions – are dynamic, evolutionary, and creative. They thrust toward ever-higher orders of complexity and integration. "Evolution," Smuts said, "has an ever deepening, inward spiritual character."

"As we'll see shortly, modern science has verified the quality of whole-making, the characteristic of nature to put things together in an ever-more synergistic, meaningful pattern. General Systems Theory, a related modem concept, says that each variable in any system interacts with the other variables so thoroughly that cause and effect cannot be separated. A single variable can be both cause and effect. Reality will not be still. Similarly, it cannot be taken apart! One cannot understand a cell, a rat, a brain structure, a family, or a culture if one isolates it from its context. Relationship is everything."

"Ludwig von Bertalanffy said that General Systems Theory aims to understand the principles of wholeness and self-organization at all levels. Its applications range from the biophysics of cellular processes to the

dynamics of populations, from the problems of physics to those of psychiatry and those of political and cultural units."

"General Systems Theory is symptomatic of a change in our worldview. No longer do we see the world in a blind play of atoms, but rather a great organization."

"This theory says that history, while interesting and instructive, may not predict the future at all. Who can say what the dance of variables will produce tomorrow... next month.... next year? Surprise is inherent in nature."

2.2 TERMS AND DEFINITIONS

ADP-Age Degradation Process: Any one of or combination of physical or chemical degradation processes such as fatigue, environmental effects (corrosion on metals and joints), creep, wear, and synergisms of these.

Anomalous: From Merriam Webster computer dictionary. This word was recently used by Bob Eastin to refer to corrosion, etc. Continuing discussions about the use of this term or the following terms for corrosion, fretting, creep, etc., in conjunction with fatigue have led to the notion of inconsistency, of deviation from what is usual, normal, or expected: IRREGULAR, UNUSUAL. Similarly it introduces the notion of uncertainty in nature or classification. The meaning is characterized by incongruity or contradiction: for synonyms see IRREGULAR

Extraneous: From Merriam Webster computer dictionary. This term was one the author used in papers to describe the extrinsic influences that should often be considered either concurrently with cyclic loading or sequentially. However, he has never considered any of the following to be anomalous:

1) Existing on or coming from the outside.
2) Not forming an essential or vital part.
3) Being a number obtained in solving an equation that is not a solution of the equation *extraneous roots* (synonyms see EXTRINSIC).

CLD – Crack Like Discontinuity: A discontinuity that meets the criteria for a crack. A stress singularity exists near or at the tip of the discontinuity; no "traction forces" exist on the surfaces of the discontinuity.

DADTA – Durability And Damage Tolerance Analysis: The procedure of performing an analysis of durability and damage tolerance**.** This is an analysis of the ability of the airframe or component to resist damage (including fatigue cracking, environmentally assisted cracking, hydrogen induced cracking, corrosion, thermal degradation, delamination, wear, and the effects of foreign objects), and failure due to the presence of damage, for a specified period of unrepaired usage.

Defect – (various definitions exist): The most common definition is any feature that is outside the boundary conditions of a given component/product design that will make the component/product incapable of meeting its requirements when it is needed. Defects are also defined related to product manufacturing and also related to representation of the product.

Examples are:

- **Manufacturing Defects** – When the product departs from its intended design, even if all possible care has been exercised.
- **Design Defects** – When the foreseeable risks of harm posed by the product could have been reduced or avoided by the adoption of a reasonable alternative design, and failure to use the alternative design renders the product not reasonably safe.

- **Inadequate Instructions or Warnings Defects** – When the foreseeable risks of harm posed by the product could have been reduced or avoided by reasonable instructions or warnings, and their omission renders the product not reasonably safe.

DEP – Discontinuity Evolution Process: The specific process by which a population of discontinuities evolves.

DNP – Discontinuity Nucleation Process: Any specific physical or chemical processes that may nucleate or form a discontinuity not inherent to a material. For example, in some materials fatigue deformation occurs by both dislocation movement and the production of slip bands on external or internal surfaces or by grain or twin boundary decohesion. The slip band mentioned is thus a nucleated discontinuity. Furthermore in some aluminum, titanium, and steel alloys (as well as others) intrinsic particles are known to nucleate corrosion pits if the Pitting Potential for nucleation is achieved. The pit is formed by a DNP.

DS – Discontinuity State: See IDS, EDS, and MDS below.

DSEP – Discontinuity State Evolution Process: The specific physical or chemical processes by which the discontinuity state evolves. The major forms of time dependent or related phenomena by which the state is changed are corrosion (more generally environmental degradation), creep, fatigue, wear and sequential combinations and synergisms of them. See EDS below.

DSER – Discontinuity State Evolution Response: Any change in state of an IDS population.

EAC – Environmentally Assisted Cracking: May occur under sustained load from either applied load or "residual stresses" EAC_{sl}. It may also occur under either constant amplitude cyclic forces or variable amplitude cyclic forces $EAC_{fatigue}$.

ECD – Equivalent Corrosion Damage: A Modified Discontinuity State **(MDS)** at some specific time that is made equivalent to a crack size often referred to as a "flaw" to start a residual life assessment by sub-critical crack growth analysis.

EDS – Evolving Discontinuity State: The description of the evolution of the discontinuity and the progression of changes to the discontinuity or population of discontinuities over time and cyclic load exposures. (Subsequent to either the nucleation of a discontinuity or the activation of an IDS by a specific physical or chemical process acting alone or conjointly the resultant discontinuity or population of them may evolve in state with time or cyclic load exposure. Various metrics are used to describe the EDS).

EIFS – Equivalent Initial Flaw Size: A term used to describe a discontinuity size usually determined by extrapolation from a set of fatigue data. The EIFS has no direct relationship to any specific IDS.

FCP – Fatigue Crack Propagation: Extension of a crack under cyclic or repeated loads. The stages of crack propagation are divided into four phases, viz.; 1) small or short crack propagation, long crack propagation in the linear elastic regime, and long crack propagation in either the elastic-plastic or fully plastic regime.

The following definitions related to fretting are from Reference [2].

Fretting, *n – in tribology*: Small amplitude oscillatory motion, usually tangential, between two solid surfaces in contact. Here the term *fretting* refers only to the nature of the motion without reference to the wear, corrosion, or other damage that may ensue. The term *fretting* is often used to denote *fretting corrosion* and other forms of *fretting wear*. Usage in this sense is discouraged due to the ambiguity that may arise.

Fretting Corrosion, *n*: A form of fretting wear in which corrosion plays a significant role.

Fretting Wear, *n*: Wear arising as a result of fretting (see **Fretting**).

See later part of this document for fretting fatigue, fretting plus fatigue, etc., which are non-standard definitions.

HOLISTIC: The whole and not fragmented actions in the structural integrity design process. See introductory remarks above and items below.

IDS – Initial Discontinuity State: The initial (intrinsic) population of discontinuities that are in a structure made of a given material as it was manufactured in a given geometric form. The IDS is a geometric and material characteristic that is a function of composition, microstructure, phases and phase morphology, and the manufacturing process used to process the material. The geometric and material discontinuities can be modeled separately. Examples of material IDS types include constitutive particles, inclusions, grain boundaries, segregated phases, phase boundaries, voids (vacancies, micro-porosity, and porosity) and intrinsic cracks, etc. Manufacturing processes such as machining and assembly can introduce additional discontinuities at fasteners, fillets, etc., that extend the tail (larger discontinuity sizes) of the IDS distribution.

IDSmat – Initial Discontinuity State associated with a material: The initial population of intrinsic material discontinuities. See IDS.

IDSmfg – Initial Discontinuity State associated with manufacturing of a given type: The resultant effect on the population of discontinuities from a given manufacturing process or sequence of manufacturing processes including joining of the three major types (viz. mechanical joining, thermal joining and adhesive bonding).

IDSgeo – Initial geometric discontinuity: The initial geometric discontinuities in a product. These often are generally referred to as a “notch”.

Integrity: Three concepts provide the basis of integrity, namely:

1) Firm adherence to a code of especially moral or artistic values: INCORRUPTIBILITY.
2) An unimpaired condition: SOUNDNESS.
3) The quality or state of being complete or undivided: COMPLETENESS.

Material Behavior: Response of a material to various factors such as chemical environment, forces, thermal environment, etc. Appropriate units must be used. Examples are fatigue behavior, environmentally assisted crack propagation.

Material Property Designators: See Mil Handbook 5, Section 9.2.2, Data Basis, T, S, A, B.

“Section 9.2.2.1, Data Basis – There are four types of room-temperature mechanical properties included in MIL HDBK-5. They are listed here, in order, from that having the least statistical confidence to that having the highest statistical confidence, as follows:

- **Typical Basis:** A-typical property value is an average value and has no statistical assurance associated with it.
- **S-Basis:** This designation represents the specification minimum value established by the governing industry specification (as issued by standardization groups such as SAE Aerospace Materials Division, ASTM, etc.) or federal or military standards for the material. (See MIL-Sm-970 for order of preference of specifications.) For certain products heat treated by the user (for example, steels

hardened and tempered to a designated *Ftu),* the S-value may reflect a specified quality-control requirement. Statistical assurance associated with this value is not known.

- **B-Basis:** This designation indicates that at least 90 percent of the population of values is expected to equal or exceed the statistically calculated mechanical property value, with a confidence of 95 percent.
- **A-Basis:** The lower value of either a statistically calculated number, or the specification minimum (S-basis). The statistically calculated number indicates that at least 99 percent of the population is expected to equal or exceed the statistically calculated mechanical property value with a confidence of 95 percent.

Material Response Characteristic: The manner in which a material behaves when subjected to a set of external parameters in a given condition of manufacture and geometry and joint. External parameters are cyclic forces (fatigue), different rates of force application, chemical environments, thermal environments, neutron environments, irradiation environments, contact conditions, wear conditions, and synergisms of these.

MDS – Modified Discontinuity State: This is described as the physical state of a discontinuity or damage state at any given time in its evolution. Various metrics may be used to describe the state. Example 1 – A crack has grown to a given size and is an MDS at a specific time and thus size. Example 2 – A corrosion pit has grown to a state at some point in time. The IDS may progress (EDS) to various MDS values through the mechanisms of corrosion, creep, fatigue, wear or combinations of these over time.

MSD and MED: "Multiple Site Damage (**MSD**) is a source of **WFD** characterized by the simultaneous presence of fatigue cracks in the same structural element (e.g., fatigue cracks that may coalesce with or without other damage leading to the loss of the residual strength). **Multiple Element Damage (MED)** is a source of **WFD** characterized by the simultaneous presence of fatigue cracks in similar adjacent structural elements. The development of cracks at multiple locations (both **MED** and **MSD**) may result in strong interactions that can affect subsequent crack growth, in which case the predictions for local cracking would no longer apply. An example of this situation may occur at a fuselage skin lap joint. Simultaneous cracking at many fasteners along a common rivet line may reduce the residual strength of the joint below required levels before the cracks are readily detectable during routine maintenance." From FAA AC 91-56.

Prognosis: The prospect of recovery as anticipated from the usual course of disease or peculiarities of the case. "MOD policy for the development and exploitation of prognostic technology", Author CTS REL1B, Squadron Leader-Fergus Hawkins, UK-MOD. "The process of using one or more parameters to predict the condition of a system at a defined point in its future operation". These parameters may be data measured by in-line sensors, derived from off-line monitoring processes, empirical observations or any appropriate combination of these. From Dr. J. Cook, AHM Group, ES (Air), 24/3/03.

PSE – Principal Structural Element

Safe Life: A term usually taken to mean structural design based on ideal continuum mechanics assumptions and practices without consideration of cracks or crack like discontinuities and based on the assumptions of homogeneity and continuity. In traditional safe life design toughness, sub-critical crack growth, directed inspection and inspection intervals are not dealt with for fatigue, corrosion and related items.

Structure: "1: The action of building, as in CONSTRUCTION. 2a: Something (as a building) that is constructed. 2b: Something arranged in a definite pattern of organization (a rigid totalitarian structure, leaves and other plant structures). 3: Manner of construction, (MAKEUP, Gothic in structure). 4a: The arrangement of particles or parts in a substance or body (soil structure, molecular structure). 4b: Organization of parts as dominated by the general character of the whole (economic structure, personality structure). 5: The aggregate of elements of an entity in their relationships to each other."

SSL – Structurally Significant Location: The significant locations on a structure determined by the potential behavior and changes in state that may occur in the structure related to its use under conditions of interest.

SSI – Structurally Significant Item: See Appendix 2-1.

Surface Morphology:

Morphology – From Merriam Webster computer dictionary:

"1a: A branch of biology that deals with the form and structure of animals and plants. 1b: The form and structure of an organism or any of its parts. 2a: A study and description of word formation (as inflection, derivation, and compounding) in language. 2b: The system of word-forming elements and processes in a language. 3a: A study of structure or form. 3b: STRUCTURE, FORM. 4: The external structure of rocks in relation to the development of erosional forms or topographic features."

Surface Topography:

Topography – From Merriam Webster computer dictionary:

"1a: The art or practice of graphic delineation in detail usually on maps or charts of natural and man-made features of a place or region especially in a way to show their relative positions and elevations. 1b: Topographical surveying. 2a: The configuration of a surface including its relief and the position of its natural and man-made features. 2b: The physical or natural features of an object or entity and their structural relationships."

Surface Topology:

Topology – From Merriam Webster computer dictionary:

1: Topographic study of a particular place; specifically the history of a region as indicated by its topography. 2a (1): A branch of mathematics concerned with those properties of geometric configurations (as point sets) which are unaltered by elastic deformations (as a stretching or a twisting) that are homeomorphisms, (2): the set of all open sub-sets of a topological feature.

Validate: 1a: To make legally valid. 1b: To grant official sanction to by marking. 1c: To confirm the validity of (an election); and also to declare (a person) elected. 2: To support or corroborate on a sound or authoritative basis experiments designed to validate the hypothesis.

Verify: 1: To confirm or substantiate in law by oath. 2: To establish the truth, accuracy, or reality of.

Widespread Corrosion Damage: Corrosion damage that is global on either a PSE or SSI or both and damage that may extend to one or more structural elements.

WFD – Widespread Fatigue Damage: Uniformly loaded structure may develop cracks in adjacent fasteners, or in adjacent similar structural details, which interact to reduce the damage tolerance of the structure in a manner which may not be readily detectable. Widespread Fatigue Damage (WFD) is characterized by the simultaneous presence of cracks at multiple structural details that are of sufficient size and density whereby the structure will no longer meet its damage tolerance requirement, § 25.571 (e.g., not maintaining required residual strength after partial structural failure). Multiple Site Damage (MSD) is a source of WFD characterized by the simultaneous presence of fatigue cracks in the same structural element (e.g., fatigue cracks that may coalesce with or without other damage leading to the loss of the residual strength). Multiple Element Damage (MED) is a source of WFD characterized by the simultaneous presence of fatigue cracks in similar adjacent structural elements. The development of cracks at multiple locations (both MED and MSD) may result in strong interactions that can affect subsequent crack growth, in which case the predictions for local cracking would no longer apply. An example of this situation

may occur at a fuselage skin lap joint. Simultaneous cracking at many fasteners along a common rivet line may reduce the residual strength of the joint below required levels before the cracks are readily detectable during routine maintenance. From FAA AC 91-56A 4/29/98.

2.3 LIST OF DEFINITIONS RELATED TO CORROSION FATIGUE AND STRESS CORROSION CRACKING

The following definitions are taken from Reference [3].

Corrosion Fatigue: The process in which a metal fractures prematurely under conditions of simultaneous corrosion and repeated cyclic loading at lower levels or fewer cycles than would be required in the absence of the corrosive environment. See for example G15-99B, Page 69.

Corrosion Fatigue Strength: The maximum repeated stress that can be endured by a metal without failure under definite conditions of corrosion and fatigue and for a specific number of stress cycles and a specified period of time. See for example G15-99B, Page 69.

Exfoliation Corrosion: Corrosion that proceeds laterally from the sites of nucleation along planes parallel to the surface, generally at grain boundaries, forming corrosion products that force metal away from the body of the material and giving rise to a layered appearance. See for example G15-99B.

Pitting: Corrosion of a metal surface, confined to a point or small area that takes the form of small cavities.

Stress-Corrosion Cracking: A cracking process that requires the simultaneous action of a corrodent and sustained tensile stress. (This excludes corrosion-reduced sections which fail by fast fracture. It also excludes intercrystalline or transcrystalline corrosion which can disintegrate an alloy without either applied or residual stress.)

The following definitions are taken from Reference [4].

Corrosion Fatigue: The process by which fracture occurs prematurely under conditions of simultaneous corrosion and repeated cyclic loading at lower stress levels or fewer cycles than would be required in the absence of the corrosive environment. See for example E1823-96, Page 1016.

EAC – Environment Assisted Cracking: A cracking process in which the environment promotes crack growth or higher crack growth rates than would occur without the presence of the environment. See for example E1823-96, page 1028. The same definition appears in E 1681-95, Page 944 (see below).

Fatigue: The process of progressive localized permanent structural change occurring in a material subjected to conditions that produce fluctuating stresses and strains at some point or points and that may culminate in cracks or complete fracture after a sufficient number of fluctuations. See for example E1823-96, Page 1019.

The following definition is taken from Reference [5].

Stress-Corrosion Crack: A crack which may be intergranular or transgranular depending on the material, resulting from the combined action of corrosion and stress, either external (applied) or internal (residual). See for example E7-97a, Page 52.

The following definitions are taken from Reference [6].

SCC – Stress-Corrosion Cracking: A cracking process that requires the simultaneous action of a corrodent and sustained tensile stress. See for example E1681-95, Page 943.

EAC – Environment-Assisted Cracking: Same as above in E1823 – 96 and E1681 – 95, Page 944.

The author has found no standard definitions for either corrosion – fatigue or corrosion/fatigue. Thus, unless one can be found or suggested for our work the author suggests using only standard terminology. Also, some other definitions have been added in the following appendix. These terms are all often used at conferences and our various team meetings.

Additional definitions are given in Appendix 2-1.

2.4 ACKNOWLEDGEMENTS

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2.5 REFERENCES

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[2] Standard Terminology Relating to Wear and Erosion”, ASTM G40-99, American Society for Testing and Materials, 100 Barr Harbor Dr., West Conshohocken, PA, USA, 1999.

[3] ASTM Standards Volume 03.02 – Wear and Erosion; Metal Corrosion, G15-97a – Standard Terminology Relating to Corrosion and Corrosion Testing, ASTM, Philadelphia, PA, USA, 1994.

[4] ASTM Standards Volume 03.01 – Metals-Mechanical Testing; Elevated and Low Temperature Tests; Metallography, E1823 – 96, Standard Terminology Relating to Fatigue and Fracture Testing, ASTM, Philadelphia, PA, USA, 1998.

[5] ASTM Standards Volume 03.01 – Metals-Mechanical Testing; Elevated and Low Temperature Tests; Metallography, E7-97a: Standard Terminology Relating to Metallography, ASTM, Philadelphia, PA, USA, 1998.

[6] ASTM Standards Volume 03.01 – Metals-Mechanical Testing; Elevated and Low Temperature Tests; Metallography, E1681-95: Standard Test Method for Determining a Threshold Stress Intensity Factor for Environment-Assisted Cracking of Metallic Materials Under Constant Load, ASTM, Philadelphia, PA, USA, 1998.

Appendix 2-1: ADDITIONAL DEFINITIONS

The definitions in this section are not standard definitions.

Corrosion + Fatigue: Fatigue occurs in a material/structure that has undergone corrosion. The fatigue may occur as either pure fatigue or corrosion fatigue. See ASTM definitions previously supplied.

Corrosion – Fatigue: Fatigue occurs in a material/structure that has undergone corrosion. The fatigue may occur as either pure fatigue or corrosion fatigue. See ASTM definitions previously supplied.

Corrosion/Fatigue: Fatigue occurs in a material/structure that has undergone corrosion. The fatigue may occur as either pure fatigue or corrosion fatigue. See ASTM definitions previously supplied.

Fretting Fatigue: Fatigue occurs in the presence of fretting. Thus, the action is concomitant. This situation occurs in many holes with fasteners moving in the holes or on faying surfaces in splice joints. It is also a significant challenge in many joints of helicopters (both airframes and rotor system components), engines, landing gears, wire cables and many other components.

Fretting + Fatigue: Fatigue occurs on a material/structure that has undergone fretting. The fatigue may occur as either pure fatigue or corrosion fatigue.

Fretting/Fatigue: Fatigue occurs on a material/structure that has undergone fretting. The fatigue may occur as either pure fatigue or corrosion fatigue.

(Prior Corrosion) + Fatigue: Fatigue occurs in a material/structure that has undergone corrosion. The fatigue may occur as either pure fatigue or corrosion fatigue. See ASTM definitions previously supplied.

(Prior Corrosion) / Fatigue: Fatigue occurs in a material/structure that has undergone corrosion. The fatigue may occur as either pure fatigue or corrosion fatigue. See ASTM definitions previously supplied.

Mechanism Overlap: The interaction of more than one degradation mechanism in generation of the degradation condition in a material/structure.

Missed Corrosion + Fatigue: Fatigue occurs in a material/structure that has undergone corrosion. The fatigue may occur as either pure fatigue or corrosion fatigue. See ASTM definitions previously supplied.

Missed Corrosion / Fatigue: Fatigue occurs in a material/structure that has undergone corrosion. The fatigue may occur as either pure fatigue or corrosion fatigue. See ASTM definitions previously supplied.

SSI/Corrosion: A structurally significant item designated by its propensity to become a critical item based on the potential for corrosion degradation of any type.

SSI / Corrosion Fatigue: A structurally significant item designated by its propensity to become a critical item based on the potential for corrosion fatigue degradation.

SSI/Fatigue: A structurally significant item designated by its propensity to become a critical item based on the potential for fatigue degradation. These sites are usually determined by durability and/or damage tolerance assessment.

SSI/Fatigue/Durability: A structurally significant item designated by its propensity to become a critical item based on the potential for fatigue degradation as determined by the durability assessment.

SSI / Fatigue / Damage Tolerance: A structurally significant item designated by its propensity to become a critical item based on the potential for fatigue degradation as determined by the damage tolerance assessment.

SSI / Fretting Fatigue: A structurally significant item designated by its propensity to become a critical item based on the potential for fretting fatigue degradation.

SSI/SCC: A structurally significant item based on its propensity to undergo the degradation mechanism of stress corrosion cracking. See the ASTM standard previously supplied on stress corrosion cracking.

SSL/Corrosion: A structurally significant location designated by its propensity to become a critical location based on the potential for corrosion degradation of any type.

SSL / Corrosion Fatigue: A structurally significant location designated by its propensity to become a critical location based on the potential for corrosion fatigue degradation.

SSL/Fatigue/Durability: A structurally significant location designated by its propensity to become a critical location based on the potential for fatigue degradation as determined by the durability assessment.

SSL / Fatigue / Damage Tolerance: A structurally significant item designated by its propensity to become a critical location based on the potential for fatigue degradation as determined by the damage tolerance assessment.

SSL / Fretting Fatigue: A structurally significant item designated by its propensity to become a critical location based on the potential for fretting fatigue degradation.

SSL/SCC: A structurally significant location based on its propensity to undergo the degradation mechanism of stress corrosion cracking. See the ASTM standard previously supplied on stress corrosion cracking.

Local Corrosion: Corrosion of a skin or web (wing, fuselage, empennage, or strut) not exceeding one frame, stinger, or stiffener bay) or corrosion of a single frame, chord, stringer, or stiffener, or corrosion of more than one frame, chord, stringer, or stiffener but, no corrosion on two adjacent members on each side of the corroded member.

Widespread Corrosion: Corrosion of two or more adjacent skin or web bays defined by frame, stringer or stiffener spacing. Or corrosion of two or more adjacent frames, chords, stringers, or stiffeners.

Level 1 Corrosion: Corrosion damage occurring between successive inspections that is LOCAL and can be re-worked/blended out within allowable limits as defined by the manufacturer. Or Corrosion damage that is local but exceeds allowable limits and can be attributed to an event not typical of the operator's usage of other airplane's in the same fleet. Or Operator experience over several years has demonstrated only light corrosion between successive inspections but latest inspection and cumulative blend-out now exceed allowable limits.

Level 2 Corrosion: Corrosion occurring between successive inspections that require re-work/blend-out which exceeds allowable limits, requiring a repair or complete or partial replacement of a principal structural element as defined by the original equipment manufacturer's structural repair manual. Or corrosion occurring between successive inspections that is widespread and requires blend-out approaching the allowable re-work limits.

Level 3 Corrosion: Corrosion found during the first or subsequent inspections, which is determined (normally by the operator) to be a potential urgent airworthiness concern requiring expeditious action.

The above are taken from Boeing Commercial Airplane Company and FAA documents.