SEYCHELLES TECHNICAL STANDARDS

STS-SUM

Standards for Units of Measurement

Seychelles Technical Standards

STS-SUM

Standards for Units of Measurement

Issue 01
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FOREWORD

1 STS-SUM addresses the Standards and Recommended Practices of ICAO Annex 5 as they pertain to the units of measurement to be used in air and ground operations. It is intended by these set of technical standards that both international and domestic air and ground operations follow a common standard.

2 The basic organisation of STS-SUM (Subparts and rules numbers) follows strict conformance with that adopted for other European standards promulgated by JAA and EASA (see JAR 11).

3 STS-SUM will only be distributed electronically by the Authority as a complete document and as such a list of effective pages is not considered necessary. Amendment to the initial issue will be distributed as a complete revised document with deleted text indicated by a strikethrough and new text highlighted in grey shading until a subsequent amended issue is published. Each page will also indicate the amendment date and amendment number. For clarity and simplification, all pages of the respective section will have the same amendment status upon amendment of one or more rules. The Amendment Records page will detail each amendment.

AMENDMENT RECORDS

UNITS OF MEASUREMENT STANDARDS FOR AIR AND GROUND OPERATIONS

SECTION 1 GENERAL TECHNICAL STANDARDS

SUBPART A – APPLICABILITY

SUM.1001 Applicability

STS-SUM prescribes specific requirements applicable to all aspects of national and international civil aviation air and ground operations.

SUM.1005 Definitions of terms

The following terms shall apply to all Subparts of this STS:

'ampere' (A) means the ampere is that constant electric current which, if maintained in two straight parallel conductors of infinite length, of negligible circular cross-section, and placed 1 metre apart in a vacuum, would produce between these conductors a force equal to 2×10^{-7} newton per metre of length.

'becquerel' (Bq) means the activity of a radionuclide having one spontaneous nuclear transition per second.

'candela' (cd) means the luminous intensity, in the perpendicular direction, of a surface of 1/600 000 square metre of black body at the temperature of freezing platinum under a pressure of 101 325 newtons per square metre.

'celsius temperature' ($t°_C$) means the Celsius temperature is equal to the difference $t°C = T – T_0$ between two thermodynamic temperatures T and T_0 where T_0 equals 273.15 kelvin.

'coulomb' (C) means the quantity of electricity transported in 1 second by a current of 1 ampere.

'degree celsius' (°C) means the special name for the unit kelvin for use in stating values of Celsius temperature.

'farad' (F) means the capacitance of a capacitor between the plates of which there appears a difference of potential of 1 volt when it is charged by a quantity of electricity equal to 1 coulomb.

'foot' (ft) means the length equal to 0.3048 metre exactly.

'gray' (Gy) means the energy imparted by ionizing radiation to a mass of matter corresponding to 1 joule per kilogram.

'henry' (H) means the inductance of a closed circuit in which an electromotive force of 1 volt is produced when the electric current in the circuit varies uniformly at a rate of 1 ampere per second.

'hertz' (Hz) means the frequency of a periodic phenomenon of which the period is 1 second.

'human performance' means human capabilities and limitations which have an impact on the safety and efficiency of aeronautical operations.

'joule' (J) means the work done when the point of application of a force of 1 newton is displaced a distance of 1 metre in the direction of the force.

'kelvin' (K). A unit of thermodynamic temperature which is the fraction 1/273.16 of the thermodynamic temperature of the triple point of water.

'kilogram' (kg) means the unit of mass equal to the mass of the international prototype of the kilogram.

'knot' (kt) means the speed equal to 1 nautical mile per hour.

'litre' (L) means a unit of volume restricted to the measurement of liquids and gases which is equal to 1 cubic decimetre.

'lumen' (lm) means the luminous flux emitted in a solid angle of 1 steradian by a point source having a uniform intensity of 1 candela.

'lux' (lx) means the illuminance produced by a luminous flux of 1 lumen uniformly distributed over a surface of 1 square metre.

'metre' (m) means the distance travelled by light in a vacuum during 1/299 792 458 of a second.

'mole' (mol) means the amount of substance of a system which contains as many elementary entities as there are atoms in 0.012 kilogram of carbon-12.

Note: *When the mole is used, the elementary entities must be specified and may be atoms, molecules, ions, electrons, other particles or specified groups of such particles.*

'nautical mile' (NM) means the length equal to 1852 metres exactly.

'newton' (N) means the force which when applied to a body having a mass of 1 kilogram gives it an acceleration of 1 metre per second squared.

'ohm' (Ω) means the electric resistance between two points of a conductor when a constant difference of potential of 1 volt, applied between these two points, produces in this conductor a current of 1 ampere, this conductor not being the source of any electromotive force.

'pascal' (Pa) means the pressure or stress of 1 newton per square metre.

'radian' (rad) means the plane angle between two radii of a circle which cut off on the circumference an arc equal in length to the radius.

'second' (s) means the duration of 9 192 631 770 periods of the radiation corresponding to the transition between the two hyperfine levels of the ground state of the caesium-133 atom.

'siemens' (S) means the electric conductance of a conductor in which a current of 1 ampere is produced by an electric potential difference of 1 volt.

'sievert' (Sv) means the unit of radiation dose equivalent corresponding to 1 joule per kilogram.

'steradian' (sr) means he solid angle which, having its vertex in the centre of a sphere, cuts off an area of the surface of the sphere equal to that of a square with sides of length equal to the radius of the sphere.

'tesla' (T) means the magnetic flux density given by a magnetic flux of 1 weber per square metre.

'tonne' (t) means the mass equal to 1 000 kilograms.

'volt' (V) means the unit of electric potential difference and electromotive force which is the difference of electric potential between two points of a conductor carrying a constant current of 1 ampere, when the power dissipated between these points is equal to 1 watt.

'watt' (W) means the power which gives rise to the production of energy at the rate of 1 joule per second.

'weber' (Wb) means the magnetic flux which, linking a circuit of one turn, produces in it an electromotive force of 1 volt as it is reduced to zero at a uniform rate in 1 second.

SECTION 2 SPECIFIC TECHNICAL STANDARDS

SUBPART A – STANDARD APPLICATION OF UNITS OF MEASUREMENT

SUM.2001 SI units

(a) Air and ground operations shall use the International System of Units developed and maintained by the General Conference of Weights and Measures (CGPM) as the standard system of units of measurement for all aspects of international civil aviation air and ground operations, subject to the provisions SUM.2005 and SUM.2010.

(b) Air and ground operations shall use the prefixes and symbols listed in Table 3-1 to form names and symbols of the decimal multiples and submultiples of SI units.

Table 3-1. SI unit prefixes

Multiplication factor		*Prefix*	*Symbol*
1 000 000 000 000 000 000	$= 10^{18}$	exa	E
1 000 000 000 000 000	$= 10^{15}$	peta	P
1 000 000 000 000	$= 10^{12}$	tera	T
1 000 000 000	$= 10^{9}$	giga	G
1 000 000	$= 10^{6}$	mega	M
1 000	$= 10^{3}$	kilo	k
100	$= 10^{2}$	hecto	h
10	$= 10^{1}$	deca	da
0.1	$= 10^{-1}$	deci	d
0.01	$= 10^{-2}$	centi	c
0.001	$= 10^{-3}$	milli	m
0.000 001	$= 10^{-6}$	micro	µ
0.000 000 001	$= 10^{-9}$	nano	n
0.000 000 000 001	$= 10^{-12}$	pico	p
0.000 000 000 000 001	$= 10^{-15}$	femto	f
0.000 000 000 000 000 001	$= 10^{-18}$	atto	a

SUM.2005 Non-SI units

(a) Air and ground operations shall use Non-SI units listed in Table 3-2 either in lieu of, or in addition to, SI units as primary units of measurement but only as specified in Table 3-4.

Table 3-2. Non-SI units for use with the SI

Specific quantities in Table 3-4 related to	*Unit*	*Symbol*	*Definition (in terms of SI units)*
mass	tonne	t	1 t = 10^3 kg
plane angle	degree	°	1° = (π/180) rad
	minute	'	1' = (1/60)° = (π/10 800) rad
	second	"	1" = (1/60)' = (π/648 000) rad
temperature	degree Celsius	°C	1 unit °C = 1 unit K[a)]
time	minute	min	1 min = 60s
	hour	h	1 h = 60 min = 3600 s
	day	d	1 d = 24 h = 86400 s

	week, month, year		
volume	litre	L	1 L = 1 dm^3 = $10^{-3}m^3$

a) See GEN 2.6 Conversion Tables of the Seychelles AIP

(b) The non-SI units listed in Table 3-3 shall be permitted for temporary use as alternative units of measurement for air and ground operations, but only for those specific quantities listed in Table 3-4.

SUM.2010 Application of specific units

(Refer to Guidance material on human performance can be found in the ICAO Doc 9683 - Human Factors Training Manual)

(a) The application of units of measurement for certain quantities used in international civil aviation air and ground operations shall be in accordance with Table 3-4.

(b) Air and ground operations should establish means and provisions for design, procedures and training for operations in environments involving the use of SI and non-SI alternatives of specific units of measurement or the transition between environments using different units, with due consideration to human performance.

Table 3-3. Non-SI alternative units permitted for temporary use with the SI

Specific quantities in Table 3-4 related to	*Unit*	*Symbol*	*Definition (in terms of SI units)*
distance (long)	nautical mile	NM	1 NM = 1 852 m
distance (vertical)[a)]	foot	ft	1 ft = 0.304 8 m
speed	knot	kt	1 kt = 0.514 444 m/s

a) altitude, elevation, height, vertical speed.

Table 3-4. Standard application of specific units of measurement

Ref. No.	*Quantity*	*Primary unit (symbol)*	*Non-SI alternative unit (symbol)*
1.	***Direction/Space/Time***		
1.1	altitude	m	ft
1.2	area	m²	
1.3	distance (long)[a)]	km	NM
1.4	distance (short)	m	
1.5	elevation	m	ft
1.6	endurance	h and min	
1.7	height	m	ft
1.8	latitude	° ' "	
1.9	length	m	
1.10	longitude	° ' "	
1.11	plane angle (when required, decimal subdivisions of the degree shall be used)	°	
1.12	runway length	m	
1.13	runway visual range	m	
1.14	tank capacities (aircraft)[b)]	L	

Ref. No.	Quantity	Primary unit (symbol)	Non-SI alternative unit (symbol)
1.15	time	s min h d week month year	
1.16	visibility[c)]	km	
1.17	volume	m^3	
1.18	wind direction (wind directions other than for a landing and take-off shall be expressed in degrees true; for landing and take-off wind directions shall be expressed in degrees magnetic)	°	
2.	***Mass-related***		
2.1	air density	kg/m^3	
2.2	area density	kg/m^2	
2.3	cargo capacity	kg	
2.4	cargo density	kg/m^3	
2.5	density (mass density)	kg/m^3	
2.6	fuel capacity (gravimetric)	kg	
2.7	gas density	kg/m^3	
2.8	gross mass or payload	kg t	
2.9	hoisting provisions	kg	
2.10	linear density	kg/m	
2.11	liquid density	kg/m^3	
2.12	mass	kg	
2.13	moment of inertia	$kg \cdot m^2$	
2.14	moment of momentum	$kg \cdot m^2/s$	
2.15	momentum	$kg \cdot m/s$	
3.	***Force-related***		
3.1	air pressure (general)	kPa	
3.2	altimeter setting	hPa	
3.3	atmospheric pressure	hPa	
3.4	bending moment	$kN \cdot m$	
3.5	force	N	
3.6	fuel supply pressure	kPa	
3.7	hydraulic pressure	kPa	
3.8	modulus of elasticity	MPa	
3.9	pressure	kPa	
3.10	stress	MPa	
3.11	surface tension	mN/m	
3.12	thrust	kN	
3.13	torque	$N \cdot m$	
3.14	vacuum	Pa	
4.	***Mechanics***		
4.1	airspeed[d)]	km/h	kt
4.2	angular acceleration	rad/s^2	

Ref. No.	Quantity	Primary unit (symbol)	Non-SI alternative unit (symbol)
4.3	angular velocity	rad/s	
4.4	energy or work	J	
4.5	equivalent shaft power	kW	
4.6	frequency	Hz	
4.7	ground speed	km/h	kt
4.8	impact	J/m^2	
4.9	kinetic energy absorbed by brakes	MJ	
4.10	linear acceleration	m/s^2	
4.11	power	kW	
4.12	rate of trim	°/s	
4.13	shaft power	kW	
4.14	velocity	m/s	
4.15	vertical speed	m/s	ft/min
4.16	wind speed[e)]	m/s	kt
5.	***Flow***		
5.1	engine airflow	kg/s	
5.2	engine waterflow	kg/h	
5.3	fuel consumption (specific)		
	piston engines	kg/(kW · h)	
	turbo-shaft engines	kg/(kW · h)	
	jet engines	kg/(kN · h)	
5.4	fuel flow	kg/h	
5.5	fuel tank filling rate (gravimetric)	kg/min	
5.6	gas flow	kg/s	
5.7	liquid flow (gravimetric)	g/s	
5.8	liquid flow (volumetric)	L/s	
5.9	mass flow	kg/s	
5.10	oil consumption		
	gas turbine	kg/h	
	piston engines (specific)	g/(kW · h)	
5.11	oil flow	g/s	
5.12	pump capacity	L/min	
5.13	ventilation airflow	m^3/min	
5.14	viscosity (dynamic)	Pa · s	
5.15	viscosity (kinematic)	m^2/s	
6.	***Thermodynamics***		
6.1	coefficient of heat transfer	$W/(m^2 \cdot K)$	
6.2	heat flow per unit area	J/m^2	
6.3	heat flow rate	W	
6.4	humidity (absolute)	g/kg	
6.5	coefficient of linear expansion	$°C^{-1}$	
6.6	quantity of heat	J	
6.7	temperature	°C	
7.	***Electricity and magnetism***		
7.1	capacitance	F	
7.2	conductance	S	
7.3	conductivity	S/m	

Ref. No.	Quantity	Primary unit (symbol)	Non-SI alternative unit (symbol)
7.1	capacitance	F	
7.2	conductance	S	
7.3	conductivity	S/m	
7.4	current density	A/m^2	
7.5	electric current	A	
7.6	electric field strength	C/m^2	
7.7	electric potential	V	
7.8	electromotive force	V	
7.9	magnetic field strength	A/m	
7.10	magnetic flux	Wb	
7.11	magnetic flux density	T	
7.12	power	W	
7.13	quantity of electricity	C	
7.14	resistance	Ω	
8.	***Light and related electromagnetic radiations***		
8.1	illuminance	lx	
8.2	luminance	cd/m^2	
8.3	luminous exitance	lm/m^2	
8.4	luminous flux	lm	
8.5	luminous intensity	cd	
8.6	quantity of light	lm · s	
8.7	radiant energy	J	
8.8	wavelength	m	
9.	***Acoustics***		
9.1	frequency	Hz	
9.2	mass density	kg/m^3	
9.3	noise level	dB[e)]	
9.4	period, periodic time	s	
9.5	sound intensity	W/m^2	
9.6	sound power	W	
9.7	sound pressure	Pa	
9.8	sound level	dB[f)]	
9.9	static pressure (instantaneous)	Pa	
9.10	velocity of sound	m/s	
9.11	volume velocity (instantaneous)	m^3/s	
9.12	wavelength	m	
10.	***Nuclear physics and ionizing radiation***		
10.1	absorbed dose	Gy	
10.2	absorbed dose rate	Gy/s	
10.3	activity of radionuclides	Bq	
10.4	dose equivalent	Sv	
10.5	radiation exposure	C/kg	
10.6	exposure rate	C/kg · s	

a) As used in navigation, generally in excess of 4 000 m.
b) Such as aircraft fuel, hydraulic fluids, water, oil and high pressure oxygen vessels.
c) Visibility of less than 5 km may be given in m.
d) Airspeed is sometimes reported in flight operations in terms of the ratio MACH number.
e) A conversion of 1 kt = 0.5 m/s is used in ICAO Annexes for the representation of wind speed.
f) The decibel (dB) is a ratio which may be used as a unit for expressing sound pressure level and sound power level. When used, the reference level
g) must be specified.

SUBPART B – TERMINATION OF USE OF NON-SI ALTERNATIVE UNITS

SUM.2015 Termination dates

The use in international civil aviation operations of the alternative non-SI units listed in Table 3-3 shall be terminated on the dates listed in Table 4-1.

Table 4-1. Termination dates for non-SI alternative units

Non-SI alternative unit	*Termination date*
Knot Nautical mile	not established
Foot	not established

ACCEPTABLE MEANS OF COMPLIANCE AND INTERPRETATIVE/EXPLANATORY MATERIAL (AMC & IEM)

1 *GENERAL*

1.1 This Section contains Acceptable Means of Compliance and Interpretative/Explanatory Material that has been agreed for inclusion in STS-SUM.

1.2 Where a particular STS paragraph does not have an Acceptable Means of Compliance or any Interpretative/Explanatory Material, it is considered that no supplementary material is required.

2 *PRESENTATION*

2.1 The Acceptable Means of Compliance and Interpretative/Explanatory Material are presented in full page width on loose pages, each page being identified by the date of issue and/or the Amendment number under which it is amended or reissued.

2.2 A numbering system has been used in which the Acceptable Means of Compliance or Interpretative/Explanatory Material uses the same number as the STS paragraph to which it refers. The number is introduced by the letters AMC or IEM to distinguish the material from the STS itself.

2.3 The acronyms AMC and IEM also indicate the nature of the material and for this purpose the two types of material are defined as follows:

Acceptable Means of Compliance (AMC) illustrates a means, or several alternative means, but not necessarily the only possible means by which a technical standard can be met. It should however be noted that where a new AMC is developed, any such AMC which may be additional to an existing AMC will be amended into the document following consultation under the NPA procedure.

Interpretative/Explanatory Material (IEM) helps to illustrate the meaning of a technical standard.

2.4 Explanatory Notes not forming part of the AMC or IEM text appear in a smaller type face.

2.5 New, amended or corrected text is enclosed within heavy brackets.

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ACJ/AMC/IEM B – Reserved