行政院及所屬各機關出國報告

(出國類別:其他)

「汰換桃園及松山機場低空風切警報 系統(LLWAS)採購案」 工廠測試 出國報告書

服務機關:民用航空局飛航服務總臺 姓名職稱:江世忠工務員 陳盈曄觀測員 派赴國家:德國杜塞爾多夫 出國期間:103.07.13~103.07.19 報告日期:103.09.02

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一、目的

本次廠測之主要目的在於測試「汰換桃園及松山機場低空風切警報(LLWAS) 系統」採購案所採購之系統功能是否符合本總臺之合約規範,藉以確保本總臺所 購系統之品質與性能。

根據統計資料,發生飛航事故最大機率為航機起飛及降落之時,尤以降落為 最。航機降落時,距離地面已近,若有臨時發生之風切,導致風的方向或速度急 遽改變,將反應不及導致不願發生之事件。低空風切警報(LLWAS)系統係利用架 設於機場周遭之測風塔,收集機場周遭之風速及風向資料,據以分析風之幅散、 幅合,根據美國大氣研究大學聯盟(UCAR)發展之第三代低空風切告警系統 (Phase-III LLWAS)演算法,提供氣象及航管人員即時而正確的低空風切告警, 藉以警告航機避免憾事發生。

上一代桃園及松山機場之低空風切警報系統於民國 90 年建置,至今使用已 13 年餘。臺灣地區本為高溫潮濕天氣,且桃園機場地近海濱;含鹽分海風吹拂之 下,收集風速、風向資料之測風塔多有鏽蝕情況,為維護飛航安全以提供不間斷 的低空風切告警服務,本採購案包含測風塔保養以及新系統建置一併進行。

依據本購案契約規定,廠商提供之系統需經完成工廠測試、功能測試及信心 測試後始得報請正式驗收。與本案系統相關之伺服器及工作站電腦,將由臺灣廠 商直接出貨,故本次LLWAS工廠測試為驗證系統軟體功能為主,以確認系統於安 裝前符合需求;而相較於松山機場單跑道運作,桃園機場雙跑道運作狀況更為複 雜,故本次驗證系統功能以桃園機場為驗證對象。伺服器及工作站電腦等硬體設 備於陣地安裝前再行點驗,合先敘明。

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二、廠測與會人員

總臺代表:

- 江世忠 飛航服務總臺/航電技術室/工務員
- 陳盈曄 飛航服務總臺/桃園航空氣象臺/觀測員

SELEX 公司代表:

Rene GraBelt/ Program Manager

神通資科(本案承商)代表:

張蒼民/ 專案經理

三、過程

本次廠測,本總臺選派2名人員前往系統製造商SELEX公司位於德國杜塞 爾多夫之工廠舉行,測試期程共計4日(註:含行程共計7天),相關行程如后:

- 1.103年7月13日搭乘中華航空班機,由臺北飛往德國法蘭克福機場,於 7月14日早上飛抵法蘭克福,之後改搭德國鐵路抵達杜塞爾多夫。
- 2.103 年 7 月 14 日下午起至 7 月 16 日:逐條進行工廠測試項目。
- 3.103年7月17日:進行廠測資料整理,下午由雙方代表進行總結會議,並 簽署本次廠測紀錄。
- 4.103年7月18日:搭乘中華航空班機回程。
- 5.103 年 7 月 19 日:返抵桃園國際機場。

四、廠測內容

本次工廠測試於 103 年 7 月 13 日至 7 月 19 日由本總臺派員會同承商神通資 科公司及系統製造商 SELEX 公司人員於德國杜塞爾多夫工廠進行。工廠測試內容 係依據承商於 103 年 6 月 10 日提送總臺審閱之工廠測試程序,於測試過程中將 測試結果逐項紀錄。

(一)、測試程序

依據工廠測試程序內容,共分為六大類內容說明如下:

- 1. General Information
 - 敘述工廠測試(Factory Acceptance Test)進行的目的與預計達到的成果。
- 2. Verification of the IT system Review of Design
 - 確認執行 LLWAS 程式所需之硬體規格。
- 3. Verification of the Server Design and software
 - 確認系統各項功能,包含 LLWAS 告警顯示、介面處理、資料重建等。
- 4. Verification of the LLWAS algorithm
 - 確認機場相關資料,如跑道、測風塔位置等。
- 5. LLWAS data archive function test
 - 確認 LLWAS 資料庫功能,可正確重建過往記錄,包含風向風速資料、歷史 告警等。
- 6. NCAR comparison Test
 - 驗證在相同氣象資料下,經由 SELEX 公司所建置的 LLWAS 系統顯示的 WSA 及 MBA 告警,與帶入 NCAR 演算法運算後所得結果相符。

(二)、測試環境說明

SELEX 公司以2部HP 伺服器模擬桃園機場雙跑道運作之LLWAS 伺服器工作情形,另以1部筆記型電腦模擬與伺服器連線之工作站。系統則以持續發生 MBA(微爆氣流)告警之風速、風向資料,經 SELEX 公司依 NCAR 第三代低空風切告警系統運算;另有載入先前自總臺取得的桃園 AWOS 氣象觀測站資料作為顯示。



(三)、測試項目

Step	Action	Expected Results	Check
3.1.2	Verify by review that a	The user	OK.
	structural program	identified a clear	檢視其目錄及檔案結
	technique is used.	directory and file	構。
		structure.	

rainbow@INC-03-02.	/usr/local /usr/l	ocal/Rainbow5/rain	barre
AnemometerDate	disclosed /Rainbow5	/rainbow>ls	
AnemometerData.16	help	map	Strings
bin	htdace	offline	scripts to to to
bin.initial	htdoor initia	online	sdf
cdf	icone	overlay	Sensordate
cmap	impart	pdf	Sounde
current	init	ppdf	task
debug	Initialize on the	pref	tmp
defaultCDF	init initial	python	tmp ngs
defaultPDF	landucamaa	rawdata	translations
defaultPPDF	lib	rbSinput	wallpaper
defaultSDF	loa	relfiles.initial	
rainbow@INC-03-02:	/usr/local/Painhaut	scheduler	
total 236	asi / cocac/ Rainbows/	rainbow>ll	
drwxrwxr-x 2 rainb	W Fainbow 12288 1.1	14 15.00	
drwxrwxr-x 2 rainb	ow rainbow 16384 Jul	9 17:20 Anemomet	erData
drwxr-xr-x 6 rainb	ow rainbow 4096 Jul	11 12:11 bd	erData.16
drwxr-xr-x 2 rainb	ow rainbow 4096 Jul	3 15:22 bin inte	
drwxr-xr-x 5 rainb	ow rainbow 4096 Jul	2 02:00 cdf	Lat
drwxrwxr-x 2 rainb	ow rainbow 4096 Jun	30 18:09 cmap	
drwxrwxr-x 2 rainb	ow rainbow 4096 Jun	30 18:09 current	
drwxr-xr-x 2 rainb	ow rainbow 4096 Jul	2 02:00 debug	
drwxr-xr-x 2 rainb	ow rainbow 4096 Jul	2 02:00 default(DE
drwxr-xr-x 3 rainb	ow rainbow 4096 Jul	2 02:00 defaultPr	DF
drwxr-xr-x 2 rainb	ow rainbow 4096 Jul	2 02:00 defaultPr	PDF
drwyrwyr y 5 rainb	ow rainbow 4096 Jul	2 02:00 defaults)F
drwxrwxr-x A rainb	ow rainbow 4096 Jun	18 18:45 gisdata	
drwxr-xr-x 2 rainb	ow rainbow 4096 Jul	14 13:43 help	
drwxr-xr-x 3 rainb	ow rainbow 4096 Jul	2 02:33 htdocs	and the second
drwxr-xr-x 5 rainb	pw rainbow 16384 Jul	2 02:00 icons	Itist
drwxrwxr-x 3 rainb	ow rainbow 4096 Jul	1 15:22 import	
drwxr-xr-x 5 rainb	ow rainbow 4096 Jul	11 13:12 init	
-rw-rr 1 rainb	ow rainbow 1259 Jul	2 02:00 Initializa	e RM.txt
drwxr-xr-x 5 rainb	ow rainbow 4096 Jul	2 02:00 init.init:	ial
drwxr-xr-x 2 rainb	ow rainbow 4096 Jul	2 02:33 landuseman	•
drwxr-xr-x 4 rainb	ow rainbow 16384 Jul	2 02:33 Lib	
drwxr-xr-x 2 rainb	ow rainbow 4096 Jul	2 02:00 man	
drwxr-xr-x 2 rainb	ow rainbow 4096 Jul	2 02:33 offline	
drwxr-xr-x 2 rainb	ow rainbow 4096 Jul	2 02:33 online	
drwxr-xr-x 2 rainb	ow rainbow 4096 Jul	2 02:33 overlay	
drwxrwxr-x 3 rainb	ow rainbow 4096 Jun	30 18:09 pdf	
drwxrwxr-x 3 rainb	ow rainbow 4096 Jun	1 13:16 pref	
drwxr-xr-x 3 rainb	ow rainbow 4096 Jul	11 12:16 python	
drwxr-xr-x 2 rainb	ow rainbow 4096 Jul	2 02:33 rawdata	
drwxrwxr-x 2 rainb	ow rainbow 4096 Jul	2 09:43 rb5input	
drwxr-xr-x 2 rainb	ow rainbow 4096 Jul	2 02:00 retrites.in	
drwxr-xr-x 2 rainb	ow rainbow 4096 Jul	11 12:16 scripts	
drwxr-xr-x 2 rainb	ow rainbow 4096 Jul	2 02:33 scripts.ini	tial .
drwxrwxr-x 2 rainb	ow rainbow 4096 Jun	30 18:09 sdf	
drwxr-xr-x 2 rainb	ow rainbow 4896 Jul	2 02:00 sensordata	
drux rux - xr - x 2 rainb	ow rainbow 4096 Jul	2 02:00 soonas	
drwxrwxr-x 3 rainb	ow rainbow 4896 Jul	14 15:24 Tmp	
drwxrwxr-x 2 rainb	ow rainbow 4096 Jun	30 18:09 twp_ngs	
THE COMPANY OF THE PARTY OF THE	ow ratabow 4096 Jul	2 92:33 1100051010	

Step	Action	Expected Results	Check
3.1.3	Verify by review software maintaining/reporting:	The user identified:	OK. 伺服器軟體版本: Red Hat 6.5
	Check if S/W is made in plain English.	The software language is English.	
	The Operating System is Linux Red Hat 6.x	The MS operates with Red Hat	
	Check if S/W is operated and the data processes on Linux Red Hat system.		



Step	Action	Expected Results	Check
3.1.5	Check the redundant server system mode "hot hot". Simulate a breakdown of one MS.	The second system proceeds with the work. An alert should be generated.	於廠測現場MS1與MS2 設定為「Hot-Hot」 mode。檢視技術規範說 明書2.2.1.3及 2.2.1.4,MS1與MS2設 定為「Hot-Hot」或 「Hot-Standby」mode 均符合部分需求,待返
			台後再行討論採用何 種模式較佳,於功能測 試(SAT)時再次驗證。
3.1.8	Verify by review that CPU operational load less than 50%, useage of memory is lower than 50% and HD space occupied right after the initial installation is lower than 50% of the total capacity.	The Req. is fulfilled.	OK. 於廠測現場,系統所佔 硬碟容量僅23.9%、CPU 使用率最高僅11%。惟 應於功能測試(SAT)時 再度檢測。





Step	Action	Expected Results	Check
3.2.2	Starting RainShear using	RainShear is	OK.
	the Icon	open	可正確開啟程式。





Step	Action	Expected Results	Check
3.3.1	Verify by testing that	Examine time	OK.
	operators are in the	setting function	可經由網路校時,並可
	situation to set time on	on both systems.	選擇網路校時的NTP
	both systems. The time	Storing a file	Server °
	shall be displayed in	and examine the	
	line with network. The	file name.	
	ShearScout/ LLWAS uses		
	these applicable hours	The file name is	
	in storing files,	stored using	
	maintaining and	time	
	operating every other	provided by the	
	function.	servers (GPS	
		time).	



Step	Action	Expected Results	Check
3.3.3	Verify that MS is able to	Examine the	OK.
	calculate the Network	Network Mean	"Network Mean" 為測
	Mean	Values.	風站風速資料u、v之平
			均值。

Jun 30 17					BainShear	
Jul 9 18	10			AND DESCRIPTION OF THE OWNER OF T	Manufacture and a second second	
Jun 30 17		WAS-R	epor	ts Real	time Realine Normal	
Jun 30 17	5			DELEMENT	cine	View Setting
Jun 30 17						ex new setting
Jun 30 17	Time					
Jun 30 17	Time	U		V	Data	
Jun 30 17	2014-07	7-14 12:59:17		-0.1 m/s	oust wind: 49 knote	
Jul 11 13	P 🛕 2014-01	7-14 12:59:07	-0.3 m/s	-0.2 m/s	gust wind: 49 knots	
Jun 30 17	▶ ▲ 2014-01	7-14 12:58:57	-0.2 m/s	-0.1 m/s	dust wind: 49 knots	
v5/rainbow	P A 2014-07	7-14 12:58:47	-0.1 m/s	0.0 m/s	dust wind: 49 knots	
	D A 2014-07	7-14 12:58:37	-0.1 m/s	-0.2 m/s	gust wind: 49 knots	
v5/rainbow	₽ ▲ 2014-07	7-14 12:58:27	-0.0 m/s	-0.4 m/s	dust wind: 49 knots	
e-4.0-noar	Þ A 2014-07	7-14 12:58:17	-0.1 m/s	-0.2 m/s	gust wind: 49 knots	
kstation	D A 2014-07	7-14 12:58:07	-0.1 m/s	-0.1 m/s	gust wind: 49 knots	
LINUX WORK	D A 2014-07	7-14 12:57:57	0.1 m/s	-0.2 m/s	gust wind: 49 knots	
	D A 2014-07	7-14 12:57:47	0.3 m/s	-0.3 m/s	gust wind: 49 knots	
Paintlute	Þ A 2014-0	7-14 12:57:37	0.1 m/s	-0.2 m/s	gust wind: 49 knots	
w5/rainhow	D A 2014-0	7-14 12:57:27	-0.0 m/s	-0.1 m/s	gust wind: 49 knots	
w5/rainbow	D A 2014-0	7-14 12:57-17	0.2 m/s	-0.0 m/s	gust wind: 49 knots	
w5/rainbow	D A 2014-0	7-14 12:57:07	0.4 m/s	0.0 m/s	gust wind: 49 knots	
w5/rainbow	D A 2014-0	7-14 12:56:57	0.2 m/s	-0.1 m/s	oust wind: 49 knots	
	D A 2014.0	7.14 12:56:47	0.1 m/s	-0.1 m/s	gust wind: 49 knots	
users, l	A 2014-0	7 14 12 56 27	0.1 m/s	0.1 m/s	gust wind: 49 knots	
sleeping,	D A 2014-0	7 14 12:56:27	0.2 m/s	0.3 m/s	oust wind: 49 knots	
93.9%id,	2014-0	7 14 12:56:17	0.2 m/s	0.2 m/s	aust wind: 49 knots	
ed, 9206	D A 2014-0	7 14 12:56:07	0.1 m/s	0.0 m/s	gust wind: 49 knots	
ed, 20971	D 2014-0	7-14 12:50:07	0.0 m/s	0.2 m/s	gust wind: 49 knots	
CHD C SCDU	D A 2014-0	7-14 12.55.07	-0.1 m/s	0.4 m/s	gust wind: 49 knots	
85m S 9 3	P A 2014-0	7 14 12.55.37	0.0 m/s	0.2 m/s	gust wind: 49 knots	
47m S 1.7	D A 2014-0	7 14 12:55:27	0.1 m/s	0.1 m/s	gust wind: 49 knots	
12m 5 1.3	P A 2014-0	7 14 12:55:17	-0.1 m/s	0.1 m/s	gust wind: 49 knots	
15m S 1.3	D A 2014-0	7.14 12:55:07	-0.3 m/s	0.2 m/s	gust wind: 49 knots	
4388 S 1.0	> 2014-0	7.14 12:54:57	-0.2 m/s	0.2 m/s	gust wind: 49 knots	
30m 5 1.0	2014-0	7.14 12:54:47	-0.0 m/s	0.1 m/s	gust wind: 49 knots	
29m S 0.7	× 2014-0	7.14 12:54:37	-0.2 m/s	-0.0 m/s	gust wind: 49 knots	
3144 5 0.3	P A 2014-0		0.4 m/s	-0.1 m/s	gust wind: 49 knots	

Step	Action	Expected Results	Check
3.4.3	Check the LLWAS System	This status should	OK.
	status which will be	indicate when all	廠測時,模擬測風塔資
	indicated in	anemometers 16	料全部重啟後,隨測風
	RainShear:	deliver wind data.	塔資料陸續接入,系統
	Real time normal		狀態依序
	(green)		由"Support"
		Some anemometers	→"Degraded"
	Real time degraded	15 – 14 break down	→"Normal".
	(yellow)	but LLWAS still	
		operating.	
		—	
		To few anemometers	
	System Support (red)	out of order 13 the	
		LLWAS is not able	
		to operate	
		The IIWAS will be	
	Initialization	initialized (e o	
	(vellow)	after restart)	
	()0110 ()		
		No anemometers and	
		also no RS status	
	Off (red)	for more than n	
		seconds.	
3.4.4	Open the Wind-	Wind-Situation	OK.
	Situation Display (RWY	Display window is	
	underlay)	open.	
3.4.5	Verify by review that	Wind-Situation	OK.
	sensor information is	Display indicates	當滑鼠移到該測風塔
	shown on the Wind-	wind sensor	時,即會顯示該測風塔
	Situation Display	information (wind	之風速、風向資料。
		speed, wind	
		direction or in	
		case of break down	
		the current	
		status) of each	
	TT 10 1	anemometer.	OV
3.4.6	verity by review that	Ine wind	
	the wind speed and	parameters are	母10秒史新谷測風哈
	directions are updated	updated every 10	
	by each anemometer and	seconds.	
	displayed on the Wind-		
	SILUATION DISPLAY		





Step	Action	Expected Results	Check
3.4.7	Verify by review that in	The "error"	OK.
	case of sensor breakdown	message is	
	the code "error" is	indicated of	
	displayed.	failed	
		anemometer/s.	
3.4.8	Verify by review that the	The centerfield	OK.
	centerfield sensor is	sensor is	中場測風塔會以紅色
	indicated.	displayed.	外框標示。



Step	Action	Expected Results	Check
3.4.9	Verify by test and click on any anemometer to display the temporal evolution of wind direction and wind	An extra screen is displayed containing overview of wind direction and	OK. 以滑鼠點擊各測風 塔,會跳出該測風塔的 風速風向資料統計視 窗。
	velocity	wind velocity.	



Step	Action	Expected Results	Check
3.4.10	Verify by review that	Wind-Situation	OK.
	the gust wind is	Display displays	於中場測風塔右下角
	displayed	gust wind.	以五段顯示陣風資料。



Step	Action	Expected Results	Check
3.4.11	Verify by review that	The AWOS	OK.
	the system is be able to	informations are	
	access the wind speed	displayed.	AAD:顯示該跑道AWOS
	and wind direction data		之風速及風向資料。
	in Buyer's existing		
	AWOS system (for Taoyan		GAD:將配合" Wind-
	airport, it shall		Situation Display"
	include data in the		畫面一併顯示各測風
	middle of runway) at		站及AWOS陣地資料。
	both ends of runway, and		
	display this numerical		
	value on AAD and GAD.		



Step	Action	Expected Results	Check
3.4.12	Verify by review that	The AWOS	OK.
	users are able to read	information are	將滑鼠移至AWOS區塊
	the AWOS information on	displayed.	上,將顯示該AWOS陣地
	the screen.		測得之相關氣象資料。



Step	Action	Expected Results	Check
3.4.13	All displayed windows for wind shear, wind data and AWOS information are displayed inside the same screen to easy	The Req. is fulfilled.	OK. 風切告警及風場資料 可於同畫面顯示。
	operators operating.		



Step	Action	Expected Results	Check
3.4.14	Verify by review that the wind direction at the middle of airport is indicated by three digits from 001 to 360; the wind speed is indicated by two digits from 03 to 95 Knots, less than 3 Knots is indicated by CALM; the gust is indicated by two digits. If the maximum wind speed is greater than the previous of two minutes average, system should display it on screen.	The Req. is fulfilled.	因中場陣風為10分鐘 統計所得,原廠提出需 再確認NCAR演算法是 為「2分鐘」或「10分 鐘」平均。
3.4.15	Verify by test to switch back to RainShear start-up screen.	The start-up screen will be displayed.	OK.
3.4.16	Open the Maintenance Screen	Maintenance Screen window is open.	OK.
3.4.17	Verify by review that sensor information regarding speed and direction deviation and sensor status is shown on the Maintenance Screen	Maintenance Screen indicates wind sensor information (wind speed, wind direction deviation and status) of each anemometer	OK. 各測風塔之風速、風向 資料顯示如下。



Step	Action	Expected Results	Check
3.4.18	Verify by review that	The parameters	OK.
	the wind speed and	are updated	每10秒風速風向均有
	directions deviation as	every 10	更新。
	well as sensor status is	seconds.	
	updated by each		
	anemometer and		
	displayed on the		
	Maintenance Screen		
3.4.19	Verify by review that in	A warning is	OK.
	case of sensor breakdown	displayed.	根據NCAR演算法,u、v
	the operational		超限後經過30sec才會
	degradation is below		顯示"error"。
	threshold.		



Step	Action	Expected Results	Check
3.4.20	Verify by review that	The centerfield	OK.
	the centerfield	sensor is	中場測風塔可正確顯示
	sensor is indicated.	displayed.	為"Centerfield".



Step	Action	Expected Results	Check
3.4.21	Verify by test: Click on	An extra screen	OK.
	any anemometer to	is display can be	風花圖如圖所示。
	display the temporal	opened to view	
	evolution of wind speed	the different	
	and direction deviation	functionalities.	
	and operational		
	degradation as well as		
	the wind rose display		
	and settings option		
	functionality.		



Step	Action	Expected Results	Check
3.4.22	Verify by testing the	The sensor can be	OK.
	system can manually isolate	isolated.	
	the remote site from system		輸入管理者密碼
	calculation when its data		後,可控制各測風
	becomes faulty or abnormal;		塔是否隔離/納入
	however the speed and		LLWAS運算。
	direction data shall still		
	be shown. The operator can		將#11測風塔隔離
	manually accept the sensor		後,仍可持續接收
	and include it in		風速風向之u與v
	calculation once it has		資料。
	recovered.		





Step	Action	Expected Results	Check
3.4.24	Verify by testing that the maintenance screen is able to display wind speed, wind direction and measured the average wind speed and wind direction in system of each anemometer, and can be showed in tabular form.	The Req. is fulfilled.	OK. 各測風塔資料可 於"LLWAS Report"頁面以 列表方式呈現。
	Verify by testing that the maintenance screen is able to display the wind rose drawing of each anemometer, and each one of the wind rose drawing can be selected by quarter, month, day, or by specifying the time interval screening.		如風花圖所示。
	According to selected sites and counted by quarter, month, day, or by specifying the time interval to filter out and display wind shear data, and can show them in tabular format.		可於"LLWAS Report"之資料 庫選擇「時段」、 「日」、「月」方 式顯示。

			See Hild. HS KIULS	of the second
▷ ▲ 2014-07-15 07:41:31	0.2 m/s	0.1 m/s	gust wind: 49 knots	
▶ \Lambda 2014-07-15 07:41:21	0.1 m/s	-0.1 m/s	gust wind: 49 knots	
▶ 🛕 2014-07-15 07:41:11	0.1 m/s	0.2 m/s	gust wind: 49 knots	
▶ ▲ 2014-07-15 07:41:01	0.1 m/s	0.4 m/s	gust wind: 49 knots	
▶ ▲ 2014-07-15 07:40:51	0.1 m/s	0.2 m/s	gust wind: 49 knots	
▼ ▲ 2014-07-15 07:40:41	0.1 m/s	0.1 m/s	gust wind: 49 knots	
A LIWAS			gast wind, 45 knots	
Anemometer				
TPE 001	18.6 m/s	-16.7 m/s	OK Heating set off	
TPE 002	10.2 m/s	-22.8 m/s	OK Heating set off	Land State State State
TPE 003	0.0 m/s	-25.0 m/s	OK Heating set off	
TPE 004	-10.1 m/s	-22.9 m/s	OK Heating set off (Centerfield)	
TPE 005	-18.6 m/s	-16.8 m/s	OK Heating set off	
TPE 006	-23.8 m/s	-7.8 m/s	OK Heating set off	
TPE 007	-24 9 m/s	2.6 m/s	OK Heating set off	
TPE 008	-21 7 m/s	12.5 m/s	OK Heating set off	
TPE 000	-14.7 m/s	20.2 m/s	OK Heating set off	
TPE_000	.5.2 m/s	24.4 m/s	OK Heating set off	
TPE_010	5.2 m/s	24.5 m/s	OK Heating set off	
	14.7 m/s	20.2 m/s	OK Heating set off	
TPE 012	21.6 m/s	12.5 m/s	OK Heating set off	
TPE_013	24.9 m/s	2.7 m/s	OK Heating set off	
TPE_014	23.8 m/s	-7.7 m/s	OK Heating set off	
TPE_015	18.6 m/s	-16.7 m/s	OK Heating set off	
A 2014-07-15 07:40:31	-0.1 m/s	0.2 m/s	gust wind: 49 knots	
A 2014-07-15 07:40:21	-0.2 m/s	0.3 m/s	gust wind: 49 knots	
A 2014-07-15 07:40:11	-0.1 m/s	0.2 m/s	gust wind: 49 knots	
> 2014-07-15 07:40:01	0.0 m/s	0.1 m/s	gust wind: 49 knots	
D A 2014-07-15 07:39:51	-0.2 m/s	0.1 m/s	gust wind: 49 knots	
▶ ▲ 2014-07-15 07:39:41	-0.4 m/s	0.1 m/s	gust wind: 49 knots	WEAK-SHIDE COURSE
A and the an an an an an	a a mainte	Contraction of	And	

Step	Action	Expected Results	Check
3.4.25	Verify by test to switch	The start-up	OK.
	back to RainShear start-up	screen will be	
	screen.	displayed.	
3.4.26	Verify by review that out of	The out of	OK.
	service time of anemometers	service time is	LLWAS-Report每
	are recorded.	recorded. 隔10秒會記錄	
			測風塔連線狀況。
3.4.29	Verify by review that in	A red point	OK.
	case of anemometers break	indicates an	測風塔異常時,將
	down an alart will be	anemometer	有紅點標示
	indicated(visual red	error.	
	sign).		
3.4.30	Verify by review that in	The failed	OK.
	case of anemometers break	anemometer is	
	down the failed sensor will	displayed.	
	be indicated.		

▼			2/16 active for 5 polls
D 🔵 LLWAS			
🗢 🗢 🗢 Anemometer			
TPE_001	0.3 m/s	0.4 m/s	OK Heating selloff
TPE_002	0.4 m/s	0.3 m/s	OK Heating set off
TPE_003	24.9 m/s	2.6 m/s	OK Heating set off
TPE_004			Axis 1 and 2 failed
TPE_005			Axis 1 and 2 failed
TPE_006			Axis 1 and 2 failed
TPE 007			Axis 1 and 2 failed
TPE 008			Axis 1 and 2 failed
TPE 009			Axis 1 and 2 failed
TPE 010			Axis 1 and 2 failed
TPE 011			Axis 1 and 2 failed
TPE 012			Axis 1 and 2 failed
TPE 013			Axis 1 and 2 failed
TPE 014			Axis 1 and 2 failed
TPE_015			Axis 1 and 2 failed
TPE_016			Axis 1 and 2 failed
▽ 🛑 2014-07-15 07:04:11			0/16 active for 5 polls
D 🛑 LLWAS			
Anemometer			
TPE_001	0.2 m/s	0.5 m/s	OK Heating set off
TPE_002	0.4 m/s	0.3 m/s	OK Heating set off
TPE_003			Axis 1 and 2 failed
TPE_004			Axis 1 and 2 failed
TPE_005			Axis 1 and 2 failed
TPE_006			Axis 1 and 2 failed
TPE_007			Axis 1 and 2 failed
TPE_008			Axis 1 and 2 failed
07:52:32			

Step	Action	Expected Results	Check
3.4.27	Open the LLWAS report	The LLWAS report	OK.
	screen.	screen is open.	
3.4.28	Check that all anemometers	All installed	OK
	and wind measurements are	anemometers	各測風塔之平均
	displayed on textual basis	displaying wind	u、v均有顯示。
	and the Network Mean is	information.	
	calculated.		
3.4.31	Verify by review that wind	A warning	MBA(微爆氣流告
	shear alarts are	triangle is	警) OK.
	displayed(textual basis).	displayed when	
	The alarts has to specify:	an alart is	WSA(風切告警)於
	WindShear - Loss/Gain	generated. A	工廠測試時未建
	Microburst - Loss Location	click on the	模擬資料,故需於
	on RWY	triangle and the	功能測試時再次
		alart is	驗證。
		specified	
		according to	
		LLWAS Phase 3	
		requirements.	

Time 2014-07-15 07:12:51 → LLWAS 05 A NBA -90k 3HF 000 00 23 D NBA -90k 3HF 000 00	u 0.0 m/s	v .0.2 m/s	Data	
✓ ▲ 2014-07-15 07:12:51 ✓ ▲ LLWAS 05 A HBA -90k SHE 000 00 23 A HBA -90k SHE 000 00	0.0 m/s	0.2 m/r	e a ca	
05 A MBA -90k 3MF 000 00		-0.2 m/s		
23 D MRA _601 BWZ 000 00				
CO D FIDA -SOL FAIL DOU DU				
23 A MBA -85k 2MF 000 00				
05 D MBA -85k BWY 000 00				
05 A MBA -90k 3MF 000 00				
24 D MBA -90k BWY 000 00				
24 A MBA -85k 3MF 000 00				
05 D MBA -85k BNY 000 00				
- Anemometer				
TPE 001	-0.5 m/s	0.2 m/s	OK Heating set off	
TPE 002	-0.4 m/s	0.3 m/s	OK Heating set off	
TPE 003	-6.1 m/s	13.7 m/s	OK Heating set off	
TPE 004	-0.0 m/s	15.0 m/s	OK Heating set off	
TPE 005	6.1 m/s	13.7 m/s	OK Heating set off	
TPE 006	11.1 m/s	10.0 m/s	OK Heating set off	
TPF 007	14.3 m/s	4.6 m/s	OK Heating set off	
TPE 008	14.9 m/s	-1.6 m/s	OK Heating set off	
TPE 009	13.0 m/s	-7.5 m/s	OK Heating set off	
TPE 010	8.8 m/s	-12.1 m/s	OK Heating set off	
TPE 011	3.1 m/s	-14.7 m/s	OK Heating set off	
TPE 012	-3.1 m/s	-14.7 m/s	OK Heating set off	
TPE 013	-8.8 m/s	-12.1 m/s	OK Heating set off	
TPE 014	-13.0 m/s	-7.5 m/s	OK Heating set off	
TPE 015	-14.9 m/s	-1.6 m/s	OK Heating set off	
TPE 016	-14.3 m/s	4.6 m/s	OK Heating set off	
▶ ▲ 2014-07-15 07:12:41	-0.1 m/s	-0.1 m/s		
▶ ▲ 2014-07-15 07:12:31	0.2 m/s	-0.1 m/s		

Step	Action	Expected Results	Check
3.4.32	Check the Online Help	The Rainbow	OK.
	function Using the	Software Online	有"Online
	corresponding symbol	Help is available	Help"功能。
	inside RainShear Display		



Step	Action	Expected Results	Check
3.4.33	Check the setting function to filter results to be visualised. - Anemometer Errors - Wind Shear Alerts - Normal conditions - All	The filter function works on required performance.	OK. SELEX公司承諾 將更改圖層設 定,使字不會被 擋到。



Step	Action	Expected Results	Check
3.4.34	Check the data archive	Within the selected	OK.
	function (click on	time frame all data	資料庫內容(歷
	database icon) for	can be visualized.	史告警)可被正
	anemometer data and wind		確顯示。
	shear alerts.		
	- select start and end		
	time		
	- start data request		
3.4.37	Verify by review that	The system cycle is	OK.
	System Cycle time of the	10 sec.	自接收資料、運
	server in main station is		算、顯示告警可
	less than 10 seconds		於10秒內完成。
	including first gets the		
	wind speed and direction		
	from the remote		
	anemometer, processes,		
	produces the		
	shear/microburst/burst		
	alert, finally shows the		
	situation on the		
	workstations and records		
	it in the database.		

Start: 20	AS-Report	ts Archiv Stop: 2014-07-1	5 07:03:58 🗘 Start Query	View Settings
Time		×	Data	
 ▷ 2014-07-15 0 ▷ ▲ 2014-07-15 0 ▽ 2014-07-15 0 ▷ ▲ 1100AS)7:03:51)7:03:49 -0.0 m/s)7:03:41	-0.2 m/s	0/16 active for 5 polls gust wind: 49 knots 0/16 active for 5 polls	
Anemom	eter	+0.2 m/s	OK Heating set off	
TPE_001	0.5 m/s	-0.3 m/s	OK Heating set off	
TPE_002	10.2 m/s	-22.8 m/s	OK Heating set off	
TPE_003	0.1 m/s	-25.0 m/s	OK Heating set off	
TPE_004	-10.1 m/s	-22.9 m/s	OK Heating set off	
TPE_005	-18.5 m/s	-16.8 m/s	OK Heating set off	
TPE_006	-23.8 m/s	-7.8 m/s	OK Heating set of	
TPE_007	-24.9 m/s	2.6 m/s	OK Heating set off	
TPE_000	-21.7 m/s	, 12.5 m/s	OK Heating set off	
TPE_005	-14.7 m/s	20.2 m/s	OK Heating set off	
TPE_01	-5.3 m/s	24.4 m/s	OK Heating set off	
TPE_01	5.1 m/s	24.5 m/s	OK Heating set off	
TPE_01	3 14.6 m/s	20.3 m/s	OK Heating set off	
TPE_01	4 21.6 m/s	12.5 m/s	OK Heating set off	
TPE 01	5 24.9 m/s	5 77 m/s	OK Heating set off	
TPE_01	6 23.8 m/s	s nam/s	gust wind: 49 knots	
TPE_01	5 07:03:39 -0.0 m/s	5 -0.4 m/s	gust wind: 49 knots	
2014-07-1	5 07:03:29 -0.1 m/s	5 0.2 m/s	gust wind: 49 knots	
2014-07-	15 07:03:19 -0.1 m/s	5 -0.2 m/5	gust wind: 49 knots	
> 2014-07-	15 07:03:09 0.1 m/s	-0.3 m/s	gust wind: 49 knots	
201107	15 07:02:59 0.3 m/s			

Step	Action	Expected Results	Check
3.4.35	Check the export function	Data are	OK.
	(click on button export) to	exported into an	系統告警及資料可
	export displayed data into	external file.	輸出為"XML"
	an external XML file		、" XML V2"
			及"CSV"等格式。

	-0.2 m/s	OK Heating set off	
;	-0.3 m/s	OK Heating set off	
S	-22.8 m/s	OK Heating set off	
:	-25.0 m/s	OK Heating set off	
/s	-22.9 m/s	OK Heating set off	
ls	-16.8 m/s	OK Heating set off	
/s	-7.8 m/s	OK Heating set off	
/s	2.6 m/s	OK 🕅 Export	×
/s	12.5 m/s	OK Choose export format:	
/s	20.2 m/s	OK XML	
S	24.4 m/s	OK XML V2	
;	24.5 m/s	OK	
S	20.3 m/s	OK meaning sec on	
s	12.5 m/s	OK Heating set off	
S	2.7 m/s	OK Heating set off	
s	-7.7 m/s	OK Heating set off	
s	-0.4 m/s	gust wind: 49 knots	
s	-0.2 m/s	gust wind: 49 knots	
/s	-0.1 m/s	gust wind: 49 knots	
S	-0.2 m/s	gust wind: 49 knots	
S	-0.3 m/s	gust wind: 49 knots	

scarch louis Documents Help	20140715070259.xml (+ /De 1/4		
🔤 Open 🗸 🖄 Save 🚔 Log Unga de la	(*/Desktop) - gedit		
20140715070259.xml 🗶			
ml version="1.8" encoding="UTF-8"?>			
inshear_data datetime="2014-87-15708:08:20" version tr to or			
<item datetime="2014-07-15T07:02:59"></item>			
<11was datetime="2014-07-15T07:02:59" centerfield="anem TPE post signature			
<pre>calertoB5A,MBA, 100,3MF.,,0.0000006,0.0000000<th>-0.27" pirportsode="all-></th></pre>	-0.27" pirportsode="all->		
calert 0:230, MBA, -100, RWY, 0.0000008, 0.000000			
salert>550,M8, 100,200,000,00000000000000000000000000			
<alert>86A, MBA, 100, 3MF, 8, 800008, 8, 0000000/alert></alert>			
<alert>24D, MBA, -100, RWY, 0.000000 (0.0000000) / alert></alert>			
<alert>24A,MBA,-100,3MF,,,0.000000,0.0000000/alert></alert>			
<alert>96D,MBA,-100,RWY,,,0.000009,0.000000</alert>			
<anemometer_field_datetime=2014-07-15t07:02:59*></anemometer_field_datetime=2014-07-15t07:02:59*>			
<and 991="" heating="" id="anem" ipl="" momenter="" off="" off<="" set="" state="acting" status="0K" td="" u="0.30" v="0.05"><td></td></and>			
sanceometer id="anen TPE 003" us" 14 71" us"20 22" status "05 Heat us of off and			
<pre><anemometer <="" id="anem TPE 004" pre="" state="eet" status="0K Heating Set off" u="-5.21" v="24.45"></anemometer></pre>	web3		
<pre><anemometer id="anem TPE 085" pre="" slatestatil<="" status="0K Heating set off" u="5,18" v="24.45"></anemometer></pre>	1-15		
<pre><anemometer <="" id="anem_TPE_006" pre="" state="are" status="0K Heating set off" u="14.88" v="20.23"></anemometer></pre>	UA-75		
<pre><anemometer id="anem TPE_007" status="or<br" u="21.64" v="12.51"></anemometer></pre>			
canemometer 1d= anem TPE 008 u= 24.86 V= 2.03 Status UX Meating Set of status.	ve 25		
componenter id- anem TPE of a ur 18 50", ver-16,72" status="OK Heating set off" statestat	196772		
canemometer Id- anem TPE 011" u= 18.18" v= -22.83" status="OK Heating set off" status and	110.75		
<anemometer act="" anem_tpe_013"="" id="anem TPE 012" mesting="" off"="" pre="" states"ac<="" status="u" u="-10.15" v=".22.85"></anemometer>	tavarte		
<pre><anemometer 18.5="" 24.86"="" <="" id="anem TPE Bla" off;="" pre="" set="" state="Alignment" status="0K Heating set of*" um="" v="2.60" w="17.4*"></anemometer></pre>			
<pre>canenometer field></pre>			
<pre><item datetime="2014-87-15T07:93:09">= and controlled atoms TPE 8044 windgust="25" u="0.1" v="19</item></pre>			
			
<a 0.808080="" 8.808080="" <="" a="" mba="98," tert="" wwy="">			
salert>23A, MBA, -85, 2MF, , , 9. 000000, 0. 0000000/a (Mr. 1977)			
<alert>85D,MBA,-85,RWY,.,0.8080808,0.9080804/318/12</alert>			
<alert>86A.MBA.98.SMF.10.800066.8.000000+/alert+</alert>			
calert>240, MBA, 85, 3MF, , , 0.900000, 0.900000, 0.100000			
calert>860,MBA, -85,RWY,.,8.000000,8.0000000,4.1			
canescent field dages TPE 001 un 14 277 un tages tatette on installing and			
cancesometer id="ances TPE 002" u= 11.15 w= 15.90" statuted by Hamilton set off spatie-tactive			
canemonotor id-"anem TPL 004" 4-" 0.00" we the por statute of the state of the stat			
canoscieter ide ance ipt ops us 5.00* weiter an entere in matter of the state and a			
Cancesport ide anom TPE 806" uesting V			
Step	Action	Expected Results	Check
--------	------------------------------	------------------	--------------
3.4.36	Verify by test to switch	The start-up	OK.
	back to RainShear start-up	screen will be	
	screen.	displayed.	
3.4.38	Open the System-log	The System-log	OK.
	screen.	screen is open.	
3.4.39	Verify be review that in	The log-message	OK.
	case of status "System	is stored	
	Support" a log-message	accordingly.	
	will be shown and stored.		
3.4.40	RainShear Status Update		OK.
	(RainRCS) - indicates the		RainShear伺服器
	status of the server		狀態可正確顯
	system.		示。點開後有詳細
			資料(包含:執行
	Verify by review that in		程序、目前狀態、
	case of a RainRCS process is		開始執行時間等
	not running a message will		等)顯示。
	be indicated. A click to		
	RainRCS and it is indicated		
	which process is 'Down'.		
	The following processes are		
	shown:		
	1. NGS	Indicates Up/	
	2. RainRLS	Down	
	3. RainAdmin		
	4. RainDbAdmin		
	5. mometerEmitter		
	6. RainDTCim		
	7. RainLLWAS		
	8. EmomoterImport		

In the second second second					
aert raised at	Host: "INC030	1"			~
lert raised at	Host: "INC030	1"			
lert raised at	Host: "INCO30	1*			
lert raised at	Host: "INC030	1*			
lert raised at	Host: "INCO30	14			
lert raised at	Host: "INC030	1*			
CITATOR SUCCESSION	Moliate.				
lainRCS stat	us report: 2	2014-0	7-15 08:23:49		
Version		1	5.41.0		
tandby mode	• • • • • • • • • • • •	1	Standalone		
Database sta	tus report				
Database is	not configu	ed.			
dr Status	Since	Rest.	Process	Parameter	
qU 1	07-14 12:43	0	NGS	-XX:-UseSplitVerifier -Xms40m -Xmx180m	-
2 Up	07-14 12:43	0	RainRLS		
3 UP	07-14 12:43	0	PostgreSQL	-FUNDD -MAINEAIN	
a up	07-14 12:43	0	RainAwosImport	fake-dates yes	
6 00	07-14 12:43	0	emometerImport	-host=127.0.0.1 -port=7019 -airport=TPB	
F				A MARKET AND A MARKET PROVIDE	0
7 Up	07-15 06:49	0	RainLLWAS	-act=init/taoyuan.act -arrport=ini -	s
8 Up	07-14 12:43	0	RainDTCSIM	-porcervity data mentality of	
 	07-14 12:43	0	elnetServer.py	10 Up 07-14 12:43 0 elnetCl	
Alert raised at	Host: "INCO30)1"			
Alert raised at	t Host: "INC030)1*			
Alert raised at	t Host: "INCO30)1"			
Alert raised a	t Host: "INCO30)1"			HIRI
Alert raised a	t Host; "INCO30)1"			
Alert raised a	t Host: "INCO30)1-			
Alert raised a	t Host: "INCOB)1"			
Alert raised a	t Host: "INCO3	01"			10700
				Clear	
	lert raised at lert raised at lert raised at lert raised at lert raised at lert raised at atabase is atabase is atabase is atabase is atabase is op 	lert raised at Host: "INC030 ainRCS status update ainRCS status update ainRCS status report: 1 atabase status report atabase status report atabase is not configure up 07-14 12:43 Alert raised at Host: "INC030 A	lert raised at Host: "INCO301" lert raised at Host: "INCO301" lert raised at Host: "INCO301" lert raised at Host: "INCO301" alinRCS status report: 2014-0 ersion	lert raised at Host: "INCO301" lert raised at Host: "INCO301" Alert rais	The traised at Host "INC0301" Hert raised at Host "INC0301" Hert raised at Host "INC0301" AIRCS Status update ainRCS status report: 2014-07-15 08:23;49 mainRCS status report: 2014 12:43 0 RainRLS mainRCS mainRCSxx:10asSplitVerifier -xma40m -xex180m mainRCS status report: 2014 12:43 0 RainRLS mainRCSxx:10asSplitVerifier -xma40m -xex180m mainRCS status report:faka-dates res mainRCS

Step	Action	Expected Results	Check
3.4.41	RainSCOUT log. Message - In case of a wind shear/ microburst alert is		OK. "alarm acknowledged"
	indicated to the controller within RainScoutATC client he has the possibility to acknowledge the alert.		將有記錄。
	Verify by test to acknowledge a windshear/microburst alert at the workstation/client computer	A log-message will be generated that the alert is acknowledged.	

フララララララララ	2014-07-15 08:29:03 2014-07-15 08:29:02 2014-07-15 08:29:02 2014-07-15 08:29:01 2014-07-15 08:28:52 2014-07-15 08:28:51 2014-07-15 08:28:42 2014-07-15 08:28:42	External RainFTP RainFTP RainFTP RainFTP RainFTP RainFTP RainFTP	file system disk space usage exceeds limit Finished: Ilwas-20140715082901.xml to totdwriwhu Transfer started: Ilwas-20140715082901.xml to totdwriwhu Scheduled Ilwas-20140715082901.xml for totdwriwhu Finished: Ilwas-20140715082851.xml to totdwriwhu Transfer started: Ilwas-20140715082851.xml to totdwriwhu Scheduled Ilwas-20140715082851.xml to totdwriwhu Finished: Ilwas-20140715082851.xml for totdwriwhu Finished: Ilwas-20140715082851.xml to totdwriwhu Finished: Ilwas-20140715082841.xml to totdwriwhu Finished: Ilwas-20140715082841.xml to totdwriwhu
D	2014-07-15 08:28:41	RainFTP	Scheduled Ilwas-20140715082841.xml for totdwriwhu
D	2014-07-15 08:28:37	RainSCOUT	Alarm Acknowledged at host: INC0302
			Alarm Acknowledged at host: INC0302
	2014-07-15 08:28:32	RainFTP	Finished: Ilwas-20140/15082831.xml to totownwhu
	2014-07-15 08:28:32	RainFTP	Transfer started: IIWas-20140/15082831.ximi to totownwho
	2014-07-15 08:28:31	RainFTP	Scheduled Ilwas-20140/15082831.xmi for totownwho
ат. Ш	2014-07-15 08:28:31	RainSCOUT	Alert raised at Host: "INC0302"
	2014-07-15 08:28:22	RainFTP	Finished: Ilwas-20140/15082821.xml to totdwriwhu
	2014-07-15 08:28:22	RainFTP	Transfer started: Ilwas-20140/15082821.xml for totdwriwhu
	2014-07-15 08:28:21	RainFTP	Scheduled Ilwas-20140/15062621.xhirtor cotalina
	2014-07-15 08:28:21	RainSCOUT	Alert raised at Host: INC0302
	2014-07-15 08:28:14	RainSCOUT	Runway mode 25 activated form to totdwriwhu
C	2014-07-15 08:28:12	RainFTP	Finished: Ilwas-20140715082811.xml to totdwriwhu
C	2014-07-15 08:28:12	RainFTP	Transfer stafted. Ilwas 20140715082811.xml for totdwriwhu
C	2014-07-15 08:28:11	RainFTP	Scheduled IWas-20110-201
-			

Step	Action	Expected Results	Check
3.4.42	RainLLWAS log. Message	The	OK.
	shows all status	corresponding	系統狀態將依據
	information regarding the	log-messages are	不同告警程度記
	LLWAS algorithm.	generated.	錄在
	Verify by review:		「System-Log」
	- when the system is		中。並可篩選顯示
	degraded but LLWAS is able		的告警。
	to run, a warning shall be		
	indicated "yellow sign"		
	- when system support is		
	needed, LLWAS is not able to		
	run, an alert is generated		
	"red sign"		
	- the system has no data		
	(LLWAS is off) an alert is		
	generated "red sign"		
	- the initialization is in		
	process "yellow sign"		

5-6	stem-Log R	Realtime	View Settings
ime	Application	Text	
2014-07-	15 08:28:03 External	file system disk space usage exceeds limit	
2014-07-	15 08:27:03 External	file system disk space usage exceeds limit	
2014-07-	15 08:26:03 External	file system disk space usage exceeds limit	
0 🕖 2014-07-	15 08:25:03 External	file system disk space usage exceeds limit	
2014-07-	15 08:24:03 External	file system disk space usage exceeds limit	
0 🔵 2014-07-	15 08:23:03 External	file system disk space usage exceeds limit	
0 🛑 2014-07-	15 08:22:03 External	file system disk space usage exceeds limit	
Þ 💓 2014-07-	15 08:21:03 External	file system disk space usage exceeds limit	
0 0 2014-07-	15 08:20:03 External	file system disk space usage exceeds limit	
Þ 💓 2014-07-	15 08:19:03 External	file system disk space usage exceeds limit	
D 🔵 2014-07-	15 08:18:03 External	file system disk space usage exceeds limit	
Þ 🔵 2014-07-	15 08:17:03 External	file system disk space usage exceeds limit	
Þ 🤭 2014-07-	15 08:16:03 External	file system disk space usage exceeds limit	
D 🔵 2014-07-	15 08:15:03 External	file system disk space usage exceeds limit	
Þ 📁 2014-07-	15 08:14:03 External	file system disk space usage exceeds limit	
Þ 📁 2014-07-	-15 08:13:03 External	file system disk space usage exceeds limit	
D 🔵 2014-07-	-15 08:12:03 External	nie system disk space usage exceeds limit	
Þ 😁 2014-07-	-15 08:11:03 External	file system disk space usage exceeds limit	
Þ 🔵 2014-07-	-15 08:10:03 External	file system disk space usage exceeds limit	
Þ 😁 2014-07	-15 08:09:03 External	file system disk space usage exceeds limit	
Þ 🧐 2014-07	-15 08:08:03 External	file system disk space usage exceeds limit	
▶ 🥏 2014-07	-15 08:07:03 External	ILWAS is operating. Some anemometers do not deriver dat	
♥ 🔵 2014-07	-15 08:06:41 Ramillar	LLWAS is operating. Some anenometers do not	file system di
	ar on oc.03 External	file system disk space usage exceeds limit	/dev/sda4 4196
2014-07	-15 08:06:03 External	file system disk space usage exceeds limit	
0 2014-07	15 08:04:03 External	file system disk space usage exceeds limit	
D 2014-07	15 08:03:03 External	file system disk space usage exceeds limit	
2014-01	7-15 08:02:03 External	file system disk space usage exceeds limit	
2014-0	7-15 08:01:03 External	file system disk space usage exceeds limit	
 ▷ 2014-07 ▷ 2014-07 ▷ 2014-07 ▷ 2014-07 ▷ 2014-07 ▷ 2014-07 	7-15 08:04:03 External 7-15 08:03:03 External 7-15 08:02:03 External 7-15 08:01:03 External	file system disk space usage exceeds limit file system disk space usage exceeds limit	



Step	Action	Expected Results	Check
3.4.43	Click on the green arrow on	The function is	OK.
	bottom on the left to	working	
	verify:	properly.	
	- the RainShear version		
	number		
	- on-line help		
	- options		
3.4.44	Verify by test to switch	The start-up	OK.
	back to RainShear startup	screen will be	
	screen.	displayed.	
3.4.45	Verify by review that the	The	OK.
	out of service interruption	corresponding	系統通訊失敗告
	time, and communication	message is	警可正確顯示。
	failure status in system is	logged.	
	logged.		

	Application	Text
 ▷ 2014-07-15 08:37:24 ▷ 2014-07-15 08:37:24 ▷ 2014-07-15 08:37:24 ▷ 2014-07-15 08:37:23 ▷ 2014-07-15 08:37:14 	RainFTP RainFTP RainLLWAS RainFTP RainFTP RainFTP RainLLWAS RainLLWAS	Finished: Ilwas-20140715083723.xml to totdwriwhu Transfer started: Ilwas-20140715083723.xml to totdwriwhu Scheduled Ilwas-20140715083723.xml for totdwriwhu Created empty LLWAS report: 0/16 active for 5 polls Finished: Ilwas-20140715083713.xml to totdwriwhu Transfer started: Ilwas-20140715083713.xml to totdwriwhu Scheduled Ilwas-20140715083713.xml for totdwriwhu Created empty LLWAS report: 0/16 active for 5 polls Initializing LLWAS algorithm.
		Initializing LLWAS algorithm.
 2014-07-15 08:37:13 2014-07-15 08:37:03 2014-07-15 08:37:03 2014-07-15 08:37:03 2014-07-15 08:36:03 2014-07-15 08:35:42 	RainAnemo RainRCS External External RainLLWAS	DTC is available again. Starting process Rain arconner roots soon file system disk space usage exceeds limit file system disk space usage exceeds limit No data after 30 seconds. Resetting LLWAS algorithm.
 ▶ ● 2014-07-15 08:35:19 ▼ ● 2014-07-15 08:35:19 	RainRCS RainAnemo	Process RainDTCSim has exited. PID was 2725. Failed connecting the DTC. Will keep trying. Failed connecting the DTC. Will keep trying. Failed connecting the DTC. Will keep trying.
 2014-07-15 08:35:12 2014-07-15 08:35:12 2014-07-15 08:35:11 2014-07-15 08:35:11 2014-07-15 08:35:03 2014-07-15 08:35:03 	RainFTP RainFTP RainSCOUT External RainFTP	Transfer started: Ilwas-20140715083511.xml to totawn Scheduled Ilwas-20140715083511.xml for totdwriwhu Alert raised at Host: "INC0302" file system disk space usage exceeds limit Finished: Ilwas-20140715083501.xml to totdwriwhu Transfer started: Ilwas-20140715083501.xml to totdwriwhu

Step	Action	Expected Results	Check
3.4.46	Verify by review that		OK.
	self-diagnosis capability		告警可以選擇以
	is available. When a		"Pop-up" 或"
	malfunction of system or		聲音"方式呈現。
	sensor or no signal, system		
	must show a screen alarm and		
	audible alarm. (The alert		
	sound can be switched		
	ON/OFF). The types of		
	malfunction etc., shall be		
	displayed and recorded in		
	the servers		
	14 RainFTP Sc Court	15084243.xml to totdwriwhu	
	A RainFTP Fi Colors Alarm	×	
	A RainFTP Tr	popup message	
	4 RainSCOUT Al Mi piay s 4 RainFTP Fi Warning	sound	
	4 RainFTP Tr So plays	popup message sound	
	4 RainSCOUT Al		
	4 RainFTP Tr Ø plays	sound	
	3 RainSCOUT A		
	4 RainFTP Fi 4 RainFTP Tr		an and the second second
	4 RainFTP Sc 4 RainSCOUT AL		
	3 External fil		
	4 RainFTP Tr		
	4 RainFTP Sc 4 RainSCOUT Al		
	4 RainFTP Fi Default	OK Cancel Apply	
	4 RainSCOUT Alert raised at Host: "INC0302	142 vol for totdwriwhu	
	:03 External fil		
	:54 RainFTP Fi k		
	:54 RainFTP Sc		
	:54 RainSCOUT Al		
	:44 RainFTP Tr		Арріу
	L:44 RainFTP Scheduled Ilwas-201407	0302" 15084143.xml for totdwriwhu	
	1:34 RainFTP Finished: Ilwas-20140715 1:34 RainFTP Transfer started: Ilwas-20	5084133.xml to totdwriwhu	
	1:34 RainFTP Scheduled Ilwas-201407	15084133.xml for totdwriwhu	-
	Alert raised at Host: "INC		
	Finished: Ilwas- RainScoutATC	juration	

Step	Action	Expected Results	Check
3.4.47	Starting RainScoutATC	RainScoutATC is	OK.
	using the Icon	open.	
3.4.48	Verify by test that RWY mode	Application	OK.
	is selectable.	allows to switch	可選擇05方向或
		between RWY	是23方向。
		modes.	





Step	Action	Expected Results	Check
3.4.49	Check the LLWAS System status which will be indicated in RainShear: Real time normal (green)	This status should indicate when all anemometers 16 deliver wind data.	OK. 依系統狀態顯示不 同顏色提醒。
	Real time degraded (yellow)	Some anemometers 15–14 break down but LLWAS still operating.	
	System Support (red)	To few anemometers out of order 13 - 0 the LLWAS is not able to operate.	
	Initialization (yellow)	The LLWAS will be initialized (e.g. after restart)	
	Off (red)	No Anemometer and also no RS status for more than n seconds (n is configurable)	





Step	Action	Expected Results	Check
3.4.50	Verify by review that	The design	OK.
	data are available and	corresponding the	字形及其他相關設定
	fonts are readable on	user needs.	可於次畫面設定。
	display.		
3.4.53	Verify by test that	The alert sound is	OK.
	the alert can be	muted.	
	acknowledged		
3.5.54	Click on the setup	The setting	OK.
	button to verify the	functions working	可列印輸出為PDF檔,
	setting function:	reliable.	或儲存為PNG圖檔。
	- version number		
	- on-line help		
	- font size setting		
	- print function		
	- save function		
	- zoom function		

	44		99	:28			
	100	prefe	rence[D	efault]			
	General Products	General				×	
-85	Colors Alarm	Display Range: (km) 20			60	00
		Font size:	40				
		Timespec:	UTC	0			
		Tool opacity	0.8				
		Unit System	: Aviati	on 🗧			
-7-		Touch Scree	n: 🗹			60	00
-/5		Location				DU	UU
		Name: Ta	oyuan	Airport Code	: TPE		
		latitude: 25	.0803	longitude:	121.232		
						ſ	
						60	00
-75						00	

Step	Action	Expected Results	Check
3.4.51	Verify by review that the LLWAS CF wind data and alternates are available.	CF winds are available and alternate winds	OK. 中場之風速、風向及 陣風可被顯示。
		are provided if the primary is out of scan.	
3.4.56	Click to the button to switch to the AAD display showing the alerts on textual basis.	The Ribbon display is opened.	OK. AAD可選擇哪些跑道 方向的告警被顯示。
3.4.57	<pre>Verify by review that the LLWAS RWY threshold wind data are available: - RwyA (arrival) - RwyD (departure) - etc. for each runway</pre>	RWY threshold winds are available and alternate winds are provided if the primary is out of scan.	ОК.
3.4.58	Verify by review that an alert is indicated when a WSA or MBA is detected containing the information: - RWY Departure/Arrival - Location - WSA or MBA	The alert information are displayed.	MBA(微爆氣流告警) OK. WSA(風切告警)於工 廠測試時未建模擬 資料,故需於功能測 試時再次驗證。



Step	Action	Expected Results	Check
3.4.52	Verify by review the	All example data	MBA(微爆氣流告警)
	graphical mode	formats are	OK.
	functionalities of the	correctly	
	RainscoutATC display:	displayed on the	WSA(風切告警)於工
	- specific data	ATC displays	廠測試時未建模擬資
	messages show the		料,故需於功能測試
	followingconditions in		時再次驗證。
	the correct format		
	WINDSHEAR (WSA)		
	MICROBURST (MBA)		
	- RWY incl. 3 NM are		
	Displayed		
	- In case of WSA and MBA		
	the location and		
	intensity is displayed		
	- an alarm message is		
	indicated when a WSA or		
	MBA is detected		
	- an alert sound when a		
	WSA or MBA is detected		



Step	Action	Expected Results	Check
3.4.55	Verify by test that the	The specific RWY	OK.
	operator is able to select	will be	可選擇哪些跑道
	which runway information	displayed.	方向的告警被顯
	shall be displayed and the		示。
	rest are not be displayed.		





Step	Action	Expected Results	Check
3.4.59	Verify by review that	The Req. is	OK.
	algorithm hast the	fulfilled	可模擬執行917 Edges、
	capability to process		296 Triangles °
	200 EDGES and 250		
	TRIANGLES.		



模擬 917 Edges



模擬 296 Triangles



相對應的測風塔



模擬各測風塔的風速風向處理資料



模擬測風塔的風速風向資料統計



模擬LLWAS-Report記錄各測風塔資訊

Step	Action	Expected	Check
		Results	
3.4.60	Verify by testing the	The Replay	OK.
	wind shear events	function is	開啟
	rebuilt and replay	working	" Rainshear(Replay)"
	functionality at each	properly.	" RainScoutATC(Replay)"
	available workstation		應用程式後,輸入重放的時
	showing each wind woer		間範圍後,GAD、各測風塔資
	warming status, alarm		料及系統告警均可一一重
	area, wind field		建。
	analysis and AAD, GAD		
	alarm display.		







GAD告警重建畫面



"Wind Situation Display"告警重建畫面



"Maintenance Screen" 告警重建畫面



"LLWAS-Reports"告警重建畫面

Step	Action	Expected Results	Check
4.1	Verify that the	Examine settings and	將請原廠更正跑道
	runway direction,	act.txt values;	石柵局「USR」、
	latitude, and	compare with the	$\lceil 23L \rfloor$ \backslash $\lceil 05L \rfloor$ \backslash
	longitude are as	approved list of	^Г 23R」 °
	specified.	airport latitude	
		longitude	
		specifications*	

	4 16 84	# 0 # 0 # 0	f RUNN F STAT F TRI/	AYS TIONS ANGLES	00			0							
	15	PER	SIS_Q	JE_LEN	IGTH										
	15	QUE	UE_LE	NGTH											
RWY,	RUNWA	Y_LAT	(init	, fina	al),		RUNWA	Y_LO	N(init,	final	.),		RUNWAY_X(init, final)	, RUNWAY
05.4	25	5 /	10 10	25	4	22 42	-121	14	36.39	-121	12	57.55	7,019	4 991	3.6
DR	25	1 -	22 12	25	5	40.19	-121	12	57.55	-121	14	36.39	4.091	7.019	1.4
2JA DCA	25	1 1	52 33	25	3	41 15	-121	14	57.73	-121	13	27.29	7.511	4.832	2.0
DOA	25	4 .	11 15	25	4	52 33	-121	13	27.29	-121	14	57.73	4.832	7.511	8.8
	-99 16 05A	RW 6 # 0 23A	Y_LOC_ f stat 06A 2	FLAG IONS, 24A	RV	Y_STAT_	LOC								
No. History	1 3	-99	-99	-99											
	2 2	-99	-99	-99											
	3 1	0	-99	-99											
	4 0	Θ	-99	-991											
A MANANA REAL	5 0	1	-99	-99											
	6 -99	2	-99	-99											
	7 -99	2	-99	3											
	8 2	-99	2	- 99											
	9 1	Θ	1	O											
-	10 0	1	Θ	1											
	11 -99	2	-99	2											
	12 -99	-99	2	-99											
	13 -99	-99) 1	9											
	14 -99	-99	9 0	0											

Step	Action	Expected Results	Check
4.2	Verify that the latitude and longitude of wind sensor sites are as specified.	Examine settings and acf.txt values; compare with the approved list of airport latitude longitude specifications.	OK. 按總臺所給測風塔 經緯度位置設置。
4.3	Verify that Centerfield sensor and alternates are correctly specified.	Examine the RainLLWAS.ini file; compare with the approved list of threshold sensors and alternates.	OK. 按總臺所給中場經 緯度位置設置。
4.4	Verify that the RWY threshold sensors and alternates are correctly specified.	Examine the RainLLWAS.ini file; compare with the approved list of threshold sensors and alternates	OK.

Step	Action	Expected Results	Check
5.1	Verify that history data	History files have	OK.
	are storedand can be	been saved and can be	歷史資料存放
	opened as specified.	opened and	於"Archive"
		displayed.	資料庫中。
5.2	Verify the content of the	- Time and Date	OK.
	history files.	- Wind Data	相關資料均有儲
		- WS Alerts	存於資料庫中。
		- MB Alerts	
		- System Status	
5.3	Verify the export of the	History files can be	OK.
	history files	exported in XML	
		format	
5.4	Verify by test the	All functions are	OK.
	possibility to open and	working reliable.	資料庫儲存資料
	display archived events		可被正常讀取、
	within RainShear. The		篩選以及儲存為
	following information		檔案攜出。
	shall be contained:		
	- ability to access to the		
	archived data of files		
	every time		
	- ability to perationally		
	filter the archived data		
	as form of alerts		
	- ability to display the		
	status of the LLWAS system		
	during archive request		
	- archived data can be		
	downloaded to a removable		
	media.		

			RainShear	
LLWAS-	Reports A	Irchive	System Support	View Settings
Start: 2014-07-15	5 07:02:58 🗘 Stop	2014-07-1	5 07:03:58 👙 Start Query	
īme	u v		Data	
 2014-07-15 07:03:51 2014-07-15 07:03:49 2014-07-15 07:03:41 014-07-15 07:03:41 	-0.0 m/s	-0.2 m/s	0/16 active for 5 polls gust wind: 49 knots 0/16 active for 5 polls	
Anemometer			OV Upstigg of off	
TPE 001	0.5 m/s	-0.2 m/s	OK Heating set off	
TPE 002	0.4 m/s	-0.3 m/s	OK Heating set off	
TPE 003	10.2 m/s	-22.8 m/s	OK Heating set off	
TPE 004	0.1 m/s	-25.0 m/s	OK Heating set off	
TPE 005	-10.1 m/s	-22.9 m/s	OK Heating set off	
TRE 006	-18.5 m/s	-16.8 m/s	OK Heating set off	
TPE 007	-23.8 m/s	-7.8 m/s	or Heating set off	
TRE 008	-24.9 m/s	2.6 m/s	OK Heating set off	
TPE 009	-21.7 m/s	12.5 m/s	or Heating set off	
TPE_005	-14.7 m/s	20.2 m/s	or Heating set off	
TPE_010	-5.3 m/s	24.4 m/s	OK Heating set off	
THE OIL	5.1 m/s	24.5 m/s	or Heating set off	
TPE_012	14.6 m/s	20.3 m/s	OK Heating set off	
TPE_015	21.6 m/s	12.5 m/s	OK Heating set off	
TPE_014	24.9 m/s	2.7 m/s	OK Heating set off	
TPE_015	23.8 m/s	-7.7 m/s	gust wind: 49 knots	
TPE_016	-0.0 m/s	-0.4 m/s	gust wind: 49 knots	
P A 2014-07-15 07:03:	-0.1 m/s	-0.2 m/s	gust wind: 49 knots	
D A 2014-07-15 07:03:	19 -0.1 m/s	0.1 m/s	gust wind: 49 knots	

Step	Action	Expected Results	Check
6	Verify the operation of	The comparing	OK.
	LLWAS algorithm by	result is	將"桃園機場
	comparison with NCAR (The	identical.	WSA+MBA" 告警發
	National Center for		生的天氣條件輸入
	Atmospheric Research) test		SELEX公司的系統
	data.		與NCAR演算法產生
	Testing is done by using		的告警檔
	input files furnished by		(cks_14_b.alert)
	NCAR (including		吻合。
	configuration files) and		
	comparing the resulting		
	alerts pr with alerts		
	produced by the Selex ES		
	GmbH LLWAS implementation.		



			te 🗈 😂 🕰	III (M (M)	** **	W 🏷 📔 🔹 H 🖬	2 1
rdneraufgaben	cks_14_b.alert	BainLLWAS_2014071	15094448_plog				
enennen	57 . E:	99 6 21 20 5	0 0.17	0.21	2.00		
schieben	58 59 TIME	99 6 21 20 5	10 0 18	0.23	2.00		
ieren	60	22 0 11 10 0		0.25	2.00		
Web veröffentlichen	61 TIME:	99 6 21 20 5	20 0.19	0.25	2.00		
E-Mail versenden ucken	62 63 TIME:	99 6 21 20 5	30 0.20	0.27	2.00		
schen	65 TIME:	99 6 21 20 5	40 0.21	0.30	2.00		
	66 0 <mark>62</mark>	WSA +15k 2	MF Psbl WS	OTSD			
	67 24D	WSA +15k 1	MD Psbl WS	OTSD			
rte	68 69 TIME:	99 6 21 20 5	50 0.22	0.32	2.00		
	70 06Å	USA +15K 2 USA +15K 1	MD Psbl WS	OTSD			
itspiatz	72			0.25			
zwerkungebung	73 TIME: 74 06Å 75 24D	99 6 21 20 6 WSA +15k 2 WSA +15k 1	MF Pabl VS	OTSD OTSD			
	76 77 TIME: 78 06Å 79 24D	99 6 21 20 WSA +15k WSA +15k	6 10 0.25 2MF Psbl WS 1MD Psbl WS	0.37 OTSD OTSD	2.00		
	80 81 TIME 82 OSA 83 23D 84 OGA	: 99 6 21 20 MBA -30k MBA -30k MBA -30k MBA -30k	6 20 0.20 2HF 2MD 2MF 2MD	0.30	2.00		
reda player	AND	E: 99 6 21 20 MBA -30k MBA -30k	6 30 0.16 2MF 2MD	0.24			
Real Property lies							
	Ready		Party of Contract of Contract				
PAT (200)							

(四)、測試結果

本次工廠測試下列測試項目需於功能測試時再次確認:

- 1. 伺服器及工作站之硬體規格。
- 2. 伺服器 MS1 與 MS2 之「Hot/Hot」或「Hot/Stanby」模式。
- 3. WSA 告警顯示。
- 4. 跑道名稱更正。

除上述待確認項目外,其餘測試皆已符合技術規範說明書所述需求。

五、心得

眼見即所得,是最適合形容總臺原有 LLWAS 系統的一句話;將所有 的資訊顯示在同一個顯示畫面裡,方便使用者獲取所需。GAD(Graphic Alarm Display,圖形化告警顯示),以三角形標示出風切發生的區域; AAD(Alphanumeric Alarm Display,文數字告警顯示),顯示風切告警的位 置,是在跑道的頭、中或是後,並且顯示出風切數值的大小。但換個角度 來看,由於終端使用者為氣象人員與管制人員,所需資訊大大不同,過多 的資訊造成了不必要的困擾,所以衍生出子程式來獲得較為簡化的資訊。

即將換裝的 LLWAS 系統為一個整合式的系統,目前亞洲有新加坡及 韓國使用,系統將目前分散的功能完整整合,但又可以適度的分開。另外, 考量到管制人員使用上的便利性,將警示依跑道畫分為數個區域,當有風 切告警時,可以明確得知風切警報發生的位置及數值大小,將可更有效的 增進飛航安全。

六、建議

一、傳統與現代,過去與未來,使用者介面有時會是系統轉換的阻礙,尤 其是對一個使用十年的系統更甚之,是故良好的溝通與協調絕對是解 決此一問題的良藥。在出發前往德國工廠測試前,由於行前無法對新 系統有較為完整的了解,故心中存在許多的疑問,甚至害怕無法順利 完成任務,但在經過與德國原廠溝通後,幾乎所有的問題都迎刃而 解。所以在出發前,原廠代理商如能就工廠測試程序中可能會遇到的 問題,先跟我方人員溝通,解決心中疑惑,應該會讓工廠測試更為順 利。

二、 改變,破壞了原有的運作規律,讓原本熟悉的系統變得陌生;改變, 卻也是進步的動力,引入更有效率的系統來增進飛航安全。總臺現有 的 LLWAS 系統已建置 13 年餘,這 13 年來,電腦硬體的進步以及軟體 程式的開發已非同日而語。當然,改變是會帶來一些痛苦的,尤其對 於肩負飛航安全第一線的氣象及航管作業同仁,不熟悉系統作業可能 會提高風險。也希望能透過充分的溝通與完整的事前訓練,讓磨合期 盡快的度過,以嶄新的 LLWAS 系統來提供桃園及松山機場更有效率、 更安全的飛航服務。

七、附錄:工廠測試文件



FAT Protocol for LLWAS Software Procedures at TaoYuan Airport and Songshan Airport

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Within several sub-sections of the protocol all LLWAS-3 functionalities are verified and tested. The protocol shall be executed using TaoYuan airport design. The functionalities are the same for Taipei Airport.

Header

 Issue Authority: Selex ES

 Prepared by: Nils Tatjes (System Engineer)

 Date: 12.06.14

 Prepared and Approved by: Dr. René Graßelt

 Date: 12.06.14

Revisions Record Sheet

This sheet is a record of revisions to this document.

Issue	Date	Revised Pages	Document Change Note (DCN)
1.0	12.06.14	All	Version 1.0
2.0	09.07.14	All	Version 2.0

List of Abbreviations

ICD	Interface Control Document
LLWAS	Low Level Wind Shear Alert System
RS	Remote Sensor
MS	Masterstation/ Server
MB	Microburst
WS	Wind Shear
DTC	Data Transport Collector

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1.General Information

The Factory Acceptance Test (FAT) procedure described in the documents provided by Selex ES GmbH will be performed at Selex ES GmbH premise in Neuss/Germany.

Instructions to the FAT Test Team

The procedures described in this document provide observable confirmation of all LLWAS components and functionality which will be delivered and installed onsite by *Selex ES GmbH*. The tests are conducted by a mutually approved representative, who is trained in the FAT/SAT procedure by the *Selex ES GmbH*.

The test process and results are observed and verified by the procurement FAT/SAT test team. Each test item is described as to its objective, the test process, and the expected observable result. After a test procedure is conducted and there is a test team consensus that the observed result is satisfactory, that item is checked as successfully completed.

When all of the test items on a page are checked, each participating member of the test team and the participating *Selex ES GmbH* staff will initial the bottom of that page, indicating their concurrence with the approval of those test items.

When all test pages have been successfully completed, so indicated by the checked test items and the initials of the test team, the test team will sign the Signature Pages of this document, indicating the successful completion of the Factory Acceptance Test. The multiple signature pages will be distributed as required. The completed FAT documents and one signature page will be retained by *Selex ES GmbH*.

2. Verification of the IT system – Review of Design

Objectives

Factory Acceptance of the IT system verifies that all hardware components are present which are required to operate the LLWAS system. The acceptance doesn't include any infrastructure needed at the site.

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Step	Action	Expected Results	Check
2.1	Hardware Check Rack System		
2.1.1	Verify by review that a 19" inch Rack for hosting the server computers is installed.	The Hardware Req. is fulfilled.	*
Step	Action	Expected Results	Check
2.1.2	Verify by review that the Rack is equipped with:	The Hardware Req. is fulfilled.	*
2.1.3	Verify by review that both MS are equipped with: • 1 DVD-RW • 2 HDD ≥500GB • 2 GB Memory Command: free -m • 1 Redundant Hot Plug Power Supply • Ethernet Port	The Hardware Req. is fulfilled.	*
2.1.5	Verify by review that both MS are equipped with an operating system: Linux Red Hat Command: Isib release -a	The Req. is fulfilled	*
2.1.6	Verify by review that 2 HDD ≥500GB are available for spare part.	The Hardware Req. is fulfilled.	*
2.2	Hardware Check Workstation Computers	· · · · · · · · · · · · · · · · · · ·	
2.2.1	Verify by review that 2 Workstations are available.	The Hardware Req. is fulfilled.	*
2.2.2	Verify by review that both Workstations ære equipped with:	The Hardware Req. is fulfilled.	*

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	 1 DVD-RW Monitor (≥19") Keyboard/Mouse Ethernet Port All cables and connectors Restart Workstation – Start Bios 	~	-	
	(Press Escape)			
2.2.3	Verify by review that both Workstations are equipped with an operating system: Windows 7 – full licensed	The Req. is fulfilled.	*	

*Only applicable when HW is available

3.Verification of the Server Design and Software

Objectives

Factory Acceptance Test of the software system shall demonstrate that implementation and functionality of all components needed to operate the LLWAS Phase 3 algorithm is correct.

A successful demonstration ensures a reliable wind shear, microburst detection system which is ready for installation on-site. The functionalities introduced during the FAT procedure are based on the input of test data and test environments.

3.1 General Server Setup

Step	Action	Expected Results	Check
3.1.1	Login into MS system using Login/Password provided by Selex.	The user is able to login into both MS.	*
	- Test shall be executed on both MS		
3.1.2	Verify by review that a structural program technique is used.	The user identified a clear directory and file structure.	V
L	- Test shall be executed on both MS		
3.1.3	Verify by review software maintaining/reporting:	The user identified:	
	Check if S/W is made in plain English.	The software language is English.	
	The Operating System is Linux Red		

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			1
	Hat 6.x	The MS operates with	$\neg I$
	Check if SAW is operated and the data	Red riat.	$ \vee$
	processes on Linux Pod Hat system		
314	Verify by testing to switch between	A key combination	*
0.1.4	both MS	allows to switch	
	bour mo.	between both MS	-
		between both me.	
3.1.5	Check the redundant server system	The second system	<u> </u>
	mode "hot hot". Simulate a breakdown	proceeds with the work.	
	of one MS.	An alert should be	
		generated.	
	Command:	ь.	
	/upr/logal/BainhowE/rainhow/hin/rainroa ah		1
	stop		$ \vee $
	Verify by review that both MS receiving		
	row data simultaneously.		
	Change From HOT-HOF FO		
11.1	a 11 Made		
HUT	-) fund by provid	Data are received	
-		simultaneously.	
3.1.6	While switching between Primary	The function is	*
	(MS1) and Secondary servers (MS2),	confirmed.	
	the screen alert and voice alarm shall		
	be presented. The switching function		
	between servers could be implemented		
	automatically.		
3.1.7	Check the UPS function:		*
	I look the second sectors from	The UDO and the dee	
	onplug the server system from	The UPS provides the	
	eleculuity.	IVIS WITH Electricity. The	
		LLWAG SYSTEM IS	
		disruptions	
	Operating only with LIPS power to	aloruptiono.	
	simulate a longer blackout and to	Both servers shutting	
	provoke an emptying of the battery.	down automatically	
	· · · · · · · · · · · · · · · · · · ·	when UPS battery	
		reaches a critical level.	
3.1.8	Verify by review that CPU operational	The Req. is fulfilled	*
	load is less than 50%, usage of	a the	. /
	memory is lower than 50% and HD	MUSTOC	V
	space occupied right after the initial	confirmed durin	YFAT
	Installation is lower than 50% of the	SAT	1/1 AM
	total capacity.	J#1 1	VI

*Only applicable when HW is available

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3.2 General Workstation Setup

Step	Action	Expected Results	Check
3.2.1	Verify by review that Windows 7 64Bit version is installed	The Req. is fulfilled	*
3.2.2	Verify by testing the LLWAS client software is installed. Open "RainShear" Open "RainScoutATC"	The user is able to open both programs.	
3.2.3	Workstation Date and Time setup: Check if time and date on client	The user is able to setup the time.	*
	computers are configurable		
3.2.4	Maintenance workstation should be opened in average of 1 second, in maximum of 3 seconds after the operator issue a request command, and should perform reaction with system at an average of 5 seconds, in maximum of 15 seconds.	The Req. is fulfilled	\checkmark
3.2.5	When the maintenance workstation can't provide the screen warning or alert message via the monitor, the system shall provide audible sound or other feasible way to alert maintainer for the warning or alert message.	The Req. is fulfilled	\checkmark
3.2.6	The executed command on Maintenance workstation (such as reboot or reset action) should not make any adverse effects in the running LLWAS system.	The Req. is fulfilled	*

*Not Applicable - Maintenance Workstation not available during FAT

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*



3.3 Software, Interface Verification Masterstation

Step	Action	Expected Results	Check
3.3.1.	Verify by testing that operators are in the situation to set time on both systems. The time shall be displayed in line with network time. The ShearScout/ LLWAS uses these applicable hours in storing files, maintaining and operating every other function.	Examine time setting function on both systems. Storing a file and examine the file name. The file name is stored using time provided by the servers (GPS time).	
3.3.2	Verify that the MS is able to receive wind data from each RS, checks the contents of data and record the time. Verify that all the MS data will be upgraded with current wind data.	Examine the data received from DTC.	*
3.3.3	Verify that MS is able to calculate the Network Mean	Examine the Network Mean Values.	V

*Only applicable when HW is available

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3.4 Software Verification on Client/ Workstation

Step	Action	Expected Results	Check
3.4.1	Login into client system	The user is logged in.	*
3.4.2	Starting RainShear using the Icon	RainShear is open.	
3.4.3	Check the LLWAS System status which will be indicated in RainShear:		Chech-
	Real time normal (green)	This status should indicate when all anemometers 16 deliver wind data.	data gap 30 sec,
	Real time degraded (yellow)	Some anemometers 15 – 1 breaks down but LLWAS still operating.	
	System Support (red)	To few anemometers out of order 12 - 0 the LLWAS is not able to operate	
	Initialization (yellow)	The LLWAS will be initialized (e.g. after restart)	
	Off (red)	No Anemometer and also no RS status for more than n seconds (n is configurable)	
3.4.4	Open the Wind-Situation Display (RWY underlay)	Wind-Situation Display window is open.	
3.4.5	Verify by review that sensor information is shown on the Wind- Situation Display I	Wind-Situation Display indicates wind sensor information (wind speed, wind direction or in case of break down the current status) of each anemometer.	
3.4.6	Verify by review that the wind speed and directions are updated by each anemometer and displayed on the Wind- Situation Display	The wind parameters are updated every 10 seconds.	\checkmark

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Gematronik Weather Radar Systems 3.4.7 Verify by review that in The "error" message is indicated of case of sensor breakdown failed anemometer/s. the code "error" is displayed. 3.4.8 Verify by review that the The centerfield sensor is centerfield sensor is displayed. indicated. 3.4.9 Verify by test and click on An extra screen is displayed any anemometer to containing overview of wind display the temporal direction and wind velocity. evolution of wind direction and wind velocity 3.4.10 Verify by review that the Wind-Situation Display displays gust wind is displayed gust wind. Muybe bigger ifer) 3.4.11 Verify by review that the The AWOS information are system is be able to displayed. access the wind speed and wind direction data in Buyer's existing AWOS system (for Taoyan airport, it shall include data in the middle of runway) at both ends of runway, and display this numerical value on AAD and GAD. 3.4.12 Verify by review that users The AWOS information are are able to read the displayed. AWOS information on the screen. 3.4.13 The Req. is fulfilled. All displayed windows for wind shear, wind data and AWOS information are displayed inside the same screen to easy operators operating. 3.4.14 The Req. is fulfilled. Verify by review that the wind direction at the middle of airport is indicated by three digits from 001 to 360; the wind speed is indicated by two digits from 03 to 95 Knots, less than 3 Knots is indicated by CALM; the gust is indicated by two

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digits. If the maximum

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		y	
	wind speed is greater than		τ
	the previous of two	}- }	-1 ,
	minutes average, system		
	should display it on	lector 2 Mills	1011. 45
	screen.	CACCH SC Minare)	VIVIINUIU
3.4.15	Verify by test to switch	The start-up screen will be	
	back to RainShear start-up	displayed.	\vee
	screen.		
3.4.16	Open the Maintenance	Maintenance Screen window is	1
	Screen	open.	
3.4.17	Verify by review that	Maintenance Screen indicates	
	sensor information	wind sensor information (wind	
	regarding speed and	speed, wind direction deviation	
	sensor status is shown on		
	the Maintenance Screen		
3.4.18	Verify by review that the	The parameters are updated every	
	wind speed and directions	10 seconds.	
	deviation as well as sensor		
	status is updated by each		V
	displayed on the		
	Maintenance Screen		
3.4.19	Verify by review that in	A warning is displayed.	
	case of sensor breakdown		
	the operational	Start and Stop 11 (RCS).	V
	degradation is below		
3 4 20	Inresnola.	The conterfield concer is	
5.4.20	centerfield sensor is	displayed	
	indicated.	(color selectula)	
3.4.21	Verify by test: Click on any	An extra screen is display can be	
	anemometer to display the	opened to view the different	
	temporal evolution of wind	functionalities.	
	speeu and direction deviation and operational		
	degradation as well as the		
	wind rose display and		
	settings option		
	functionality.		
3.4.22	Verify by testing the	The sensor can be isolated.	
	system can manually		
	from system calculation		\vee
	when its data becomes		~
	faulty or abnormal:		
	however the speed and		

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	direction data shall still be			
	shown. The operator can			
	manually accept the			
	sensor and include it in			
	calculation once it has			
	recovered.			
3.4.23	Verify by review that	The Reg. is fulfilled	+	\neg
	analysis, calculation and			
	statistics on wind snood		1	
	and wind direction date			
	and wind direction data			
	has been made.			
	Meanwhile, basing on		3/4	
	comparing the accuracy of			
	the information and			
	reasonability in the past			
	data, determine the			
	credibility of wind speed			
	and direction in current			
	anemometer			
3424	Verify by testing that the	The Deal is fulfilled		
011121	maintenance agreen is	The Req. is luillied.		
	oble to display wind			
	able to display wind			1
	speed, wind direction and			
	measured the average			
	wind speed and wind			
	direction in system of each			
	anemometer, and can be			
	showed in tabular form.			
	Verify by testing that the			
	maintenance scree is able			
	to display the wind roso			
	drawing of each			
	champeneter and and			
	anemometer, and each			
	one of the wind rose			
	drawing can be selected			
	by quarter, month, day, or			
	by specifying the time			
	interval screening.			
	-		./	
	According to selected sites		V	
	and counted by quarter			
	month day or by			
	specifying the time interval			
	to filter out and dianta		¢	
	wind above and display			
	winu snear diata, and can			
	snow them in tabular			
	tormat.			

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3.4.25 Verify by test to switch The start-up screen will be back to RainShear start-up displayed. screen. 3.4.26 Verify by review that out of The out of service time is service time of recorded. anemometers are recorded. 3.4.27 **Open the LLWAS report** The LLWAS report screen is open. screen. 3.4.28 Check that all All installed anemometers anemometers and wind displaying wind information. measurements are displayed on textual basis and the Network Mean is calculated. 3.4.29 Verify by review that in A red point indicates an case of anemometer/s anemometer error. break down an alert will be indicated (visual red sign) 3.4.30 Verify by review that in The failed anemometer is case of anemometer/s displayed. 11 break down the failed sensor will be indicated 3.4.31 Verify by review that wind A warning triangle is displayed shear alerts are displayed when an alert is generated. A click (textual basis). on the triangle and the alert is The alerts has to specify: specified according to LLWAS Phase 3 requirements. - WSA not presented due to Testdated Wind Shear - Loss/Gain Microburst – Loss - CALCH SAT WSA Location on RWY 3.4.32 Check the Online Help The Rainbow Software Online function Help is available Using the corresponding symbol inside RainShear Display 3.4.33 Check the setting function The filter function works on to filter results to be required performance. visualised. Over (a) romoved - Anemometer Errors - Wind Shear Alerts - Normal conditions - All 3.4.34 Check the data archive Within the selected time frame all function (click on database data can be visualized. icon) for anemometer data and wind shear alerts. - select start and end time

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	- start data request		
3.4.35	Check the export function (click on button export) to export displayed data into an external XML file showing MBA and WSA alerts and Centerfield data.	Data are exported into an external file. ANWS will format for Multicast	V
3.4.36	Verify by test to switch back to RainShear start-up screen.	The start-up screen will be displayed.	V
3.4.37	Verify by review that System Cycle time of the server in main station is less than 10 seconds including first gets the wind speed and direction from the remote anemometer, processes, produces the shear/microburst/burst alert, finally shows the situation on the workstations and records it in the database.	The system cycle is 10 sec.	V
3.4.38	Open the System-log screen.	The System-log screen is open.	V
3.4.39	Verify be review that in case of status "System Support" a log-message will be shown and stored.	The log-message is stored accordingly.	V
3.4.40	RainShear Status Update (RainRCS) - indicates the status of the server system. Verify by review that in case of a RainRCS process is not running a message will be indicated. A click to RainRCS and it is indicated which process is 'Down'. The following processes are shown: 1. NGS (News Group	Indicates Up/Down	
	Server Communication) -		

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				_
	communication of LLWAS components	Indicates Up/Down		
	2. RainRLS (RainLogServer) – messages can be logged or not	Indicates Up/Down		
	3. PostgreSQL – observation of Rainbow® data base (directory, files etc)	Indicates Up/Down		
	4. RainDbAdmin – data base observation	Indicates Up/Down		
	5. RainAWOSImport– test program for reading AWOS data	Indicates Up/Down	V	
	6. EmomoterImport – anemometer data input	Indicates Up/Down		
	7. RainLLWAS – algorithm kernel (observation of algorithm)	Indicates Up/Down		
	8. RainDTCim – data import from DTC			
	9.elnetServer.py process to receive AWOS data to server			
	10. elnetClient.py process to transmit AWOS data to client			
	11. AnemometerData anemometer data input			
3.4.41	RainSCOUT log. message – In case of a wind shear/ microburst alert is indicated to the controller within RainScoutATC client he has the possibility to acknowledge the alert.	: 	\bigvee	

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p			
	Verify by test to acknowledge a wind shear/microburst alert at the workstation/client computer	A log-message will be generated that the alert is acknowledged.	
3.4.42	RainLLWAS log. message shows all status information regarding the LLWAS algorithm.		
	Verify by review:		
	- when the system is degraded but LLWAS is able to run, a warning shall be indicated "yellow sign"	The corresponding log-messages	/
	- when system support is needed, LLWAS is not able to run, an alert is generated "red sign"	are generated. (stop D rosini)	
	- the system has no data (LLWAS is off) an alert is generated "red sign"		
	- the initialization is in process "are en sign"		
3.4.43	Click on the green arrow on bottom on the left to verify:	The function is working properly.	
	- the RainShear version number - on-line help - options		V
3.4.44	Verify by test to switch back to Rain Shear startup screen.	The start-up screen will be displayed.	7
3.4.45	Verify by review that the out of service interruption time, and communication failure status in system is logged.	The corresponding message is logged.	\checkmark
3.4.46	Verify by review that self- diagnosis ca pability is available. When a malfunction of system or		

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1 **BELEX** Systems Integration

·····			
	sensor or no signal, system must show a screen alarm and audible alarm. (The alert sound can be switched ON/OFF). The types of malfunction etc., shall be displayed and recorded in the servers		
3.4.47	Starting RainScoutATC using the Icon	RainScoutATC is open.	V
3.4.48	Verify by test that RWY mode is selectable.	Application allows to switch between RWY modes.	
3.4.49	Check the LLWAS System status which will be indicated in RainShear:		
	Real time normal (green)	This status should indicate when all anemometers 16 deliver wind data.	1
	Real time degraded (yellow)	Some anemometers 15-14 break down but LLWAS still operating.	
	System Support (red)	To few anemometers out of order 13 - 0 the LLWAS is not able to operate	
	Initialization (yellow)	The LLWAS will be initialized (e.g. after restart)	
	Off (red)	No Anemometer and also no RS status for more than n seconds (n is configurable)	
3.4.50	Verify by review that data are available and fonts are readable on display	The design corresponding the user needs.	\checkmark
3.4.51	Verify by review that the LLWAS CF wind data and alternates are available	CF winds are available and alternate winds are provided if the primary is out of scan	\checkmark
3.4.52	Verify by review the graphical mode functionalities of the RainscoutATC display:	All example data formats are correctly displayed on the ATC displays	
	- specific data messages		

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	show the following conditions in the correct format WINDSHEAR (WSA)	-> check during	
	MICROBURST (MBA)	SAT	
	- RWY incl. 3 NM are displayed		
	- In case of WSA and MBA the location and intensity is displayed		V
	- an alarm message is indicated when a WSA or MBA is detected		
	- an alert sound when a WSA or MBA is detected		
3.4.53	Verify by test that the alert can be acknowledged	The alert sound is muted.	V
3.4.54	Click on the setup button to verify the setting function:	The setting functions working reliable.	
	 version number on-line help font size setting print function save function zoom function 		\searrow
4.3.55	Verify by testing that the operator is a ble to select which runway information shall be displayed and the rest are not be displayed	The specific RWY will be displayed.	
3.4.56	Click to the button to switch to the AAD display showing the alerts on textual basis	The Ribbon display is opened.	V
3.4.57	Verify by review that the LLWAS RWY threshold wind data are available: - RwyA (arrival) - RwyD (departure) - etc. for each runway	RWY threshold winds are available and alternate winds are provided if the primary is out of scan. $\widehat{J}hrchold \stackrel{from}{\overleftarrow{k}} AWOS$	1
3.4.58	Verify by review that an alert is indicated when a	The alert information are displayed.	

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	WSA or MBA is detected containing the information: - RWY Departure/Arrival - Location - WSA or MBA	-wsa on silc	
3.4.59	Verify by review that 200 NEDGES and 250 NTRIANGLES can be processed.	The Req. is fulfilled	

Step	Action	Expected Results	Check
3.4.60	Verify by testing the wind shear events rebuilt and replay functionality at each available workstation showing each wind tower warning status, Alarm Area, Wind Field Analysis and AAD, GAD alarm display	The Replay function is working properly.	

4.Verification of the LLWAS algorithm

Objektives:

Software testing verifies that the system software is correctly installed and that it is operating correctly. It will be visually checked that the software configurations match the required site descriptions for the respective airport.

Files to Check:

- acf.txt
- Station configuration file
- Display configuration file

Step	Action	Expected Results	Check
4.1	Verify that the runway direction, latitude, and longitude are as specified.	Examine settings and acf.txt values; compare with the approved list of airport latitude longitude specifications*	V
4.2	Verify that the latitude and longitude of wind sensor sites are as specified.	Examine settings and acf.txt values; compare with the approved list of airport latitude longitude specifications*	V

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4.3	Verify that Centerfield sensor and alternates are correctly specified.	Examine the RainLLWAS ini file; compare with the approved list of threshold sensors and alternates*	V
4.4	Verify that the RWY threshold sensors and alternates are correctly specified.	Examine the RainLLWAS ini file; compare with the approved list of threshold sensors and alternates*	V

* The approved list of airport site information will incorporated into this document

5.LLWAS data archive function test

Objektives:

Verify the operation of data archive functions.

General:

The archive function is included into RainShear. The archive function is available for LLWAS textual alert messages and for system status messages.

Step	Action	Expected results	Check
5.1	Verify that history data are stored and can be opened as specified.	History files have been saved and can be opened and displayed.	X
5.2	Verify the content of the history files.	 Time and Date Wind Data WS Alerts MB Alerts System Status 	
5.3	Verify the export of the history files	History files can be exported in XML format	V
5.4	Verify by test the possibility to open and display archived events within RainShear. The following information shall be contained:	All functions are working reliable.	
	 ability to access to the archived data of files every time 		
	 ability to operationally filter the archived data as form of alerts 		

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 -	ability to display the status of the LLWAS system during archive	
	request	

6.NCAR Comparison Tests

Objektives:

Verify the operation of LLWAS algorithm by comparison with NCAR (The National Center for Atmospheric Research) test data.

- NCAR test sets are developed by NCAR for evaluation purposes. Each set contains an ACF file for a simulation airport, input wind data, and Alert messages produced by the NCAR LLWAS implementation.

Test Procedure:

Testing is done by using input files furnished by NCAR (including configuration files) and comparing the resulting alerts pr with alerts produced by the *Selex ES GmbH* LLWAS implementation.

- The NCAR test data are located in the data archive. It is necessary to load the correct configuration files and to access the correct wind data file. The NCAR wind data are processed by the LLWAS algorithm through the Playback utility in step mode, and the alert message results are compared with the alerts from the NCAR archive.
- Use cks_14.acf, cks_14_b.dat , and compare with cks_14_b.alert.

From cks_14_b.alert:

Time:	6 21 20 5 40		Check
06A	WSA +15k 2MF	Psbl WS OTSD	
24D	WSA +15k 1MD	Psbl WS OTSD	

Time:	6 21 20 5 50		Check
06A	WSA +15k 2MF	Psbl WS OTSD	
24D	WSA +15k 1MD	Psbl WS OTSD	



 Time:	6212060		Check
 06A	WSA +15k 2MF	Psbl WS OTSD	
 24D	WSA +15k 1MD	Psbl WS OTSD	

Time:	6 21 20 6 10		Check
06A	WSA +15k 2MF	Psbl WS OTSD	
24D.	WSA +15k 1MD	Psbl WS OTSD	

Time:	6 21 20 6 20	Check
05A	MBA -30k 2MF	
23D	MBA -30k 2MD	
06A	MBA -30k 2MF	
24D	MBA -30k 2MD	·

Time:	6 21 20 6 30	Check
05A	MBA -30k 2MD	
23D	MBA -30k 2MD	
06A	MBA -30k 2MF	
24D	MBA -30k 2MD	
1.11		

Time:	6 21 20 6 40	Check
05A	MBA -35k 2MF	
23D	MBA -35k 2MD	
06A	MBA -35k 2MF	
24D	MBA -35k 2MD	

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The LLWAS FAT has been performed satisfactorily and witnessed by the following people representing the following authorities:

Performed by Signature 江世决1 2014.7.17. 71-2)(1 2014.1.11. P\$\$ 3.5\$ mix.7.17 Dr. René Graffelt (selex PM) R. GM/R 17.07.14 3.55 TER 2014, 7.1.)



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