出國報告(出國類別：實習）

「飛測機後艙設備研討會」出國報告書

服務機關：交通部民用航空局飛航標準組
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派赴國家：德國

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壹、目的

本局於100年初向德國飛測系統整合商Aerodata公司購買全新之飛航測試機，全案含全新的Super King Air 350iER飛機並配備1套全自動飛測系統。該飛測系統之整合商Aerodata公司負責系統軟體設計及硬體整合作業，自該公司飛測工程部門成立以來，所設計並已交貨之飛測系統共計有76套，約有50個國家使用其系統。

為提昇顧客對其產品之滿意度，該公司每2年定期召開飛測機後艙設備研討會，提供使用該公司產品之飛測相關人員交換系統使用與技術信息交流之平臺。研討會包含新飛測需求討論、飛測軟體更新說明，並提供新版軟體差異訓練。

Aerodata公司希望透過2年一次的研討會，匯集各國使用者對於該公司系統使用心得，了解顧客對於該公司產品之評價，與顧客共同研討飛航系統運作及精進之方式，促使該公司產品品質更為穩定。

飛航測試作業雖在國內已執行多年，但新飛航測試系統電腦軟體控制功能與舊系統相較大幅度增加；為避免作業與舊系統作業差異、飛測小組航機務人員於過渡期作業困難，於今年年初交機後依合約由Aerodata公司派駐一名駐廠代表協助本局飛測小組熟悉新系統之運作及解決系統作業問題。在駐廠代表協助下，本局飛測小組很快地熟悉新飛測系統作業，克服自動化系統在臺北飛航情報區特殊地形作業之困難；除定期測試外，於今年3月開始執行桃園機場05R/23L跑道CAT-II ILS啟用測試，隨後還執行了馬公02跑道PAPI燈光、馬公及鞍部DVOR、南竿LDA及馬公BM NDB…等電臺之啟用測試。

但受限臺北飛航情報區內之助導設施種類及運用限制，飛測人員對

於新飛航測試系統電腦軟體使用仍局限於基本使用功能上。為使飛測人員能汲取各國飛航測試之經驗並更深入了解飛測系統之功能，故職奉派參與會議，除接受飛測軟體差異訓練外，並可藉由會議與各國飛測負責人員接觸，更進一步瞭解各國飛航測試業務運作模式及新助導航系統飛航測試需求，建立飛測技術專家人脈。除可保持與廠家連繫溝通之管道外，更藉由與會者之報告交換/分享各個國家或飛測公司使用系統之經驗，及早發現系統功能作業問題或可提昇功能之方案，祈使本局飛航測試作業保持最佳狀態。

貳、行程紀要

日期	行程
8/31～9/1	搭乘中華航空航班前往德國法蘭克福，再轉搭德國國鐵到達飛測系統整合商Aerodata所在地
9/2 ～9/4	飛測機後艙設備研討會
9/5	飛測軟體差異訓練
9/6～9/7	由Aerodata搭火車到法蘭克福搭乘中華航空航班返抵桃園機場

參、過程

會議議程詳如附錄一。

肆、會議及訓練資料摘要：

一、 Aerodata公司介紹該公司近2年來完成之專案與新產品功能簡報(簡報資料見附件一、二)

本局新飛航測試機及全自動飛測系統係Aerodata公司於去年完成的專案之一，也是該公司成立以來售出之第71套全自動飛測系統。簡報展示了2011年以來，該公司依顧客飛航測試機之型別及對於客艙/系統配置之需求而設計/發展之各種不同組合之自動化飛測系統。

簡報提供顧客該公司產品與技術發展現況之資訊，有助於顧客飛測系統功能提昇或採購新系統規劃作業。而本局於年初才完成新系統採購驗收，首次參加該公司舉辦之【飛測機後艙設備研討會】，暫時並無功能提昇之計畫，但藉由Aerodata公司之簡報，職得以了解與會之各個單位使用之飛測系統與本局系統之差異性，並與與會人員建立交流之管道。

二、 顧客簡報

這主題是Aerodata公司之創舉，該公司提供技術發表平臺，由顧客提報其使用Aerodata產品之心得，與大家分享，聆聽各國家對於該系統之設計、飛測方法或標準容差…等議題之意見。本次會議顧客簡報討論之議題如下：

(一)、Aero Pearl飛測公司 Chief Technical Service Engineer Mr. Matthew Bruce簡報 “Experiences using the….Transponder Pulse Decoder System… for SSR Flight Inspection” (簡報資料見附件三)。

Aero Pearl飛測公司為提供澳洲民航局、新加坡等國家飛測服務之飛測公司，本簡報分享該公司於次級搜索雷達(Secondary surveillance radar, SSR)飛測時使用答詢器脈波解碼器(Transponder Pulse Decoder System, TPDS)之經驗。過去在雷達飛測時，飛測機扮演的是標的機(Target)之被動角色，做為雷達測試涵蓋範圍之標的物，不主動量測雷達特定之參數來判定雷達之性能。而Aero Pearl採用TPDS量測次級搜索雷達送出之詢問脈波波形、時間間隔與信號強度，引發與會人員針對雷達工程師對於次級雷達信號是否有詢問脈波波形、時間間隔與信號強度等性能飛測需求進行討論與質疑。

檢視我國對於雷達飛測之需求，飛航服務總今年4月9日航業字第 1020003180號函擇要摘錄如下：

【經檢視ICAO文件，有關雷達及監視系統之飛測實施，係於監視設備發生異常狀況、重大維修更換或監視系統效能有疑慮等情形始進行；參照歐、美等國家之作法，對於監視系統效能之檢測，僅擷取一定數量之在空機樣本進行精準度分析，並無定期實施雷達及監視系統飛測之必要性。

爰此，本總臺擬調整本區監視系統飛測策略，相關規劃說明如下：

（一） 於新購雷達驗收或影響位置精準之重要零件維修後，規劃適用該個別雷達之飛測路線並進行檢測。

（二） 定期採樣在空機樣本以檢視本區監視系統效能，若發現監視系統效能有疑慮，再針對個別區域進行規劃並實施飛測。…】

目前，國內對於雷達飛測並無定期飛測之需求。“Experiences using the….Transponder Pulse Decoder System… for SSR Flight Inspection”議題雖對於本局無立即性之效益，但飛測小組仍將持續注意該硬體技術之發展，以因應飛航服務總臺未來新購次級搜索雷達(Secondary surveillance radar, SSR)啟用飛測之需求。

(二)、德國 Flight Calibration Service 公司飛測工程師 Markus Schwendener簡報 “Flight Inspection of Helicopter Procedures - Limitations of Fixed Wing Aircraft －”(簡報資料見附件四)

Flight Calibration Service公司為德國飛測公司，負責德國及其鄰近國家之飛測作業。以直昇機執行一般定翼機無法執行之特別飛測概念源起於瑞士，因瑞士境內多高山，極需要以直昇機執行高山滑雪意外救護作業。雖然直昇機以目視飛航作業為主，但高山雲霧變化快速，瑞士每年因氣候變化而取消直昇機執行緊急救援之架次高達600架次，故該國致力於山區直昇機儀器飛航驗證作業，希望能縮短飛航距離、時間及降低因氣候變化取消救援作業架次。所以與Aerodata公司合作開發安裝於直昇機上之飛測系統，Flight Calibration Service公司以顧客身分分享該系統使用經驗。目前國內尚未有以直昇機執行飛測作業之計畫，但此資訊可提供空中勤務總隊參考。

三、 AFIS功能強化與運用

此段會議主題集中於AFIS功能強化說明，並介紹其多元化運用方式。

(一)、Detection and Location of RF Interference Sources(簡報資料見附件五)

現代社會無線電波被廣泛地運用，致使航空信號波道常被不知名的信號所干擾，是為飛航安全之威脅。目前尚未有全自動化之干擾信號搜索定位系統，欲以最短之飛航時間定位干擾源所在地，需要非常了解無線電信號特性、原理之系統操作人員搭配特殊接收機及定位軟體。利用陸空聯合作業，才能及時地解決干擾問題。

Aerodata公司天線硬體驗證工程師Rolf Seide以實例逐步說明如何利用該公司Direction Finder System空中偵測干擾信號並定位干擾源位置。偵測干擾信號需要2位工程師分別負責操作飛測電腦及頻譜分析儀，目前該公司已著手開發操控頻譜分析儀之軟體界面，簡化機上人員操作流程。目前，本局之飛測系統並未配置DF System，但若臺北飛航情報區內持續發生無線電波干擾之現象無法而由解決時，建議可考量利用以飛機平臺建置干擾信號搜索定位能量。

(二)、新增之軟體功能(簡報資料見附件六)

i. 新增示波器與頻譜分析儀頻率、時序、量尺等控制選項，讓飛測系統工程師可於飛測系統控制檯前直接控制示波器與頻譜分析儀，免於顛簸的機艙內飛測系統控制檯、示波器或頻譜分析儀間作業。本項功能將於下版軟體更新。

ii. GBAS飛測報告格式依測試條款修訂，目前本局之飛測系統並未配置GBAS。

iii. 曲線圖編輯器(Graphic Editor)功能新增使用者可依需求自行定義曲線樣式、顏色，以便利曲線辨識。本項功能將於下版軟體更新。

iv. 程式管理員(Program Manager)新增控管功能，對於擁有1架以上飛測機軟體之使用者，除系統利用PIN碼自動設定飛機呼號、系統ID外，程式管理員亦可以手動方式設定相關之參數，或刪除舊版/不適用之軟體。目前本局僅1架飛測機，此項軟體功能並不適用。

v. 新增FAA Offset Localizer飛測功能，此部份軟體係因應臺北飛航情報區多樣化Offset Localizer架設方式而開發。因本區內受限於機場特殊之地形限制，架設之Offset Localizer已超出ICAO Doc.8168之限制，例如：北竿機場03&21跑道、豐年機場04跑道…等跑道之LDA。於使用Aerodata軟體（ICAO飛測條件）必須設法計算虛擬跑道頭、跑道長度…等諸多使用限制。為此，Aerodata為本局開發以FAA Offset Localizer飛測條件之飛測軟體，使用者只需輸入實際跑道頭、Offset Heading、Miss Approach Point等資料，由系統自動以FAA Offset Localizer飛測條件分辨Localizer Type並推算量測點。目前本局軟體已俱備此項功能，本次會議分享軟體使用經驗，並與與會人員討論飛測方法/計算之合理性。

另會中亦針對偏架LDA之跑道其PAPI燈光架設中心線基準衍生議題進行討論，與會人員一致認為PAPI燈光架設中心線基準仍應以跑道中心線為基準。

vi. 資料下傳(Data Downlink)軟體提供飛測數據即時下傳之功能，透過UHF Datalink讓地面人員即時收到飛測結果，可即時執行地面電臺調整作業。目前本局之飛測系統並未購

置Datalink硬體，且與地面人員有專屬波道通聯，無此項功能需求。

vii. PDGPS軟體功能提昇，提昇系統精確定位之比例，同時亦提供飛行軌跡與定位狀況映像至Google earth之功能，方便研析系統架設點適當性。目前本局飛測軟體已俱備該項功能。

viii. 衛星定位系統地面量測資料(GPS Survey)直接輸入飛測軟體資料庫功能，可降低人工輸入造成之誤差。目前，本局飛測軟體已俱備該項功能。

ix. 移動式設施飛測軟體，適用於船艦上使用之TACAN、Radar飛測作業，此項作業適用於軍方飛測作業：目前，本局之飛測系統並未選配此項功能亦無此項功能需求。

x. 強化接收機調校功能，新增電纜耗損資料設定。目前本局飛測軟體已俱備該項功能。

xi. 新增航路 “Direct”測試模式，依飛機即時位置設定航路設施，如：VOR、DME、TACAN、NDB等電臺測試模式。目前本局飛測軟體已俱備該項功能。

xii. 新增俄語界面軟體選項，目前本局選用英文界面，此項軟體功能並不適用。

(三)、開發中之系統功能(簡報資料見附件七) Aerodata公司提報該公司開發中之系統功能，徵詢顧客對於該功能之實用性建議及採購意願。會中提出之議題如下：

i. Localizer Polarization

ii. CPDLC(Controller-Pilot Data Link Communication)

iii. Camera in Cockpit

經討論，各國目前均已有可替代之方法執行飛測，對於Aerodata提出之自動化飛測方案意願不高。

四、 其他飛測技術相關簡報

由Aerodata公司邀請法國ENAC(French Civil Aviation University)、德國DLR-German Aerospace Center、Technical University Braunschweig等機構及該公司工程師簡報相關技術近期之發展，讓與會人員了解更多飛測相關領域技術發展現況。本次安排簡報之議題如下：

(一)、法國ENAC(French Civil Aviation University)簡報該機構發展之ILS Simulation for Flight Inspection軟體，此軟體分為ATOLL(for LLZ)及LOGON(for GP)兩部份，提供與飛測系統執行LLZ及GP飛測相似的界面，可以模擬地面系統參數設定改變時，對於飛測結果之影響。該軟體亦提供地面障礙物對於信號場形分析，並可繪出可能產生之飛測曲線，非常適合ILS系統維修工程師維護訓練、飛測結果與硬體調校關聯性研析使用。建議飛航服務總臺於清泉崗訓練中心課程採用。

(二)、德國DLR-German Aerospace Center簡報該機構於Braunschweig機場架設之GBAS系統使用與研究進展，目前該機構著重於機場架設GBAS對於進場航路使用之效益評估，並未討論飛測細節。

(三)、德國Technical University Braunschweig簡報目前歐美、中國、印度等各種類導航衛星架設發展現況，針對各種類導航衛星應用

於航空導航對於機載系統(天線、接收機、座標系統、時序)運作及操作頻率影響研究摘要性提報。

(四)、Aerodata公司工程師Jorg Dybek簡報使用多重導航衛星信號於飛測定位系統之效益。

(五)、Aerodata公司工程師Thorsten Heinke簡報現行ADS-B out航管法規應用期程及其信號特性，會中與會各國代表說明各國空域推行ADS-B out之期程及ADS-B out飛測需求。經討論目前各國航管單位並未提出特殊飛測需求，飛測機扮演的是標的機(Target)之被動角色，裝載合格之ADS-B out發報機做為測試涵蓋範圍之標的物，不需主動量特定之參數來判定航管系統ADS-B out之性能。

五、 飛測軟體差異訓練

Aerodata公司免費提供顧客飛測軟體差異訓練，訓練教室提供電腦及軟體讓學員可以進行實務操作練習，完成訓練後頒發完訓證明(如附錄二)。本次安排訓練之內容如下：

(一)、曲線圖編輯器(Graphic Editor)及數據表(Alphanumeric Editor)操作練習

(二)、COM、DF、Radar飛測操作

(三)、飛測ASCII 資料輸出設定練習

(四)、Graphic History功能應用(註:本局飛測軟體目前並未選配此項功能)

此訓練課程安排提供飛測軟體進階性操作練習，讓飛測工程師除平日例行性飛測作業應用之軟體外，得以深入了解飛測軟體附屬工具使用

方法。這些工具原本就存在於軟體中，Aerodata開放附屬工具之使用讓飛測工程師可以在預設之資料或圖形輸出格式外，依需求自行設定資料或圖形輸出格式，活化飛測數據呈現方式，便利執行飛測數據分析使用。

伍、心得與建議事項

此次為本局首次參加 Aerodata 公司舉辦之【飛測機後艙設備研討會】，雖然飛測機於年初才完成新系統採購驗收，暫時並無功能提昇之計畫，但藉由此次會議，職得以了解與會之各個單位使用之飛測系統與本局系統之差異性，並與與會人員建立交流之管道，獲益良多。

Aerodata 簡報資料顯示，該公司近 2 年來產品因顧客需求之多元性、衛星及電腦科技快速發展，不論是硬體或軟體均有大幅之改變。為使飛測系統能符合助導航測試需求，應定期檢視飛測系統硬體性能提昇、軟體更新需求。建議定期派員參加飛測系統製造廠每 2 年定期會議，以了解市場技術發展現況。因應助導航技術之更新，從事飛航測試作業人員除需汲取相關資訊外，並應定期參與國際間飛航測試年會，以掌握新助導航技術變化，及飛航測試對應方法與解決途徑。

因全球飛測從業人員為數極少，為少數人安排專屬之飛測軟體訓練課程成本極高。Aerodata 公司利用各國飛測系統操作人員參加【飛測機後艙設備研討會】之機會，以會後多停留 1 天方式舉辦訓練課程，可集合多數有意願者，在有限的飛測人力調度下，參加飛測軟體進階性訓練，可讓飛測工程師深入了解飛測軟體之應用，不但節省人員差旅時間，並可分攤訓練費用，建議後續仍應派員參與。

附錄一 會議議程

AeroFIS User Meeting 2013 (Rev.1)

Monday, September 2nd, 2013

18:00	Welcome at Aerodata Facilities

Tuesday, September 3rd, 2013

09:15 – 09:30	Projects completed since 2011
09:30 – 10:00	Presentation of New AeroFIS Design (AD-AFIS 113 / 114)
10:00 – 10:30	Customer Presentation
10:30 – 11:00	**Coffee Break**
11:00 – 11:30	Combined GNSS Position Reference for Flight Inspection
11:30 – 12:00	Certification Aspects about Commercial-Of-The-Shelf Equipment for Flight Inspection
12:00 – 12:30	Customer Presentation
12:30 – 13:30	**Lunch Break**
13:30 – 14:00	Flight Inspection and ADS-B
14:00 – 14:30	Customer Presentation
14:30 – 15:00	Detection and Location of RF Interference Sources
15:00 – 15:30	**Coffee Break**
15:30 – 16:00	Flight Inspection System for Efficient Procedures Flight Checks
16:00 – 16:30	AD-AFIS New Hardware - New Data Down Link - New AD-CDISP - New AD-VC3 - New Features of AD-RNZ-850
17:00	**Evening Event**

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AeroFIS User Meeting 2013

Wednesday, September 4th, 2013

09:00 – 10:30	**AD-AFIS New Hardware** - New AD-GNSS Receiver - New AD-RIA - New Antenna Relay Box (RR) - Enhanced Autopilot Interface for Pro Line 21 equipped Aircraft - New Becker Intercom - New Printer Box - DME Box Rohde&Schwarz - AD-IGSS
10:30 – 11:00	**Coffee Break**
11:00 – 12:30	**AD-AFIS Software Features** - OSC and SA Settings GUI - GBAS Reports - New Features of the Grafik Editor - New Features of the Program Manager - LDA LLZ
12:30 – 13:30	**Lunch Break**
13:30 – 15:00	AD-AFIS Software Features - New Data Downlink Ground SW - PDGPS Improvements and Evaluation tools - GPS Survey Import to Facility Database - Moving Facility Calibration with FIS Guidance and Autopilot - Russian GUI und Reports - Receiver Calibration Enhancements - "Direct" Procedure
15:00 – 15:30	**Coffee Break**
15:30 – 16:30	Discussion New Features and Functions Answers to questions initiated by customers - LLZ.PO, short introduction and discussion - CPDLC, short introduction and discussion - Camera Installation in the Cockpit with Recording
17:00	**Barbecue**

Training Course 2013

Thursday, September 5th , 2013

09:00 – 10:30	Use of RNAV software in particular the Baro-VNAV functionality (FMu)
10:30 – 11:00	**Coffee Break**
11:00 – 12:30	Practical (Advanced) Usage of the Graphic Editor (SJ) Practical (Advanced) Usage of the Alpha Editor (SJ)
12:30 – 13:30	**Lunch Break**
13:30 – 15:00	Graphic History (SJ)
15:00 – 15:30	**Coffee Break**
15:30 – 17:00	ASCII Export, Demeter Interface (MHf)

附錄二 完訓證明書及訓練課程表

Certificate

Mrs. Cheryl Chang

successfully completed the following training courses:

- VHF- COM, VDF & Radar Inspection
- ASCII Export, Demeter Interface
- Graphic History
- Advanced Usage of the Graphic Editor
- Advanced Usage of the Alpha Editor

Mareile Langhorst
Director Flight Inspection Department
Braunschweig, 05 September 2013

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[precision in special mission]

Aerodata AG ▸ Hermann-Blenk-Straße 34 - 36 ▸ D-38108 Braunschweig
Phone: +49-531-23 59-0 ▸ Fax: +49-531-23 59-158 ▸ e-mail: mail@aerodata.de

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15:00 – 15:30	**Coffee Break**
15:30 – 17:00	ASCII Export, Demeter Interface (MHf)

FIS –Club 2011:
it seems like it was yesterday...

but many things have happened …

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Projects completed since last
AeroFIS® User-Meeting 2011

AeroFIS User Group

Busy times at Aerodata:

Projects completed since last AeroFIS® User-Meeting 2011

- 2011: Delivery of third AeroFIS for UkSATSE
  Client: Ukrainian State Air Traffic Service Enterprise

- 2011: Delivery of the first AeroFIS for flight Calibration in Russia with integration in Super King Air 350i
  Client: LPS, Russia

- 2011: Delivery of the fourth AeroFIS with integration into factory new B200
  Client: DGAC Indonesia

Projects completed since last AeroFIS® User-Meeting 2011

- 2011: Delivery of the fifths AeroFIS with integration into factory new B200
  Client: DGAC Indonesia

- 2011: Delivery of the second AeroFIS for PANSA with integration into LET L410-UVP
  Client: Polish Air Navigation Services, Poland

- 2011 : Delivery of an AeroFIS with integration into a Dassault Falcon 20
  Client: Royal Norwegian Air Force, Norway

- 2012: Delivery of the first AeroFIS including installation in Beech King Air 350i
  Client: AeroPearl, Australia

- 2012: Delivery of an RNAV-FIS with integration into Hawker 900 XP
  Client: DGAC Indonesia

- 2012: Delivery of the second AeroFIS for integration into a Beech King Air B350
  Client: Air Control, Kazakhstan

Projects completed since last AeroFIS® User-Meeting 2011

- 2012: Delivery of the second AeroFIS including installation in Beech Super King Air 350i
  Client: State ATM, Russia

- 2012: Delivery of the third AeroFIS including installation in Beech Super King Air 350i
  Client: State ATM, Russia

- 2012: Delivery of the second AeroFIS including installation in Beech King Air 350i
  Client: AeroPearl, Australia

Projects completed since last AeroFIS® User-Meeting 2011

- 2012: Delivery of complete new Flight Inspection aircraft Super King Air 350iER equipped with AeroFIS for Taiwan
  Client: Civil Aviation Authority Taiwan

- 2013: Delivery of second AeroFIS including installation in Hawker 750 for CASA
  Client: Civil Aviation Safety Authority, South Korea

- Within 2013: Delivery of the third AeroFIS for JASDF for integration into U-125
  Client: Japan Air Self-Defense Force (JASDF)

Projects completed since last AeroFIS® User-Meeting 2011

- Within 2013: Delivery of a complete flight inspection aircraft Super King Air 350i equipped with AeroFIS
  Client: Smart Aviation, Egypt

- Within 2013: Delivery of an AeroFIS including installation in ATR-42
  Client: Silk Way Airlines LLCV, Azerbaijan

- Within 2013: Delivery of complete factory new Multi Role Aircraft (Flight Inspection & Medical Evacuation) B300 Super King Air 350 equipped with AeroFIS.
  Client: Serbia and Montenegro AirTraffic Services Agency

AD-AFIS-112 in King Air 350:

AD-AFIS-270 in King Air 350:

AD-AFIS-280 in King Air 350:

AD-AFIS-060 in Falcon 20:

AD-AFIS-060 in Falcon 20:

AD-AFIS-355 in Hawker 750:

AD-AFIS-130 in L410:

AD-AFIS-130 in L410:

AD-RNAV-FIS in Hawker 900XP:

New AeroFIS Design (AD-AFIS-113/114)

Frank Musmann

New AeroFIS Design AD-AFIS-113/114

These systems shall cover basic, most typical Flight Inspection requirements.

Some additional capabilities are provided as options.

AD-AFIS-113 ➔ For installation on LH Cabin Side
AD-AFIS-114 ➔ For installation on RH Cabin Side

Designed for installation in the following Aircraft:

- Lear-Jet series
- King Air C90, B200, B300,
- Cessna Citation
- Rockell Turbo Commander,
- Pilatus PC-12,
- De Havilland Twin Otter,
- Cessna Caravan;
- Embraer Phenom 300
- and many others…








New "Standard" AFIS:



Standard FI-Capabilities:

2 x VOR/ILS
2 x DME (incl. 2 x 4 channel Scan DME)
2 x MKR (MKR#2 normally not used) — 2 x AD-RNZ850
1 x ADF — Collins ADF-462
1 x VHF-COM — Dittel FSG-90(H) or Becker AR6201

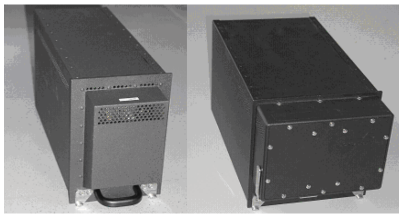
Optional FI-Capabilities:

Transponder (w or w/o ADS-B) — Collins TDR94
UHF-COM — Honeywell KTR909
GNLU (GBAS) — Collins GNLU930
TACAN — Collins TCN500FI
Oscilloscope — TDS3032
Color Printer — AD-HP6940
Data Downlink





New “Standard” AFIS:



Standard Equipment:

Display Computer	AD-CC2-0400
Realtime computer	AD-VC3-0203
19” Display	AD-CDISP-0900
SD-Card Reader	AD-SDCR-0200
Keyboard / Trackball	
Antenna Switching Unit	(AD new Design)
Audio System	Becker ACU-6100, REU 6100

Optional Equipment:

1 x Secondary Display 12” Baytek

New “Standard” AFIS:

Position Reference:

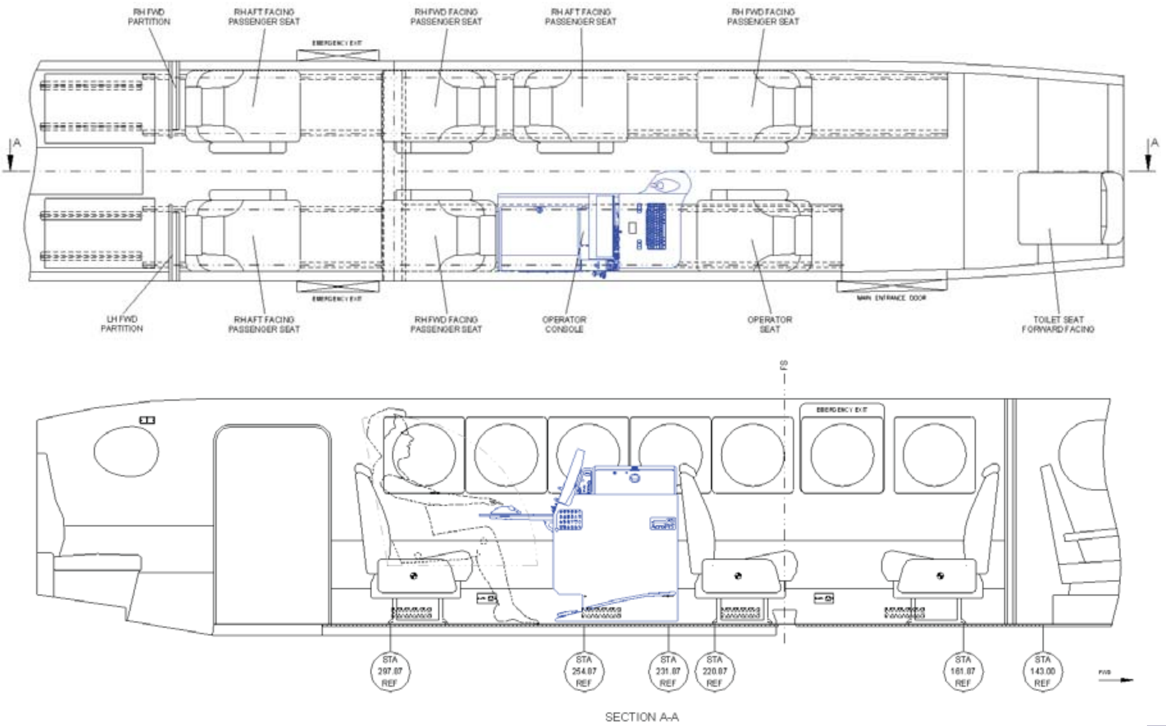
- GPS
- PDGPS
- INS / AHRS
- Air Data Computer (ADC)
- SBAS (EGNOS / WAAS)

Optional Position Reference :

- OmniStar
- GPS RTK
- GPS + GLONASS RTK

provided by AD-GNSS-0100

Typical Cabin Layout:



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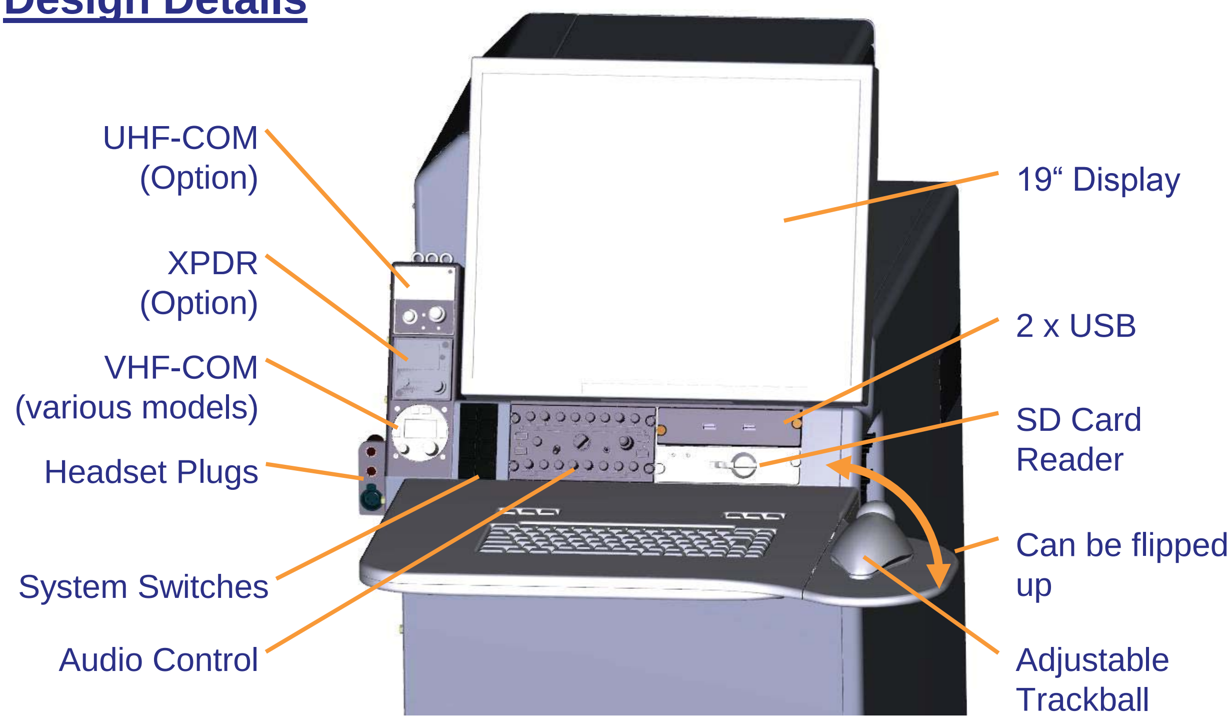

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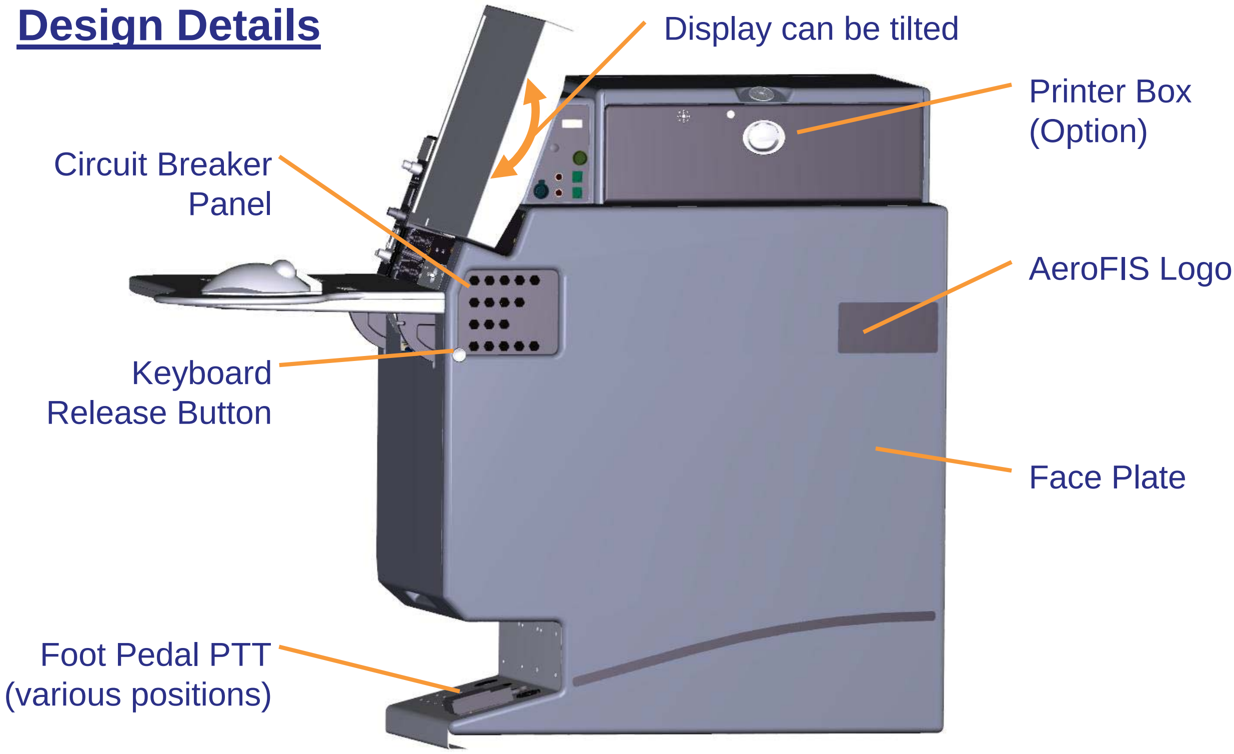

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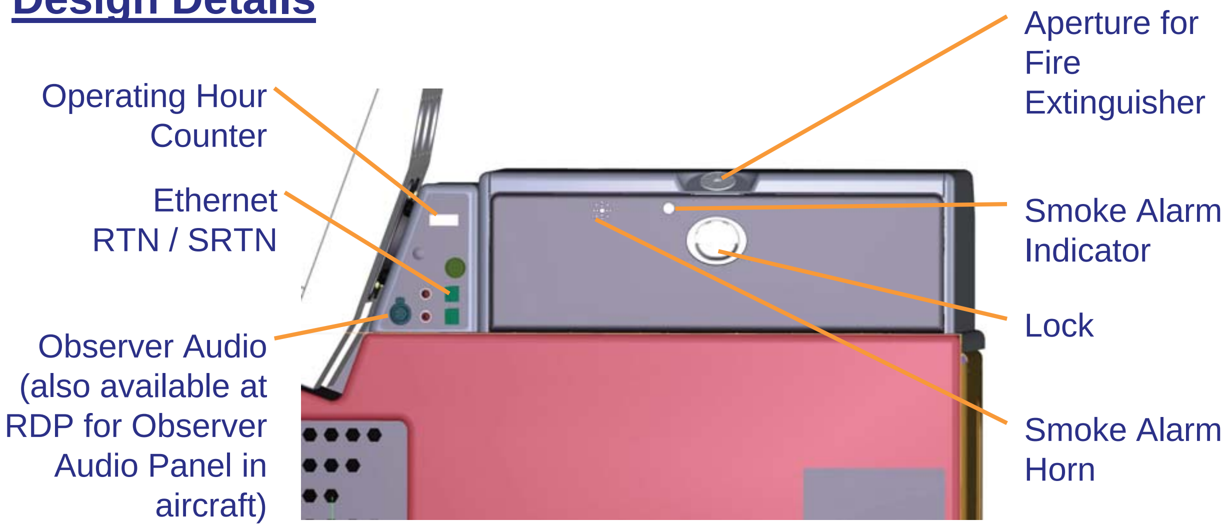

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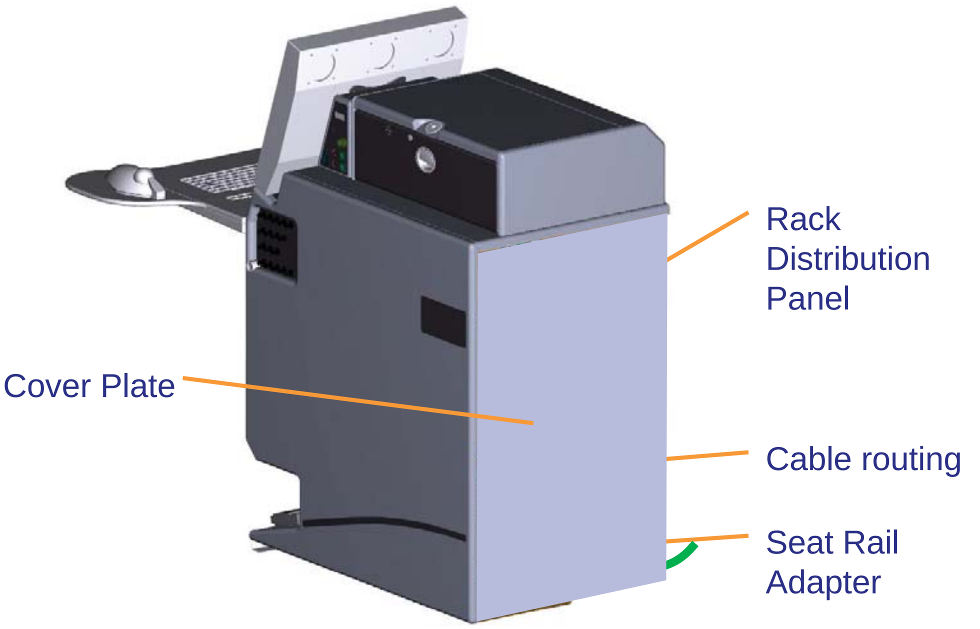

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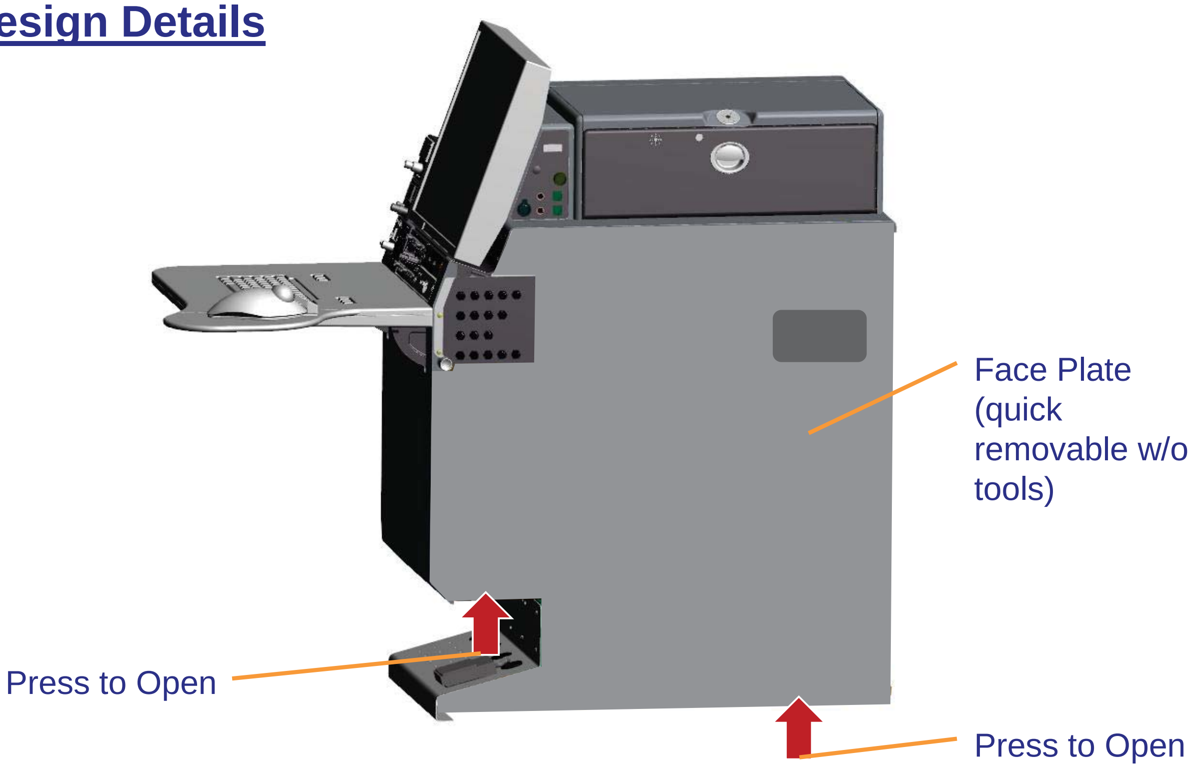

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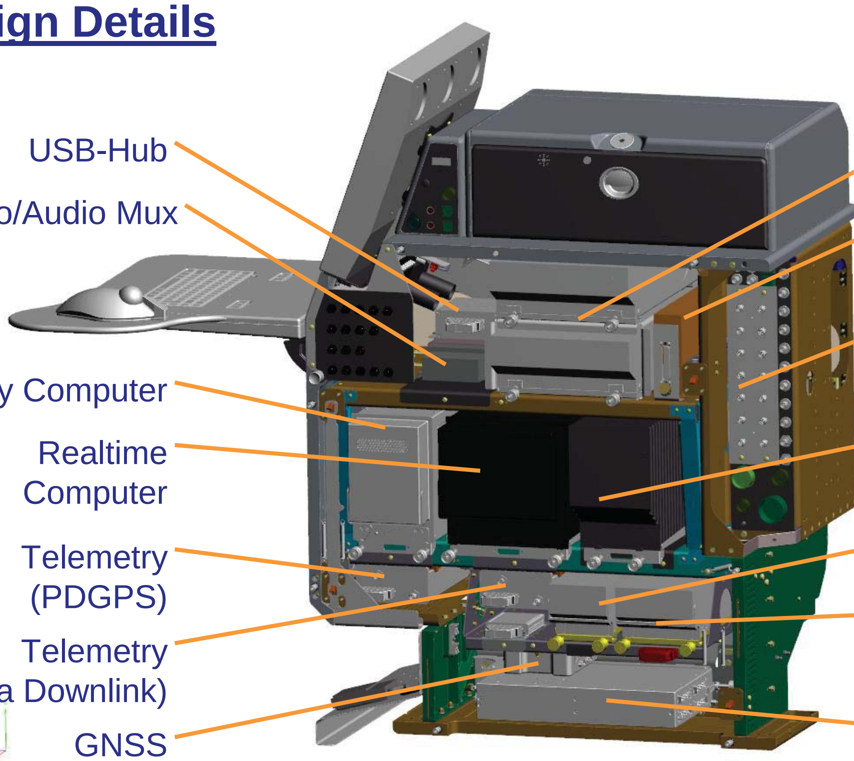

Design Details


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Precision in
Special Mission…

Experiences using the….
Transponder **P**ulse **D**ecoder **S**ystem
… for SSR Flight Inspection

Matthew Bruce

Chief Technical Services Engineer

AeroPearl

Introduction

- SSR Flight Inspection Requirements in Australia
- Pre-TPDS (– 2007)
- TPDS Mk. 1 (2007 – 2012)
- TPDS Mk. 2 (2012 –)
- Use of TPDS for investigations
- Considerations
- Future Development

AeroPearl Flight Inspection Service — SSR Inspection in Australia

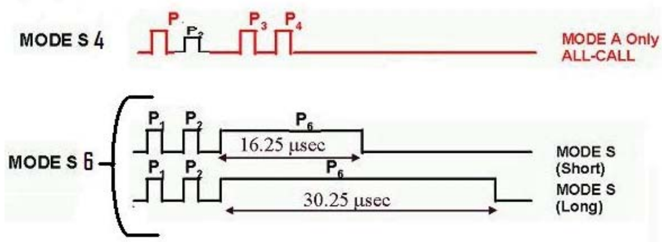
- Standard ICAO requirements on calibrated source
- Standard requirements on truth data
- Additional requirements on measurement of performance of SSR under inspection
  - Signal Level (at antenna socket)
  - Hit Rate
  - "Full Sweep Plot"
    - Shows Main Beam and Side Lobe Suppression pattern throughout rotation
    - Similar to output of RASS test set used by RADAR engineers

AeroPearl Flight Inspection Service — pre-TPDS

- How were these requirements met before the TPDS?
  - Modified Cossor IFF XPDR
  - "Aux Box", a CASA Flying Unit development
    - Took analogue data from the XPDR
      - AGC / Hit Rate for various modes
      - Pre-filtered for mode of interest
    - Sent as analogue data to the FIE
- Design worked well, but had some shortcomings
  - Could only record Signal Level & Hit Rate after pre-selection
    - Source of error
  - Only worked for Modes 1, 2, 3/A, B, C, "P"
  - Analogue design
  - Difficult to maintain, XPDR in particular

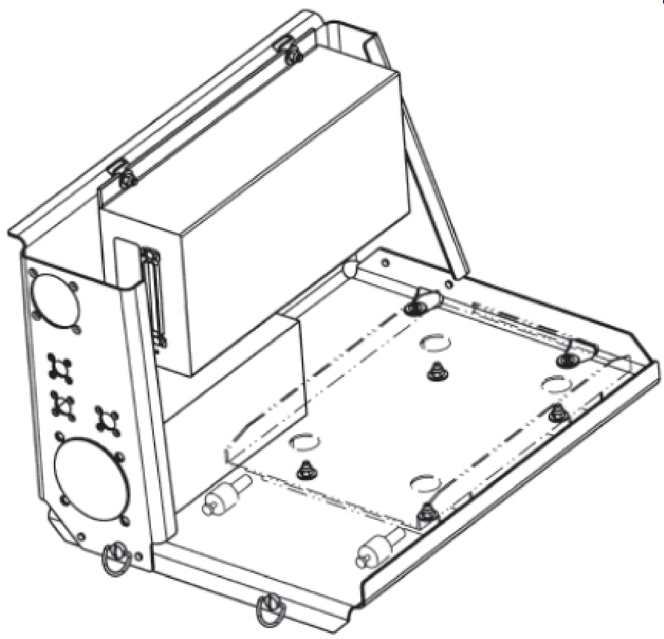
TPDS Mk. 1

- In 2006/7 Australia began to introduce Mode S SSR
  - Existing hardware was not capable of Mode S
    - No way to provide calibrated source
    - No way to measure Signal Level / Hit Rates
- Transponder Pulse Decoder System (TPDS) development began between Airservices / Aerodata / AeroPearl
- Key requirements of new design
  - Digital interfaces
  - Use of standard transponder as calibrated source
  - Mode S Capable



TPDS Mk. 1

- In 2007 the first unit was delivered
  - Filser TRT800 XDPR as 1030MHz Video Source
  - Transponder Pulse Decoder Box for processing of video
  - Raytheon AN/APX-119 XPDR as calibrated source and source of "reply" signal
    - Modes 1, 2, 3/A, C, S
  - Integrated into AD-FIS-8 and later the AD-FIS-8/R



TPDS Mk. 1

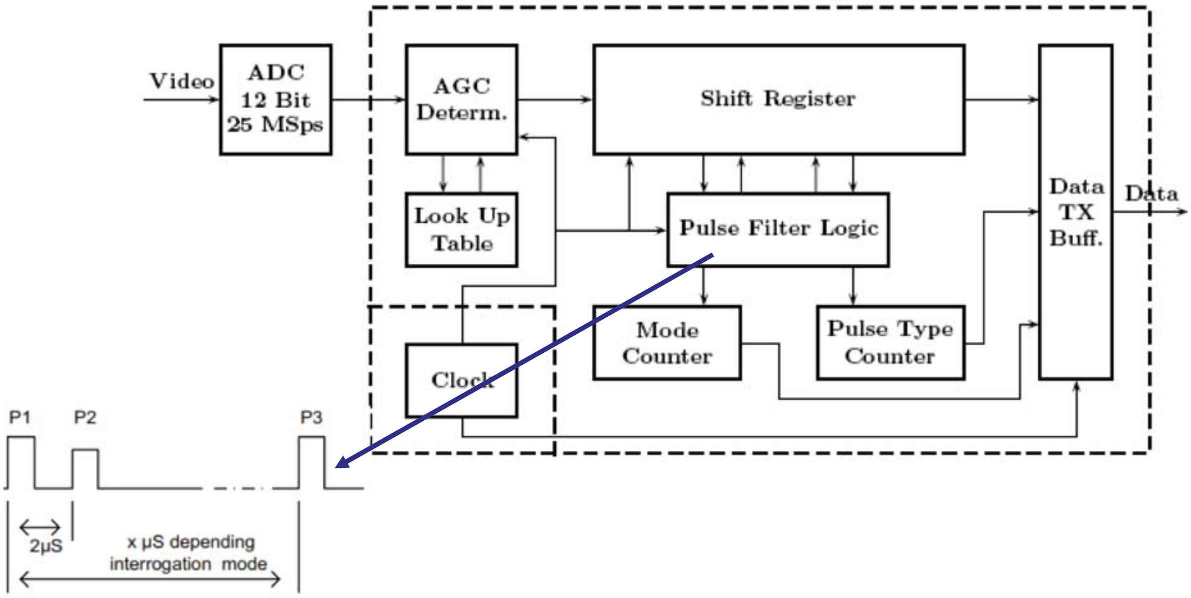
TPDS Mk. 1

- Additional controllers
  - SSR LED Panel

  - XPDR Controller

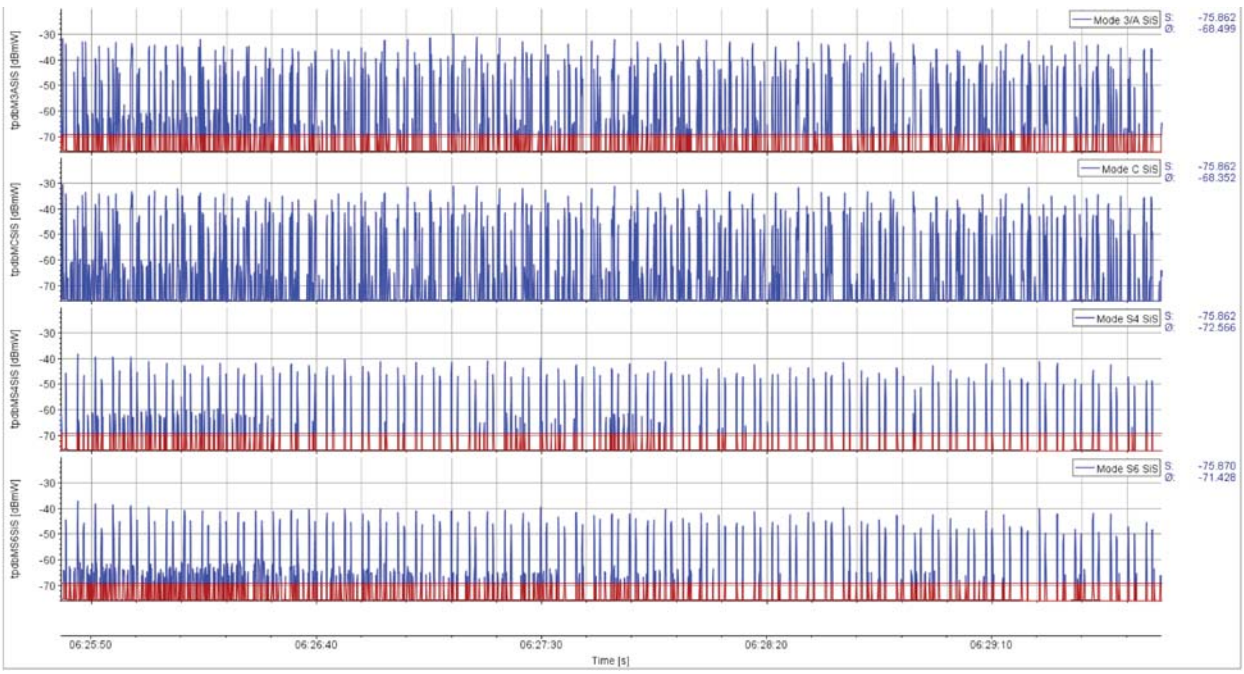
TPDS Mk. 1

- Block Diagram



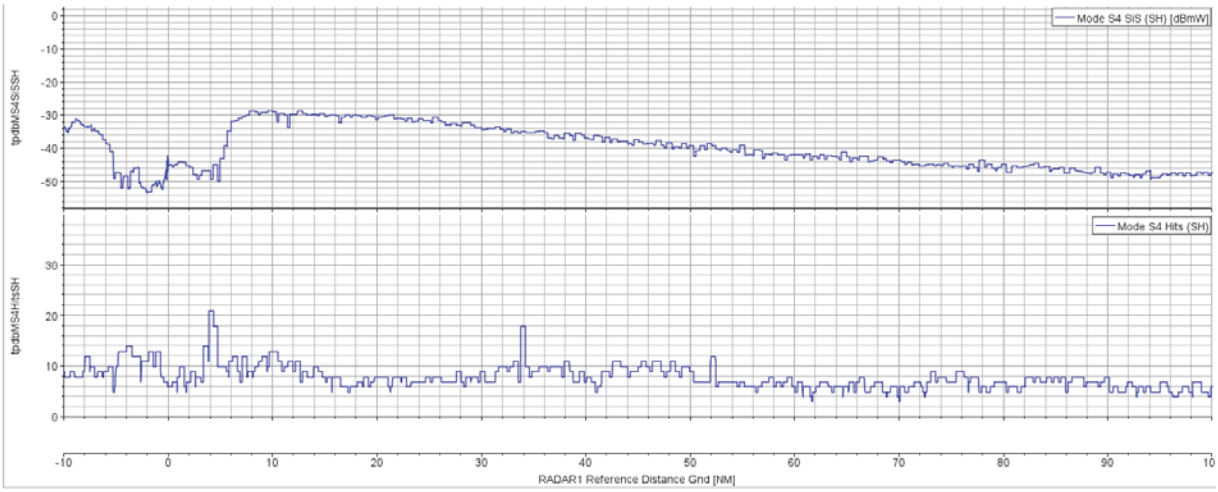
TPDS Mk. 1

- Signal Level & Hit-Rate data for all modes



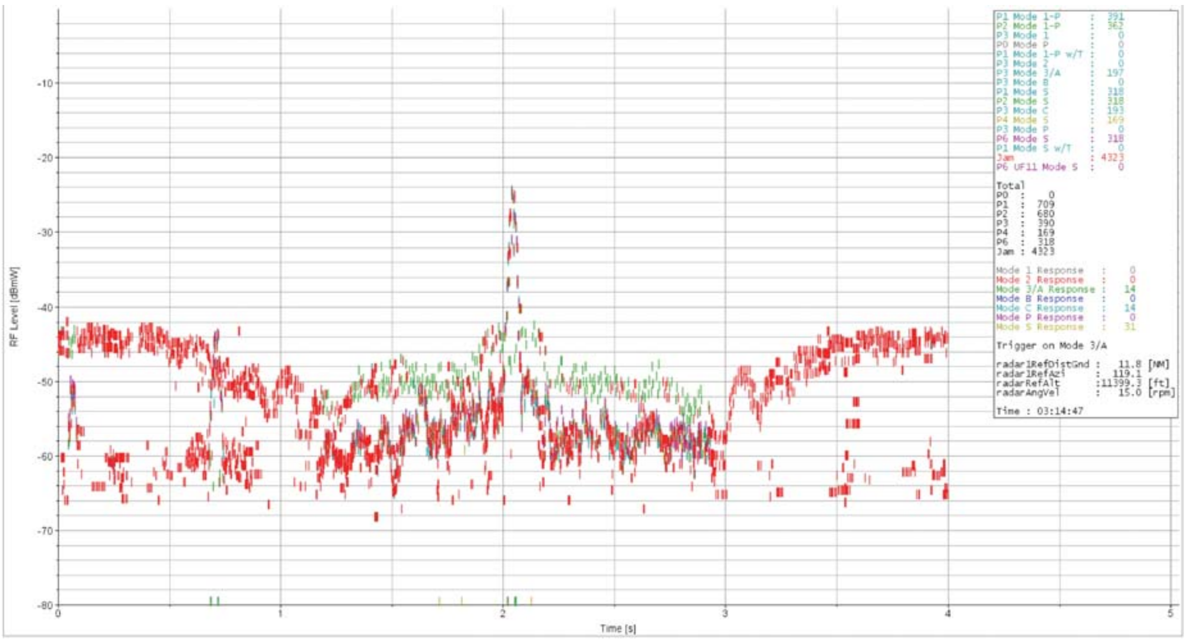
TPDS Mk. 1

- Signal Level & Hit Rate Mode “S4”
  - Experience shows that measured coverage distance and distance where radar identifies aircraft are within 5-10 NM of each other



TPDS Mk. 1

- Impulse Graphic / Full Sweep Plot
  - Triggered off selected mode



AeroPearl Flight Inspection Service

TPDS Mk. 1

- Impulse Graphic / Full Sweep Plot zoomed

AeroPearl Flight Inspection Service

TPDS Mk. 2

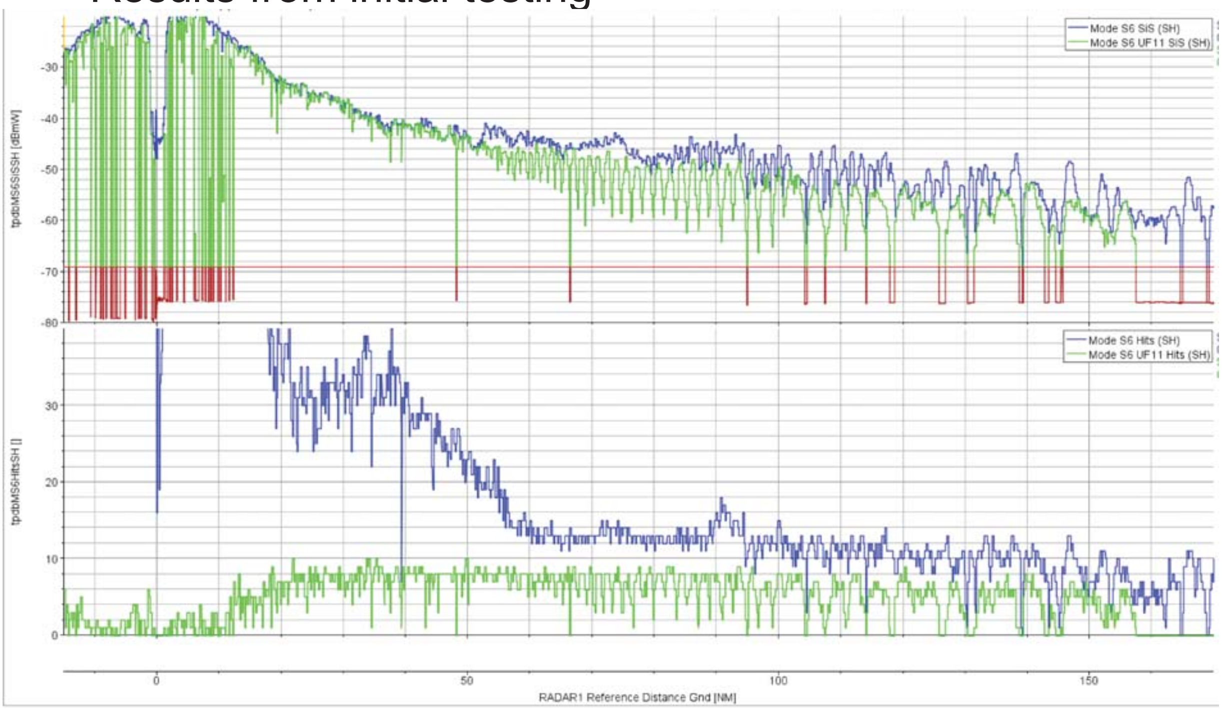
- New contract, new requirements
  - No longer able to set the SSR under test into non-standard modes
    - Philosophical reasons
    - Statistical reasons
  - Requirement to measure only the Mode S radar of interest in a multi Mode S environment
  - Re-Specification with “Lessons Learned” from Mk. 1 development
- Development of TPDS with Mode S/Mode S functionality
  - Use the IC/CL code sent as part of the UF11 “All Call” interrogation to identify the radar of interest
  - F/S and Hit Rate are calculated only for the radar of interest
    - New “Mode S6F” parameter for “Filtered”

TPDS Mk. 2

- Minor hardware adaptations required within TPDS
  - Additional wire to provide demodulated P6 data to TPDB
  - Upgraded TPDB with improved ADC, new firmware
- Interrogations from the radar of interest are filtered from
  - Other Mode S SSR
  - Other Conventional SSR
  - TCAS
  - Active WAM/MLAT systems
- Additional improvements
  - Upgraded ADC gives resolution of 0.3dB
  - More processing power used to introduce parallel processing in pulse recognition module
  - Improved CAPE integration

TPDS Mk. 2

- Results from initial testing

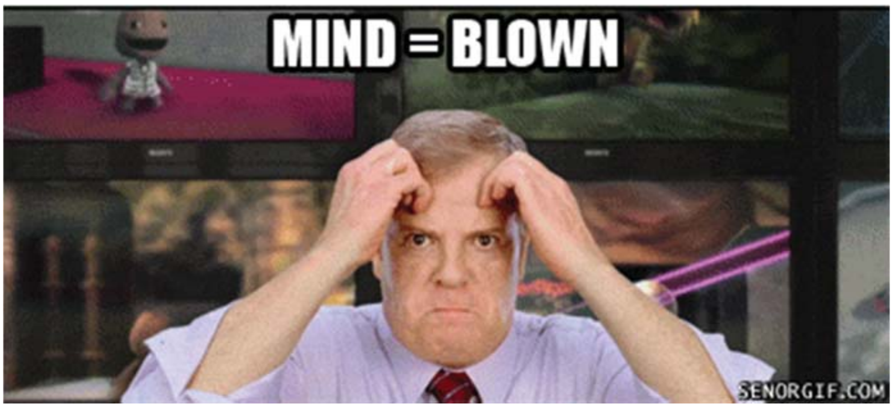


TPDS Mk. 2

- Reactions from initial testing
  - Geoff Robinson, ASA Technical Specialist Flight Inspection

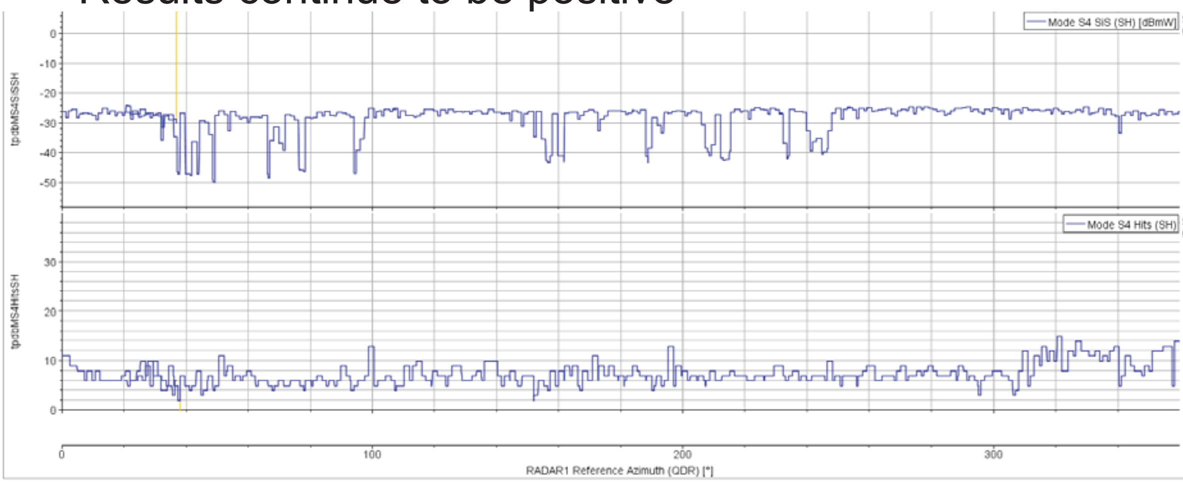
“That’s awesome”

  - Matthew Bruce, CTSE AeroPearl



TPDS Mk. 2

- Has since been used for
  - Mode S Terminal Area Radar Commissioning
  - Mode S Enroute Radar Commissioning
  - Ship SSR Routine Check
- Results continue to be positive



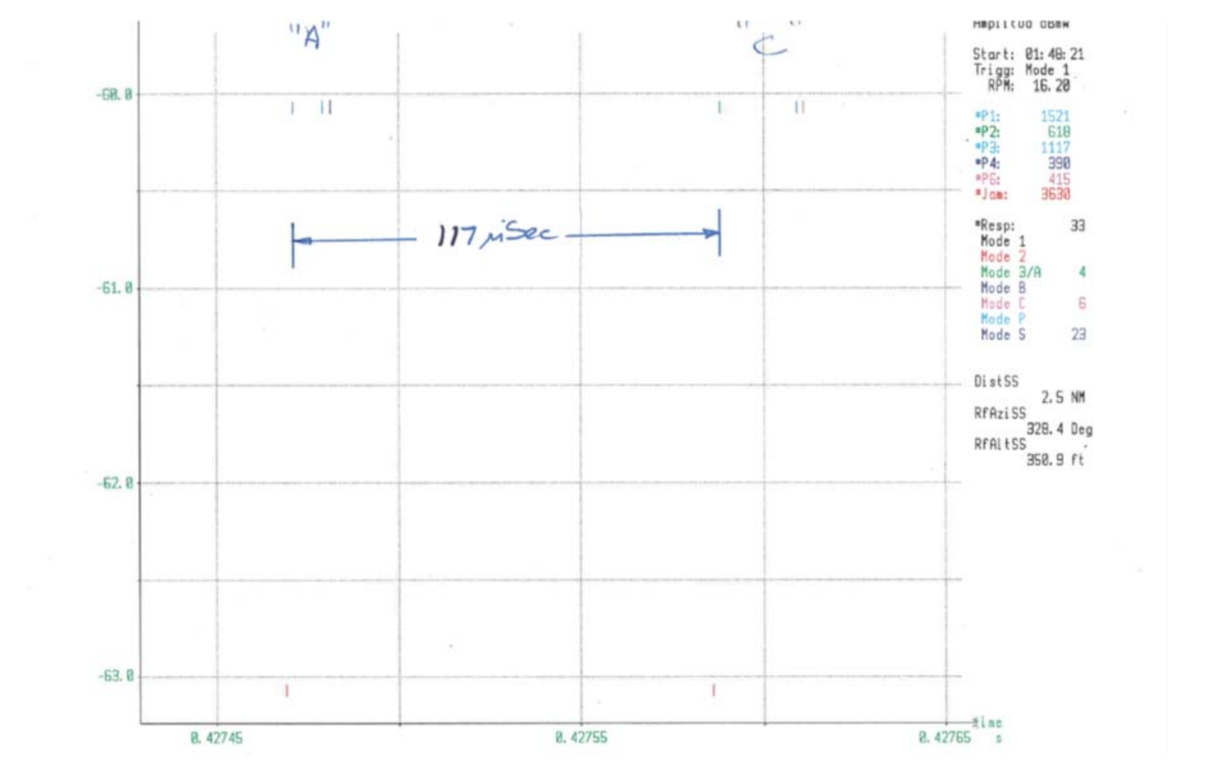
Use of TPDS for investigations

- Real power of the TPDS can only be seen during investigations
  - Signal Level / Hit Rate data
    - Investigation of nulls
    - Areas of interference/multipath
  - Impulse Graphic / Full Sweep Plot
    - Main Beam pattern
    - Side Lobe Suppression pattern
    - Areas of punchthrough/multipath
      - Common source of FRUIT and Ring Around
    - Pulse Spacing
    - Total XPDR load

Use of TPDS for investigations

- Total XPDR load
  - A site at a busy airport
  - Many interrogators
    - 2 Terminal Area SSR
    - 1 Enroute SSR
    - Wide Area Multilateration with active interrogators
    - TCAS equipped aircraft
  - Plan to use WAM to replace for the Parallel Runway Monitor
  - Reports of lost tracks in particular from older aircraft equipped with non-Mode S XPDR

Use of TPDS for investigations

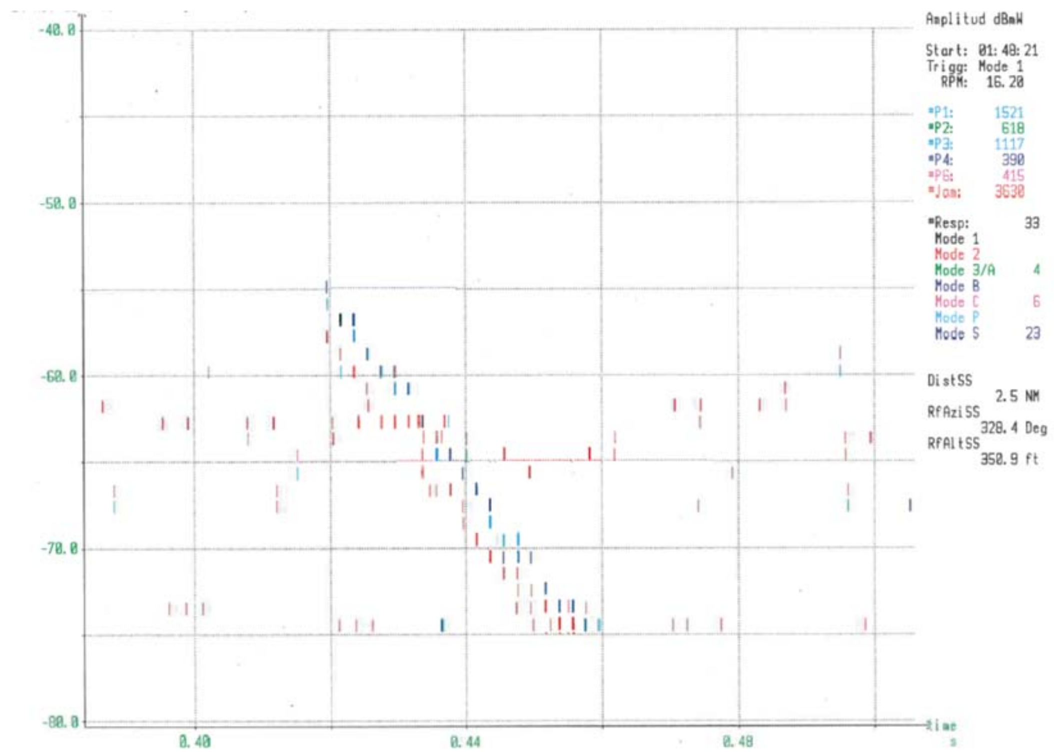


Use of TPDS for investigations

- Could see that time between Mode A and Mode C interrogations was often around 117μs
  - Older XPDR were certified with “dead time” up to 125μs
  - Means that the Mode C interrogation was not “seen” by the XPDR and as such no reply was sent
    - Resulted in WAM processing dropping the track of the aircraft
- Also noticed that the intended “whisper shout” sequence was back to front
  - Sequence used to solicit replies from nearby aircraft before those from further out
  - Simple coding error had inadvertently made a “shout whisper” sequence

AeroPearl Flight Inspection Service

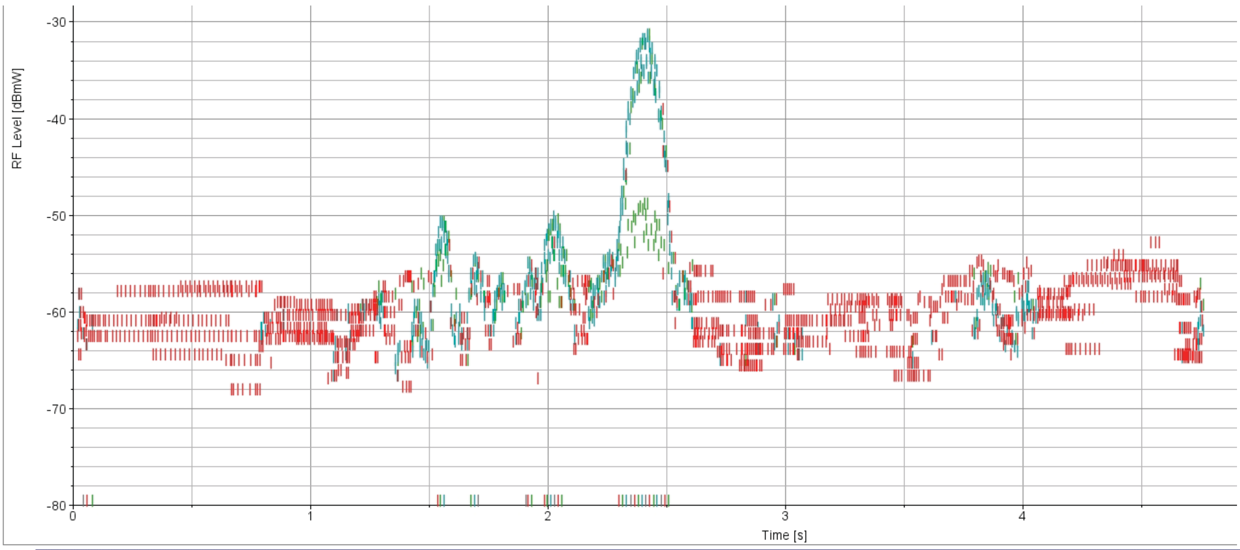
Use of TPDS for investigations



AeroPearl Flight Inspection Service

Use of TPDS for investigations

- Punchthrough seen on ship based SSR
  - Commonly due to superstructure or reflectors such as lightening arrestor rods
  - Leads to False Replies Unsynchronised in Time (FRUIT)

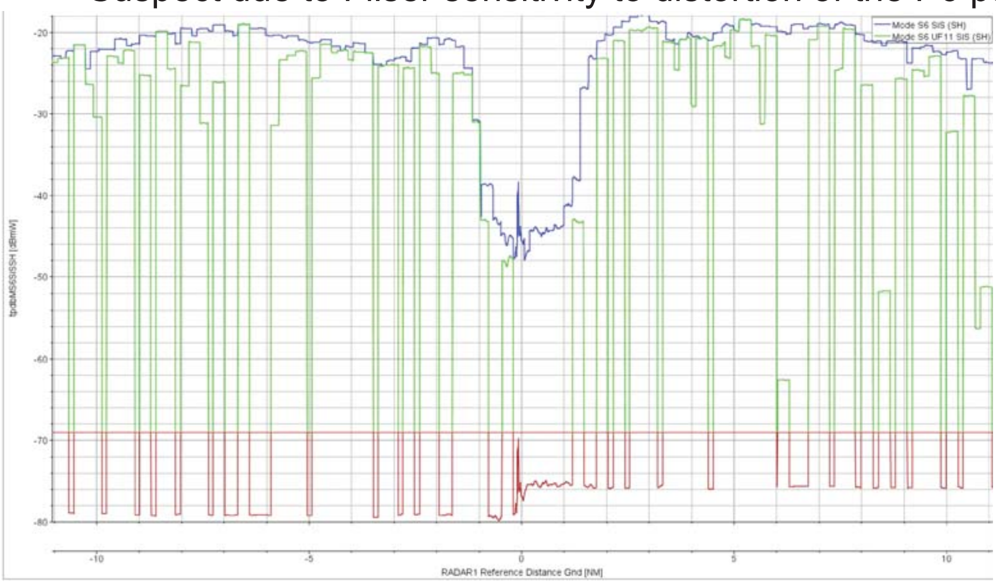


Considerations

- If you plan to use the TPDS consider the following
  - Antenna location
    - Needs to be near the reply transponder otherwise the TPDS is not “seeing” the same SSR environment as the XPDR
    - Filser transponder is easily desensitised by strong VHF transmissions
  - Source of “reply” signal
    - Can use primary transponders but need to ensure that timing is considered

Future Development

- Refining the current hardware/firmware is the goal
- Addressing Mode S6F “dropouts”
    - Suspect due to Filser sensitivity to distortion of the P6 pulse



Future Development

- Mode 1 Performance
  - Filser video output has some filtering effects
  - Pulse spacing for Mode 1 means that often P2 and P3 pulses are merged into one in the video signal
- Sensitivity
  - Currently only have small margin between receiver noise floor and coverage signal level tolerances
- Expected that removal of an external band pass filter may resolve many of the issues
  - Was implemented due to desensitisation effects and suspected DME interference but with AD-AFIS-270 antenna layout this is not as much of a concern
  - Testing with real world signals is pending

Questions

Acknowledgements

- Airservices Australia
  - Use of flight inspection data
  - Providing examples from troubleshooting using TPDS

Flight Calibration Services

Flight Inspection of Helicopter Procedures
- Limitations of Fixed Wing Aircraft -

Markus Schwendener
FCS Flight Calibration Services GmbH
AeroFIS User Meeting 2013

Introduction

Flight Calibration Services

- Background
- Research & Development Issues
- Flight Inspection
- Flight Validation
- Typical Helicopter Procedures
- Helicopter versus Fixed Wing Aircraft
- Feasibility Study
- Current Status

Courtesy REGA

Background

- Increasing demand for Special Helicopter Procedures, mainly in Switzerland due to the special topography
- HEMS Operator (Helicopter Emergency Medical Services)
- Air Force as Helicopter Operator
- 600 emergency missions per year cancelled due to weather by the major Swiss HEMS operator
- Cloud breaking for helicopters (in climb only) is in Switzerland since several decades allowed:
  - Minimum equipment for the helicopter is required
  - Procedure must be approved by FOCA (Federal Office for Civil Aviation)
- Increasing HEMS flights between hospitals

Cloud Breaking

Cloud Breaking

Flight Calibration Services

ABFLÜGE VON HELIKOPTERN UND BALLONEN BEI BODEN- ODER HOCHNEBEL

Sind die Mindestwerte für Abflüge nach Sichtflugregeln wegen Boden- oder Hochnebel nicht erfüllt, so ist der Abflug gestattet, wenn:

a. die Untergrenze der Nebelschicht nicht höher als 200 m über dem Startplatz liegt und die Schicht selbst nicht dicker als 300 m ist;

b. über der Nebelschicht Sichtwetterbedingungen herrschen und

c. der Abflug nach dem vom Bundesamt festgelegten Verfahren erfolgt.

DÉCOLLAGES D'HÉLICOPTÈRES ET DE BALLONS EN PRÉSENCE DE BROUILLARD OU D'UN STATUS ÉLEVÉ

Si les valeurs minimales pour les décollages selon les règles de vol à vue ne sont pas atteintes en raison du brouillard ou d'une couche de status élevé, le décollage est alors autorisé si:

a. la limite inférieure de la couche de brouillard ne se trouve pas à plus de 200 m au-dessus de l'endroit de décollage et la couche elle-même ne fait pas plus de 300 m d'épaisseur;

b. des conditions météorologiques de vol à vue règnent au-dessus de la couche de brouillard et

c. le décollage est effectué conformément à la procédure fixée par l'Office fédéral.

Technische Mitteilung

WEISUNG

Über die Mindestanforderungen für die Zulassung von Helikoptern für Abflüge bei Boden- oder Hochnebel

Das Bundesamt für Zivilluftfahrt,

gestützt auf Artikel 15 des Bundesgesetzes vom 21. Dezember 1948 über die Luftfahrt (SR 748.0) sowie Artikel 8, 9, 16 und 17 der Verordnung über die Zulassung und den Unterhalt von Luftfahrzeugen (VZU) vom 8. Juli 1985 (SR 748.215.1),

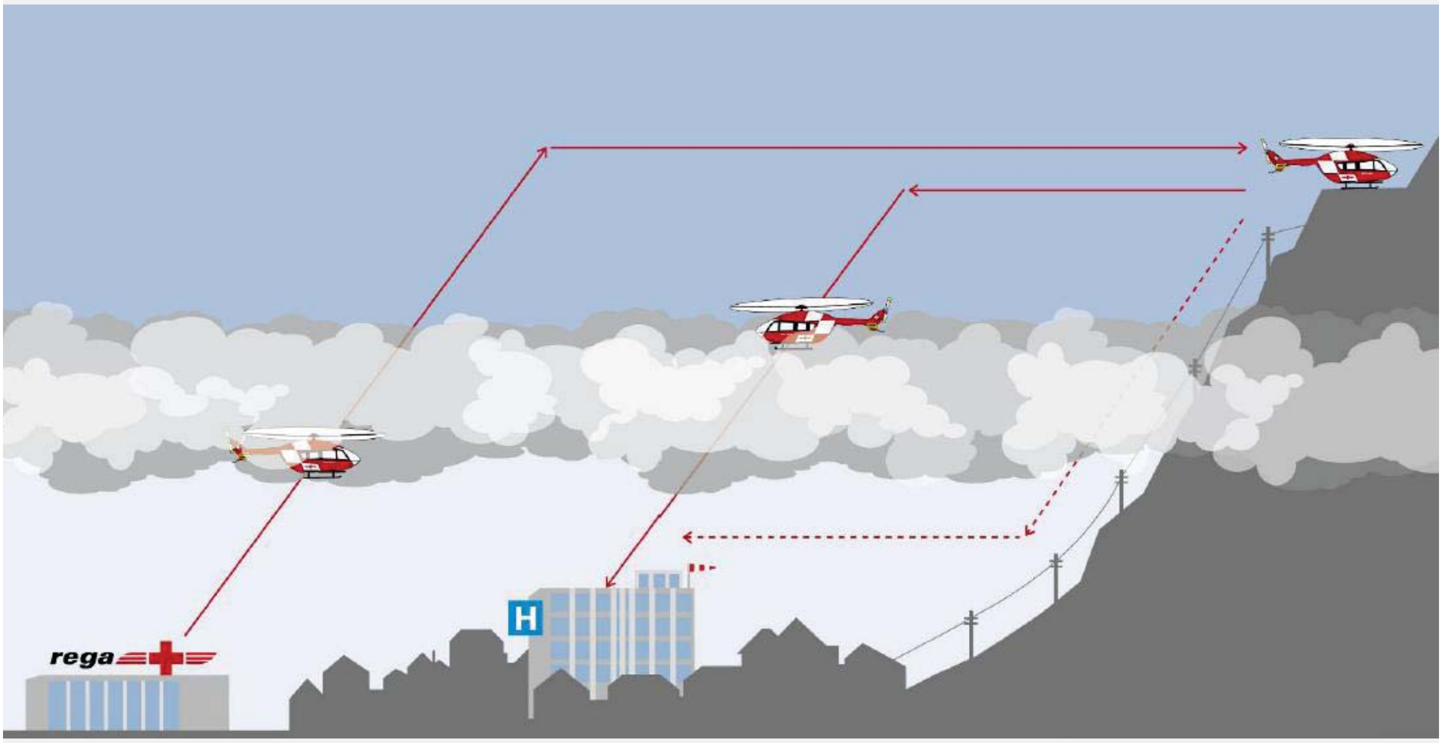
verfügt :

1. ALLGEMEINES

1.1 Für Abflüge bei Boden- oder Hochnebel werden nur ein- oder mehrmotorige Helikopter mit Turbinentriebwerken zugelassen, welche bei diesem Einsatz in der Lage sind, eine kontinuierliche Steiggeschwindigkeit von 1000 ft/min

Cloud Breaking

Flight Calibration Services



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Planned PinS (Point in Space)

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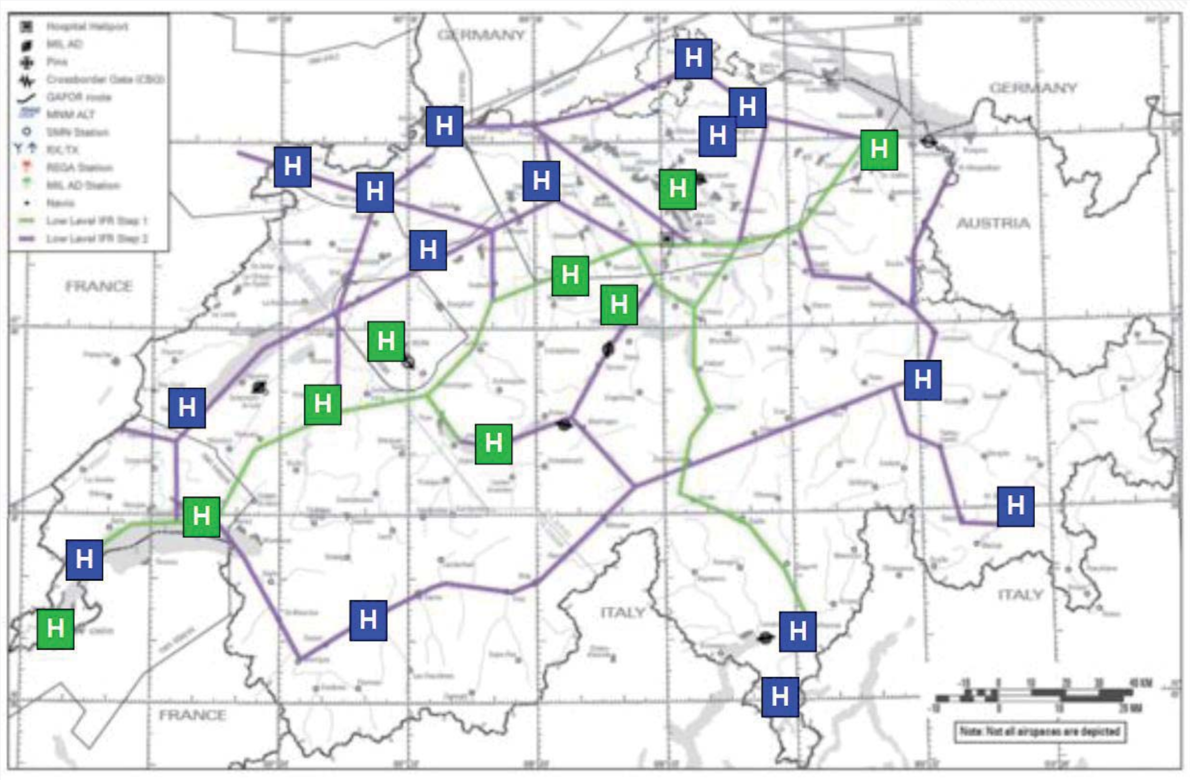

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Background

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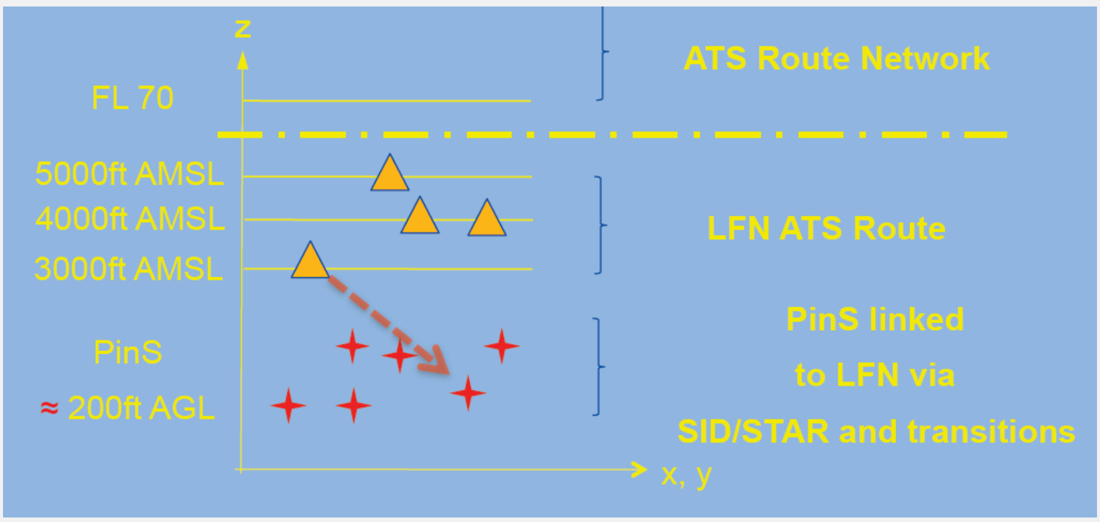
- ❑ **PinS (Point in Space)**
  HAF (Helicopter Approach in Fog)
- ❑ **Linked via a Low Level IFR Network**



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Research & Development

- CHIPS

  the CH (Swiss) wide Implementation Program of SESAR related Activities

  - SESAR: Single European Sky ATM Research Programme

  - 35 Projects on Satellite based Procedures

  - 20 Topics in R&D

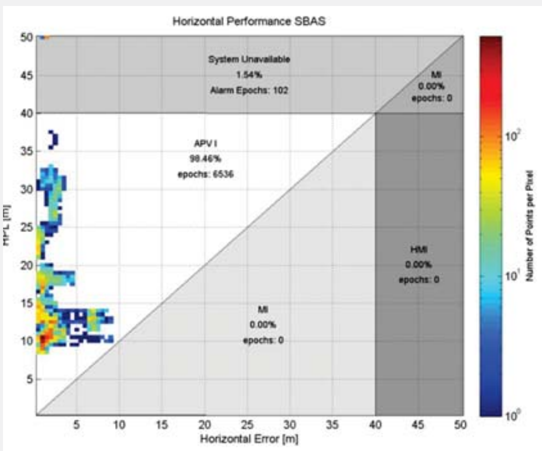
- E.g. Helicopter Recording Random Flights

  - HEMS Operator and Swiss Air Force
  - more than 30 helicopters equipped with quick access recorders

Flight Inspection

- Requirements (ICAO and National)
  - Flight inspection an all approaches required prior operational use
  - Flight inspection limited to commissioning and special inspections

- Examples
  - GNSS interference
  - EGNOS analysis (e.g. Stanford Plots)
  - VHF/UHF communication coverage



- Most of the planned helicopter procedures do not end at an airport and the routes are mainly in valleys
  - Communication with ATC could be critical

Flight Validation

- All helicopter procedures have to be flight validated

- IFR certified helicopter required
  Typically a light/medium twin engine helicopter
  - Agusta A109
  - Eurocopter EC135
  - Eurocopter EC 145

- Helicopter qualified
  Flight Validation Pilot required

- Flight validation may be
  combined with flight inspection

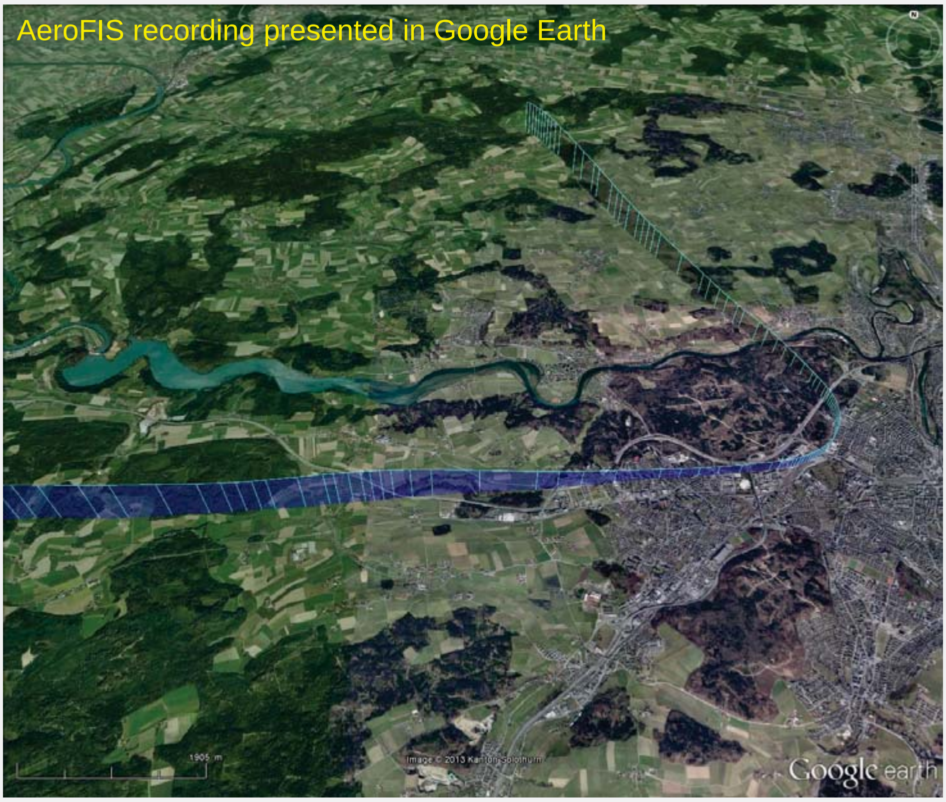
Courtesy REGA

Flight Inspection Inselspital Bern

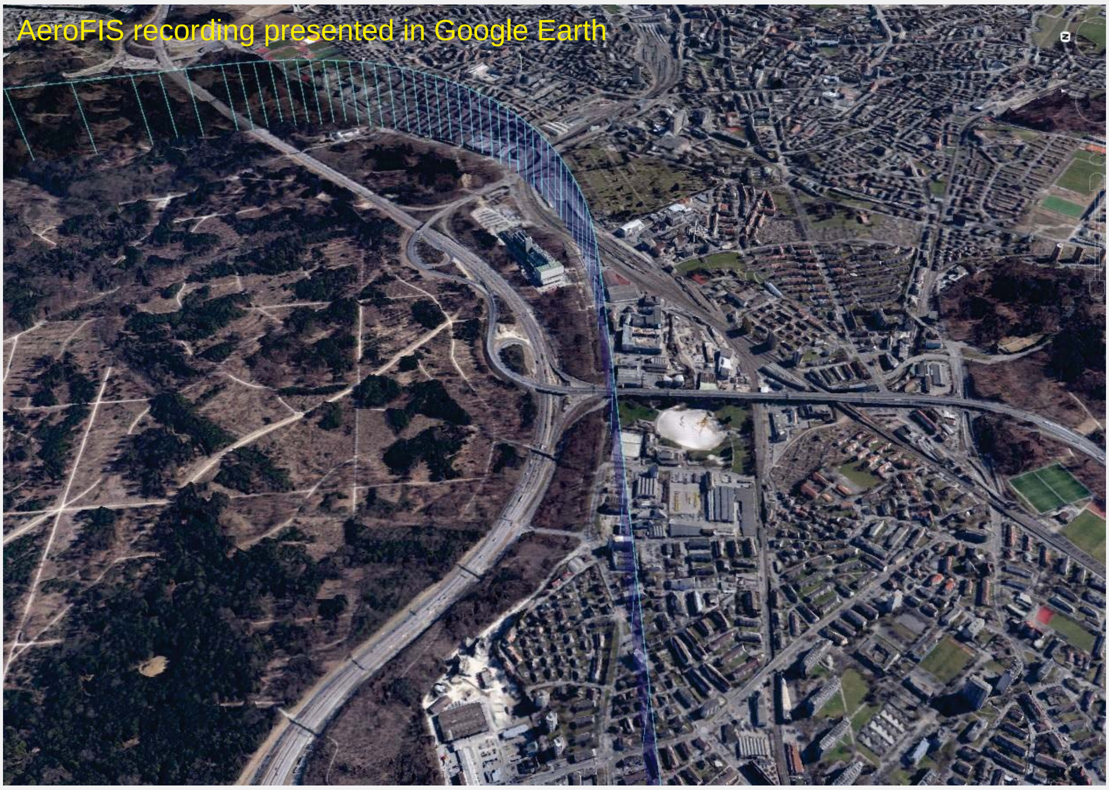
- Minimum Descent Height
  450ft

- Distances
  IAF to IF: 3NM
  IF to FAP: 3NM
  FAP to MAPt: 3,2NM

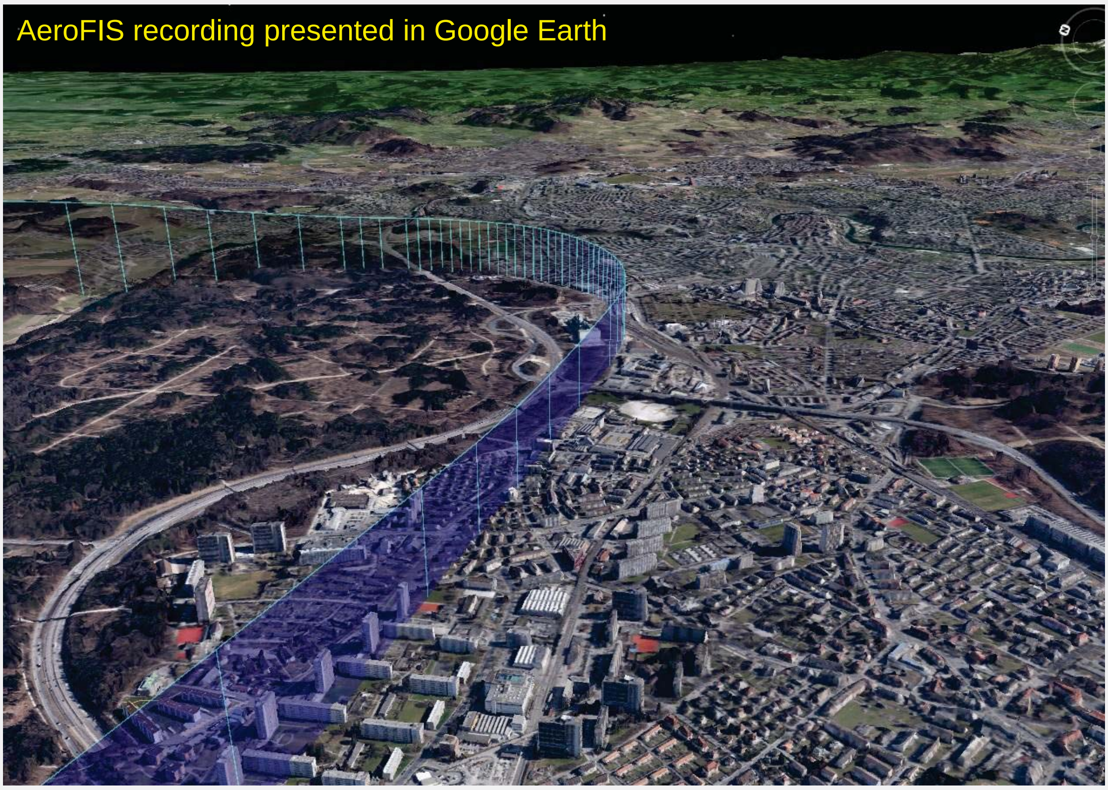
Flight Inspection Inselspital Bern



Flight Inspection Inselspital Bern



Flight Inspection Inselspital Bern



Flight Inspection Inselspital Bern

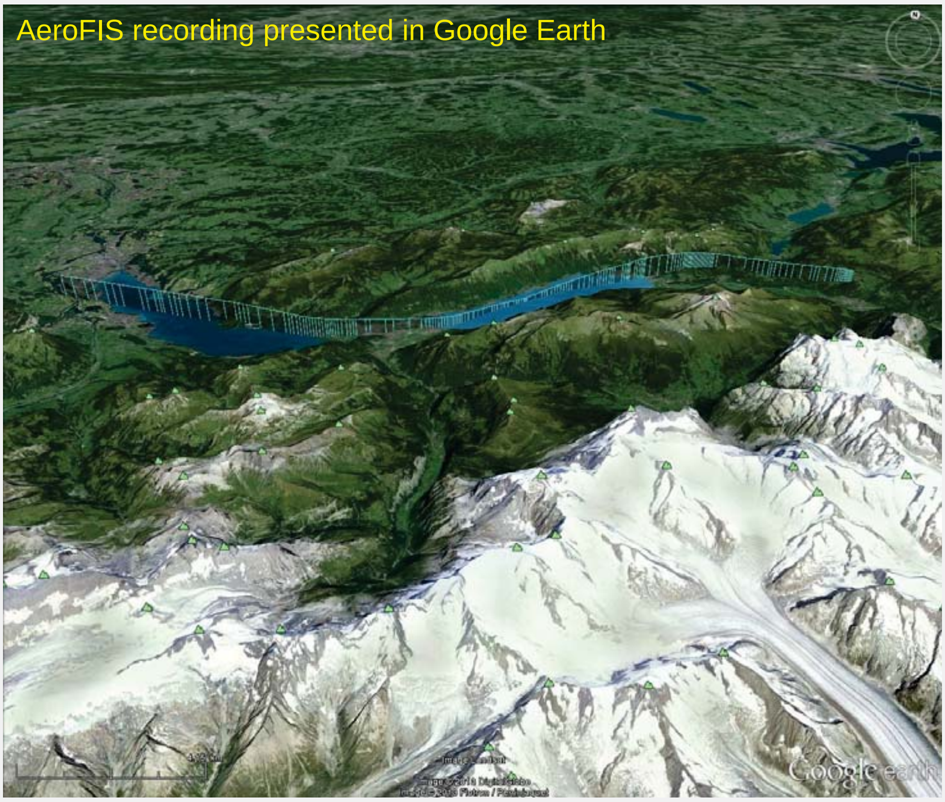
		Beech B300	Agusta AW109SP
Intercept	IFR	Critical	Possible
Approach Angle	4,7°	OK	OK
Environment	Dense population	Not acceptable	Acceptable
Flight Validation		Not possible	Possible

- **T-Procedure divided in two legs**
  - 1st leg: Southern IAF – IF – Northern IAF
  - 2nd leg: IF – FAP – MAPt – MA
- **General public was advised prior the Beech inspection flights by media (newspaper, radio and TV)**
- **Several noise complaints**

Flight Inspection HAF Meiringen

- Procedure modified due to COM coverage issues

Flight Inspection HAF Meiringen



Flight Inspection HAF Meiringen

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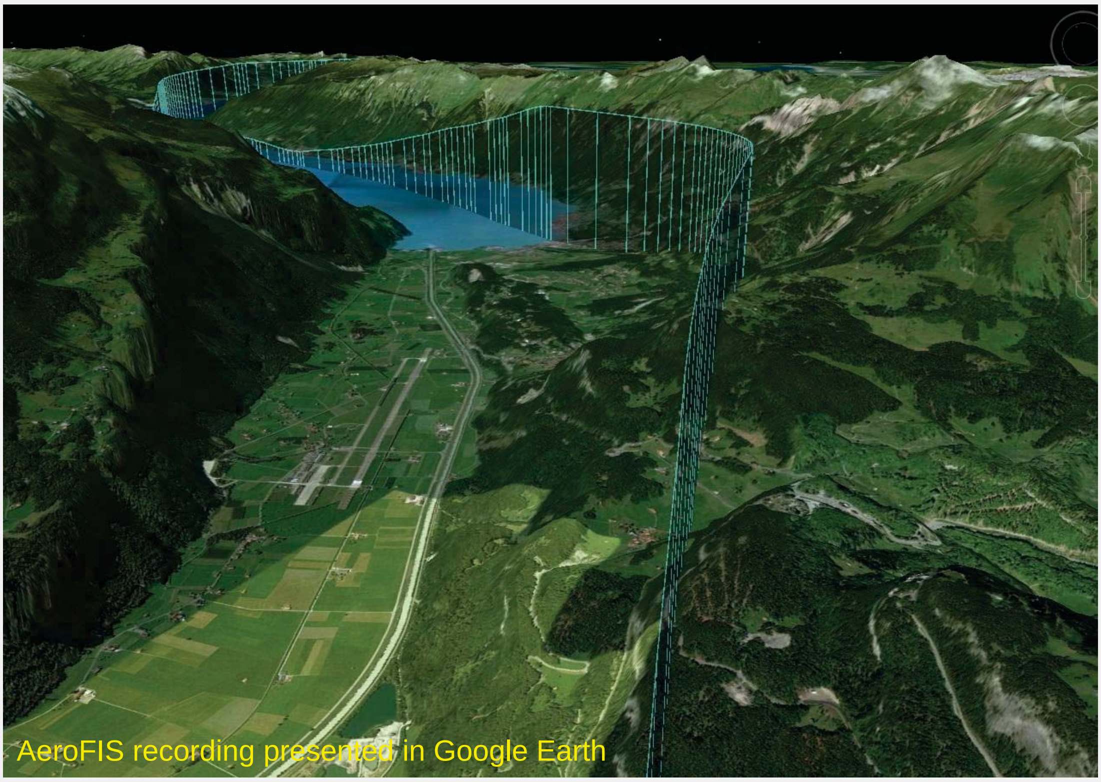

Flight Inspection HAF Meiringen

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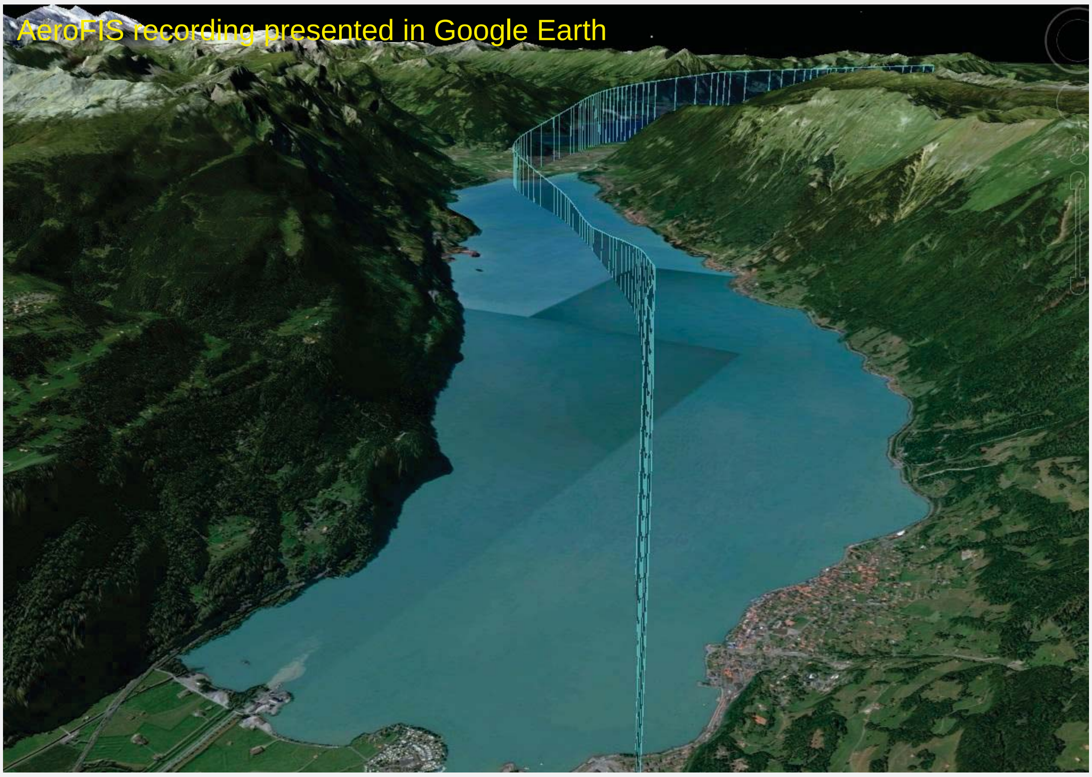

Flight Inspection HAF Meiringen

		Beech B300	Agusta AW109SP
Intercept	VFR	Critical	Possible
Approach Angle	8,3°	Not Possible	OK
Environment	Lake	Acceptable	Acceptable
Flight Validation		Not possible	Possible

- **Line Up for intercept is critical due to required turns in the valley**
- **Stable descent on 8,3° is difficult**
- **Communication coverage critical (missed approach)**

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Flight Inspection HAF Alpnach

- **Minimum Descent Height**
  960ft
- **Communication**
  2 UHF stations
  1 VHF station

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Flight Inspection HAF Alpnach

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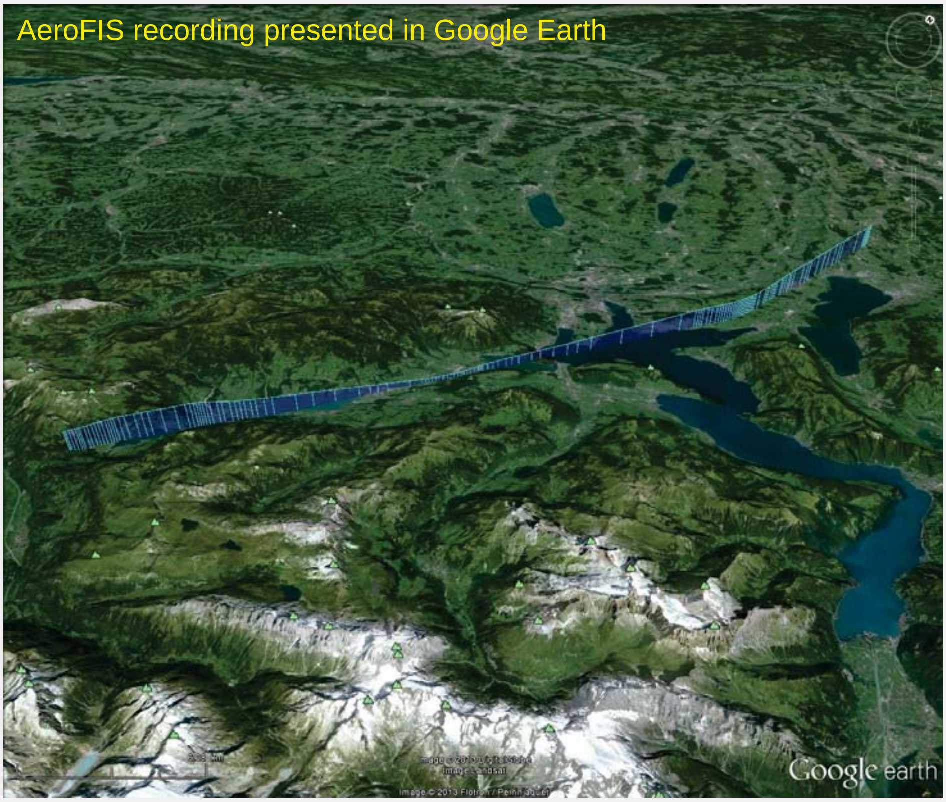
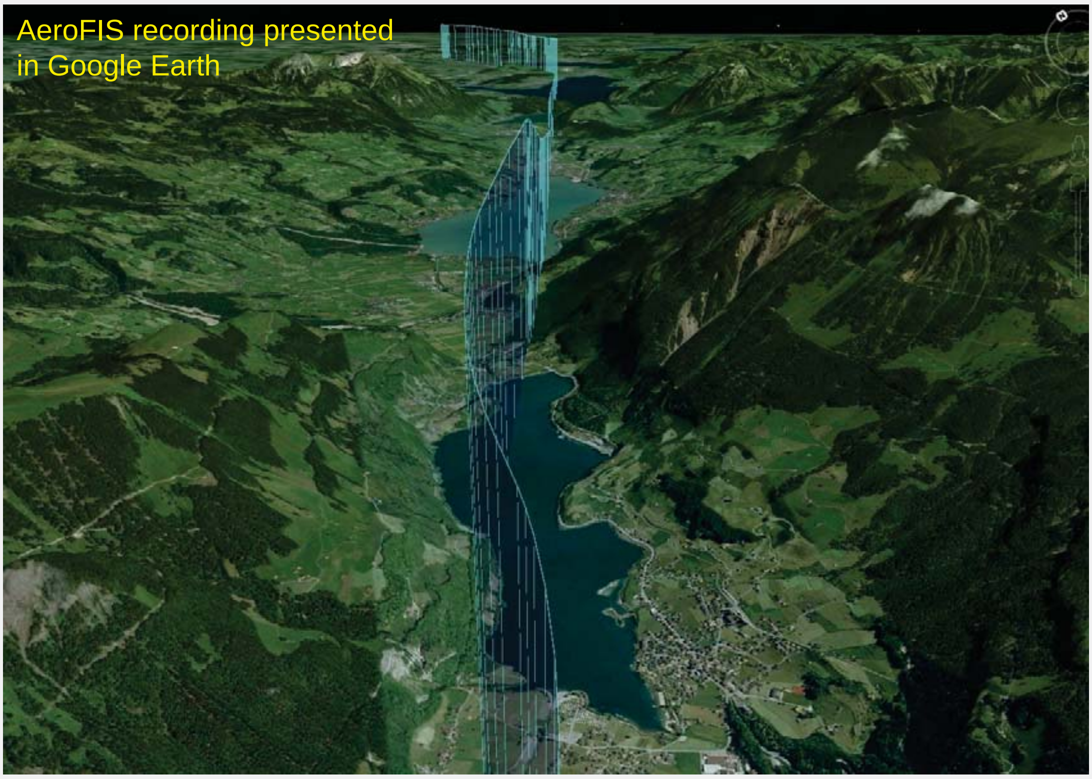
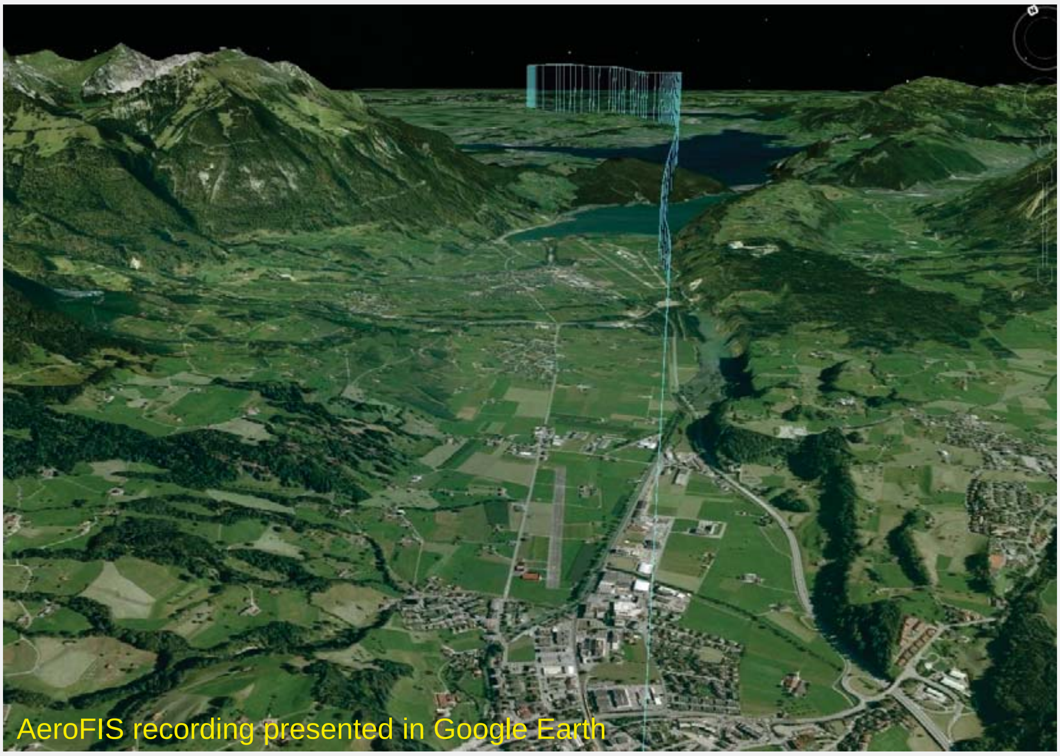


Flight Inspection HAF Alpnach

Flight Calibration Services



Flight Inspection HAF Alpnach



Flight Inspection HAF Alpnach

		Beech B300	Agusta AW109SP
Intercept	VFR	Critical	Possible
Approach Angle	7°	Not Possible	OK
Environment	Populated	Acceptable	Acceptable
Flight Validation		Not possible	Possible

- **Line Up for intercept is critical due to required turns in the valley**
- **Max. approach angle B300 6,65°**
- **Communication complex (frequency changes)**

Comparison B300 versus AW109SP

	Beech B300	Agusta AW109SP
Maximum approach angle	6,65°	9°
Approach speed	Approx. 220…120kts	55…30kts
Radius to Fix	Approx. 1,5NM (9000ft)	800ft (1500ft missed appr.)
Purchase price	Approx. 7’000’000$	Approx. 9’000’000$
Operating costs	Approx. 65$/min.	Approx. 85$/min.

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Experience with FI of Helicopter Procedures

- **Flight inspection of helicopter procedures with a B300 is critical and limited to single procedures with workarounds**
- **The flight inspection of approx. 30 helicopter procedures to hospitals located in regions with dense population and with high approach angles is not possible**
- **Flight inspection cannot be combined with flight validation**
- **Procedure flight inspection is normally limited to commissioning and the amount of helicopter procedures is limited**
- **Operating an own helicopter for flight inspection and validation is not cost effective**
- **FCS finally launched a feasibility study for a helicopter flight inspection system**

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Helicopter Flight Inspection System

Required Capabilities of the Helicopter FIS

- GNSS interference
- EGNOS with NSE (national requirement)
  requires PFIS or LASER
- VHF COM coverage
- UHF COM coverage
- Temporarily installed in a twin-engine IFR helicopter
  to combine flight inspection with flight validation and
  to reduce finally the environmental impact and the costs
- Airworthiness certification required (no loose equipment)

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Feasibility Study

- FCS Flight Calibration Services GmbH
  - Main flight inspection and flight validation provider for Switzerland
- REGA
  - Main HEMS Operator in Switzerland with 17 helicopters
  - Non government / non profit organization
  - Certified for flight validation of helicopter procedures
  - Owner of most helicopter procedures in Switzerland
- Aerodata
  - Major FIS manufacturer, EASA Design Organization
- CHIPS
  the CH (Swiss) wide Implementation Program of SESAR related Activities
  - Skyguide (Swiss ANSP), Swiss Air Force, FOCA, …

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Helicopter FIS

To reduce FIS certification issues and finally costs, the Helicopter FIS should base on the existing AeroFIS

- Same hardware components (without NAV, TAC, etc.)
- Same software, configured with special configuration files
- Reliable FIS sensors and software
- No major special procedures and training required for flight inspectors
- Same flight inspection reports
- Flight inspections and flight validation is planned on a long-term base

Helicopter

- Twin engine helicopter
  - Approaches over regions with dense population
- IFR certified
  - Combination of flight inspection with flight validation
- Interface Power Supply
  - Load shedding
- Antenna Interface
  - L1/L2 GNSS Antenna
  - VHF/UHF Antenna
- Space for a FIS Installation
  - Quick Installation/Removal

Helicopter

Courtesy REGA

Helicopter

Courtesy REGA

Helicopter

Flight Calibration Services





Courtesy Aerodata

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Helicopter & FIS

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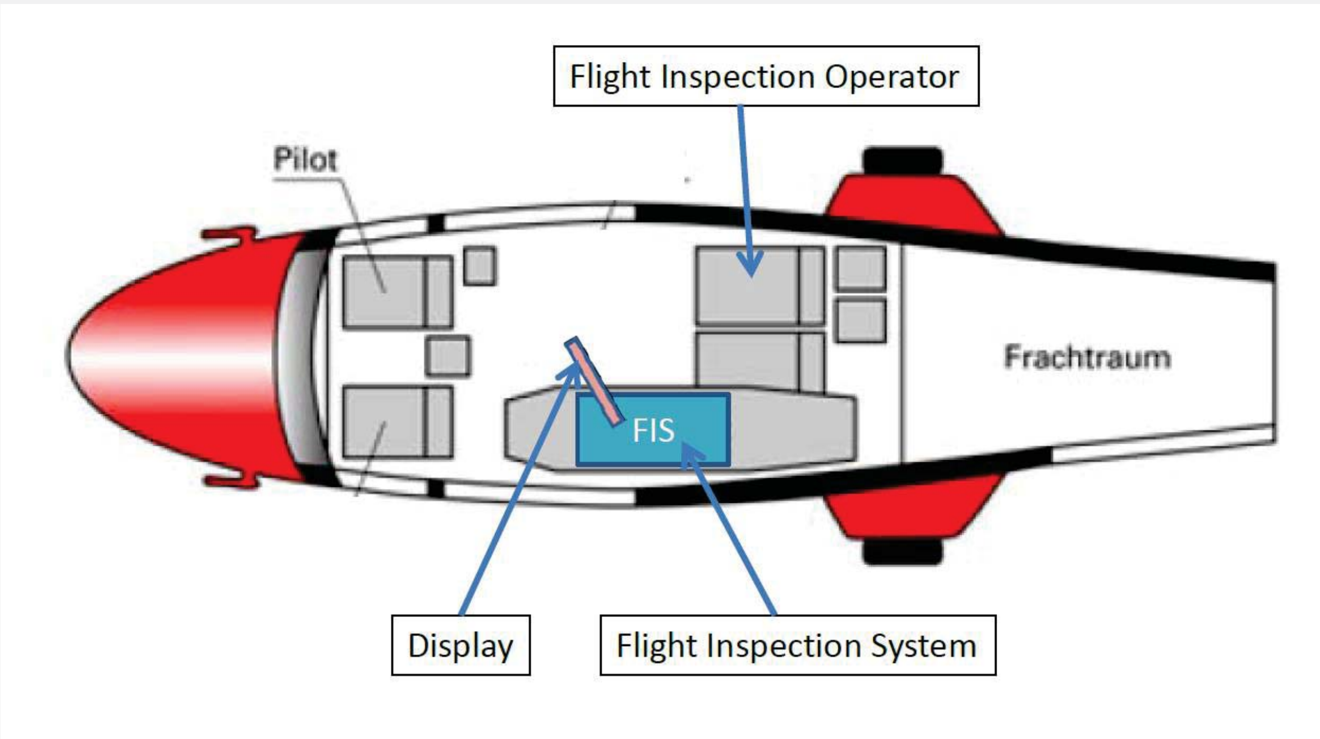

Courtesy Aerodata

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Helicopter FIS

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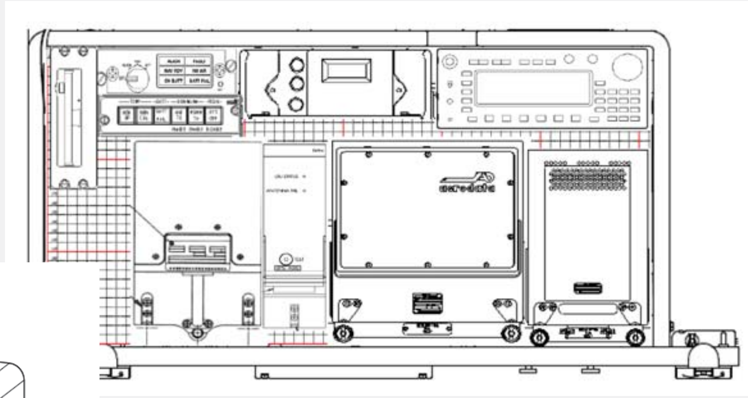
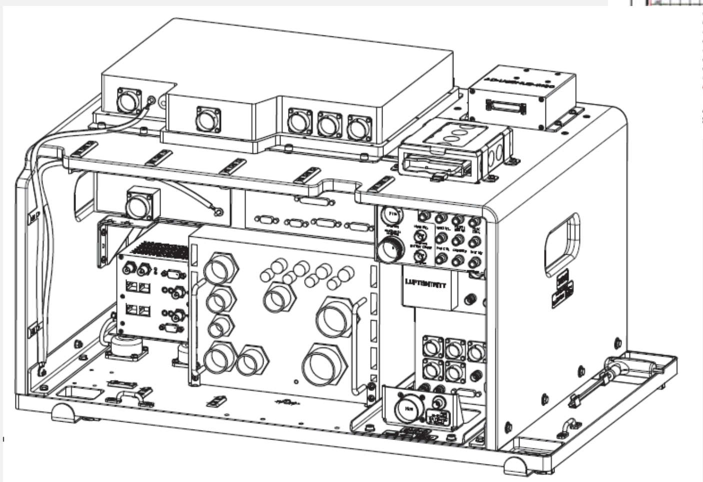
Possible Layout



Existing Equipmentholder from Aerodata

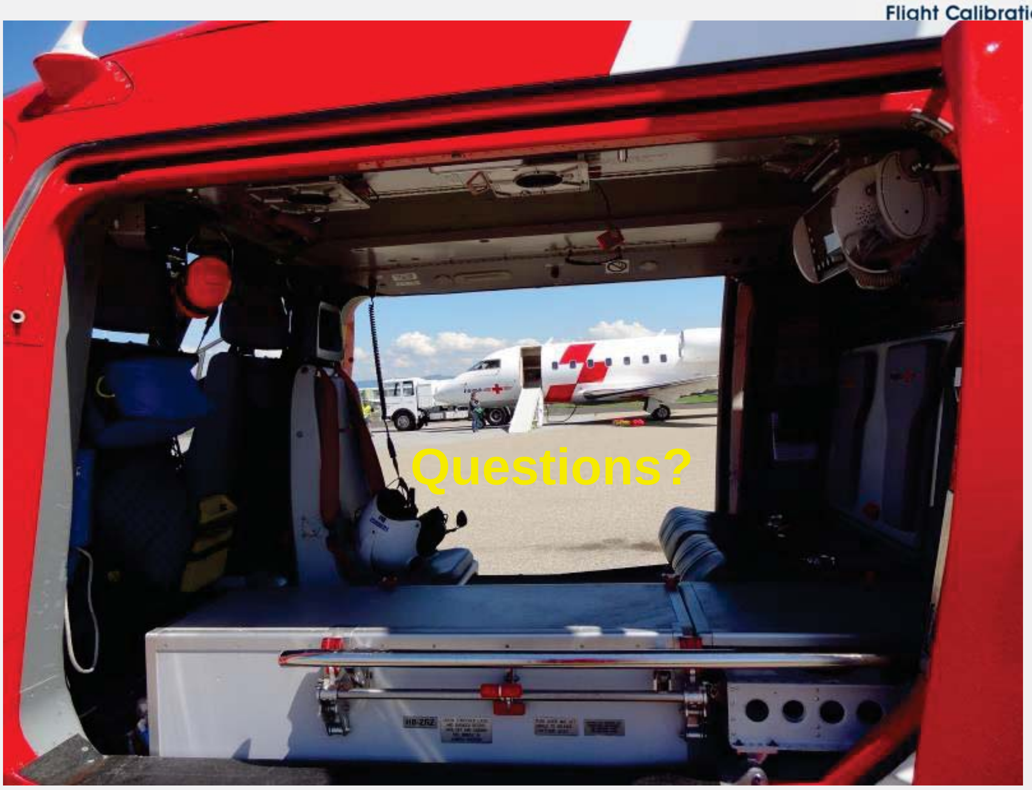


Courtesy Aerodata

Current Status

Flight Calibration Services

- ❑ **The project seems technically feasible**
- ❑ **A backup/training helicopter is available**
- ❑ **AeroFIS architecture could be maintained**
- ❑ **Equipmentholder from Aerodata available**
- ❑ **Existing helicopter equipment platform may be used**
- ❑ **Existing VHF/UHF antenna and power interface may be used**
- ❑ **Airworthiness certification possible**
- ❑ **Open: Operator display / GNSS L1/L2 antenna installation**



Courtesy REGA

Detection and Location of RF Interference Sources

Rolf Seide

Aerodata, Braunschweig, Germany

Introduction

- Detection and Location of Interference sources is not a simple, fully automatized process.
- A basic investigation of the signal to be detected has to be performed <u>before</u> the DF system is operated.
- With the results of this investigation sometimes the source is already identified and/or located.
- Unknown stations have to be investigated in depth.
- If the signal is understood, the DF system comes into operation. In conjunction with special flight maneuvers the signal source can be located and the system generates a graphical and numerical result plot.
- In this presentation fictitious and real data are shown

Steps

- What signal to detect?
- What information is available beforehand ?
- How can I receive the signal ? → Which frequency band, antenna selection ?
- Which antenna → horizontal, vertical or circular, antenna selection ?
- What is the expected signal strength → close to station or far away ?
- What is the expected modulation → use demodulator to listen.
- What is the expected bandwidth → use spectrum analyzer .
- What is the expected timing → continuous or intermittent ?

With the first answers to the questions above, the DF system can be properly set up.

In the following, more detailed questions and answers with a fictitious example are shown.

Step 1, gathering details

What signal to detect?
What information is available beforehand ?

`Fictitious Example Answer:`

- `Interference reported on 135,25 MHz, airport approach frequency`
- `unreadable, but seems to be voice`

Additional information

- `Was not reported before, showed up two days ago.`

Step 2, antenna selection

How can I receive the signal ? → Which frequency band, antenna selection

Which antenna → horizontal, vertical or circular, antenna selection

Fictitious Example Answer:

- VHF COM band
- Interference reported on VHF COM, which is vertical polarized. First choice is the vertical VHF COM antenna on the aircraft

Step 3, signal strength

- What is the expected signal strength → close to station or far away
- Is there any noise on the signal or clear?
- Is it a single signal transmitter or multiple TX?

Fictitious Example Answer:

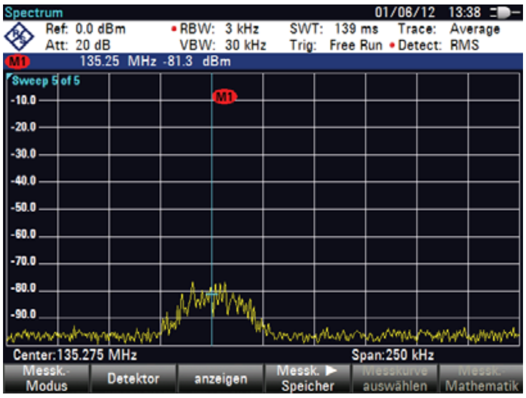
- Signal strength opening the squelch, but strong aircraft radios are clearly readable above the signal.
- It seems to be a single station; all signals have the same quality. No different operators (voices) talking.

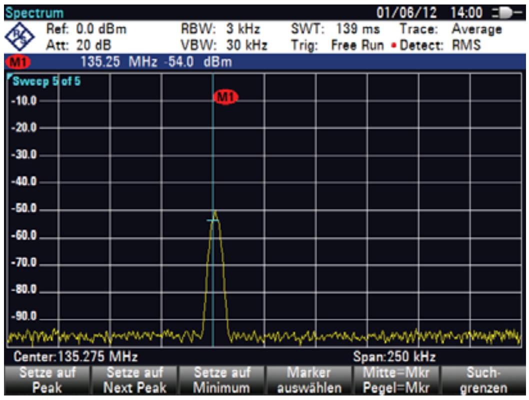
Step 4, band width

What is the expected bandwidth → use spectrum analyzer

Fictitious Example Answer:

- Spectrum set up to 25 kHz/div
- Marker set to 135,25 MHz
- Occupied bandwidth of interference signal is about +/- 20kHz
- VHF COM signal is about 30 dB stronger





Step 5, modulation

What is the expected modulation → use demodulator to listen

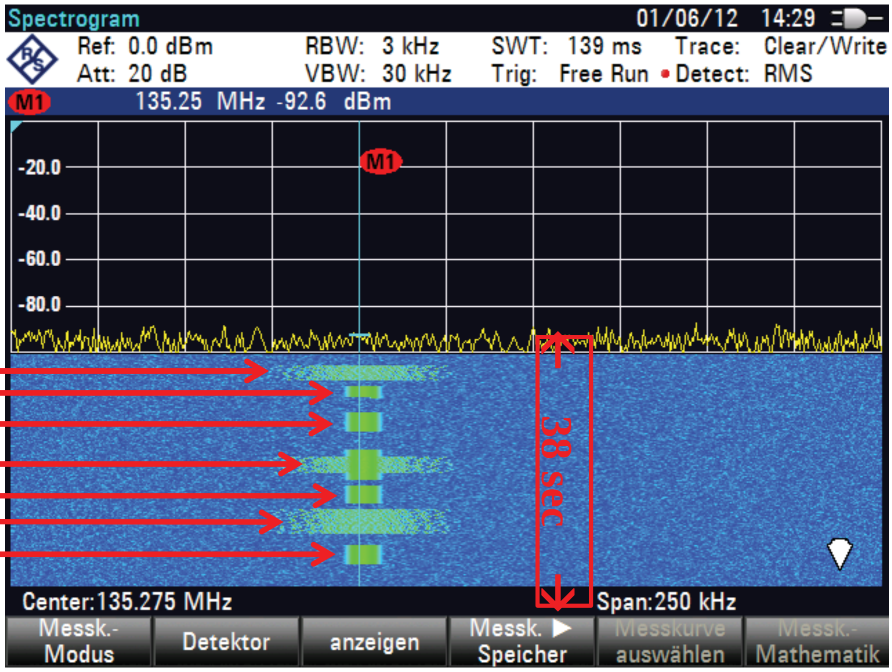
Fictitious Example Answer:

- Example Answer:
  Distorted readability was reported in AM, as used in A/C VHF COMs.
- Tests in FM-narrow with DF demodulator output showed over-modulated signal, closing the squelch if spoken louder. Signal could be identified as voice.
- Tests in FM-wide showed under-modulated signal, squelch opening properly, clear voice could be identified.
- This is now identified as +/- 20 kHz FM voice modulation

Step 6, timing

What is the expected timing → continuous or intermittent, use spectrogram or "waterfall-diagram" if available

Intermittent, interference is typical voice communication, single channel operation with PTT, only one station could be heard.



Step 7, set up the DF

With the information found until now, the DF will be set up:

- Frequency: 130.25 MHz,
- Bandwidth and modulation: FM wide (100 kHz)
- Antenna of DF: set to VHF array
- Valid bearing indication if interference station is TX is received and copied to the cockpit

Step 7, flight preparation

Briefing with the flight crew

- A Direction Finder procedure shall be flown, if high activity on this channel is reported.
- The DF indication shall be transferred to the pilot´s bearing indicator, the pilots shall roughly try to overfly the station. If the needle swings back, around this point an orbit of roughly 5 NM radius shall be flown.
- Flight track need not be very accurate, but high bank angles should be avoided.
- The flight inspector / DF operator shall activate the DF software with automatic tracking capability of the signal.
- It can be flown under IFR, visual contact not needed
- If possible, normal communication on the interfered channel shall be shifted to other frequencies to have only a single target. This makes the operation much simpler
- ATC should be informed before flight

Step 8, flight (2)

- **Operation of the DF system in flight:**
- The flight inspector / DF-operator operates spectrum analyzer, audio system and DF from his console. Spectrum analyzer settings can be pre-programmed to ease operation
- If the signal is valid, the bearing is transferred to the cockpit, presented like FIS guidance
- Cockpit guidance to overfly the station is possible by:
  – Bearing pointer on PFD: Only Manual flight
  – Course needle: Autopilot coupling possible direct to interference station
- Finally the location of the station is shown in graphical and alphanumerical form by the software

Flight Test Results

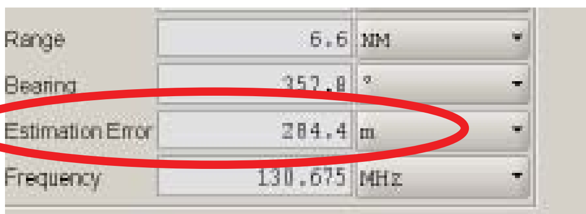
Results of Performance Flight Tests

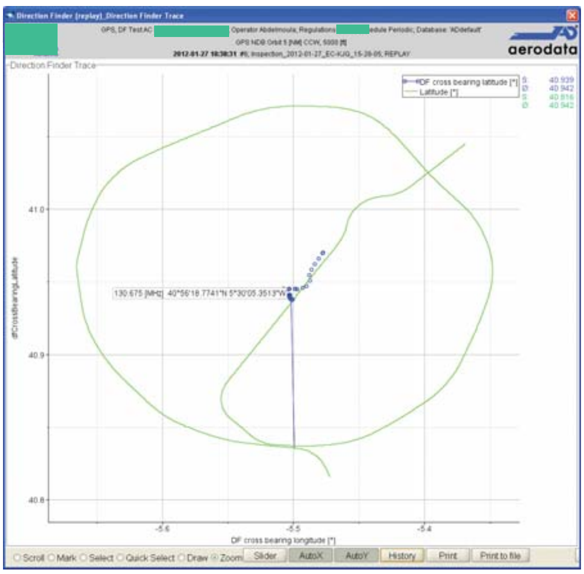
- The following plots have been taken from target search in VHF, UHF and L-Band DF search flights. Altitude was 6500 ft above the ground station, IMC conditions, IFR operation.
- All plots were made in real time, progress continuously presented to the operator in flight.
- The system continuously shows an estimated position error (data taken from the signal quality and the variation of the bearings) of the expected TX location.
- The real position of the TX was not known to the software.

Real in-flight plots, VHF

The following results were plotted in flight in real time locating a VHF ground station, 6500 ft AGL, IFR:

- The estimated position error as shown the system in flight was 0.15 NM when flown in a orbit with 10 NM diameter.
- The estimation error only takes quality data into account, the real position is not known to the software.



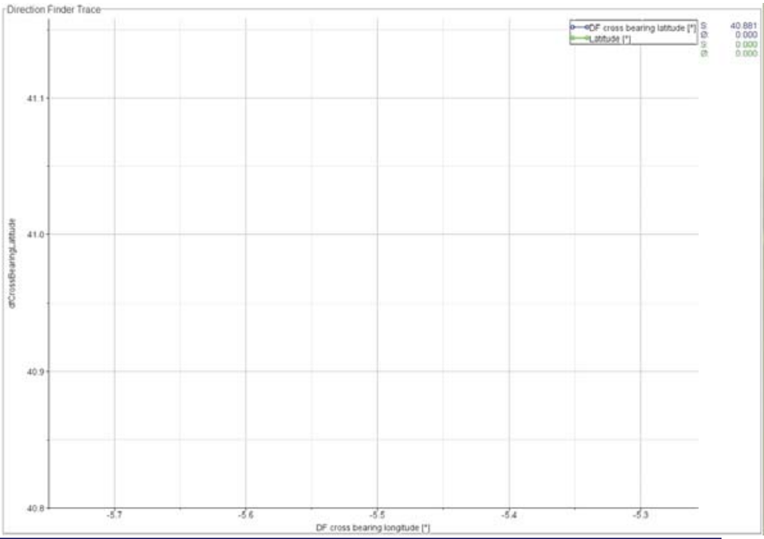


Real in-flight plots, UHF

The following results are plotted in flight in real time locating a UHF ground station, 6500 ft AGL, IFR :

- The estimated position error as shown by the system in flight was less than 0.1 NM when flown in a orbit with 10 NM diameter.
- The estimation error only takes measured data into account, the real position is not known to the software.

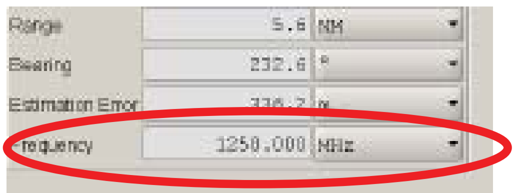
Video: 20x real time

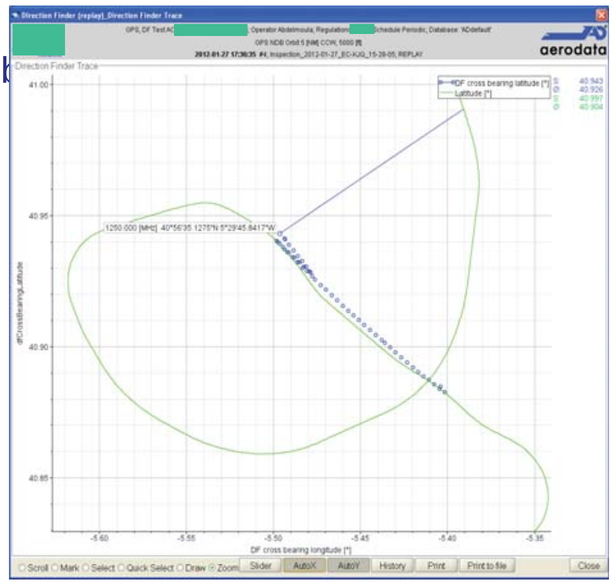


Real in-flight plots, L-band

The following results are plotted in flight in real time locating a L-band ground station, 6500 ft AGL, IFR :

- The estimated position error as shown by the system in flight was 0.2 NM when flown in a orbit with 10 NM diameter.
- The estimation error only takes quality data into account, the real position is not known to the software.





This track could not be flown in a full orbit, but the software still gets a very good result.

Presentation in Google Maps

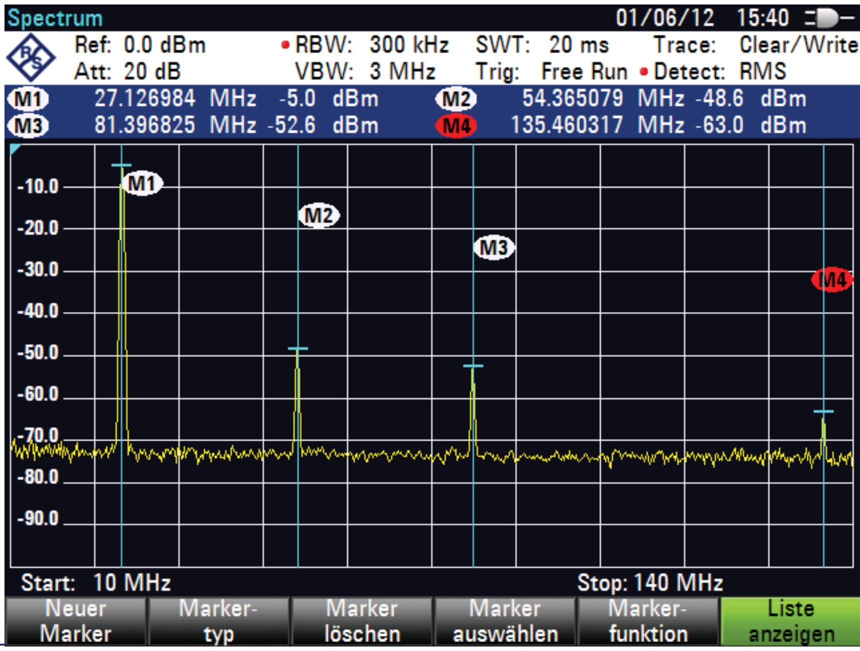
- Data from the flight can be exported in KML-Format to be presented on a map, e.g. Google maps/earth.
- Flight track and position found can be shown.

Final Interpretation of Fictitious Signal

- The transmitter was operating in the CB-Band, frequency of 27.050 MHz in FM. The fifth harmonic (135.250 MHz) was modulated with 5 times the standard FM deviation of about 4 kHz. The station was close to the interfered receiver, and the harmonic resulted in a level of -75dBm on the VHF COM antenna.
- The radio was modified a few days before; the output power was turned up without watching the harmonics of the signal.
- With this knowledge the basic frequency of 27.050 MHz could be demodulated with a normal FM-narrow receiver.
- The mobile stations used unmodified radios not transmitting on the harmonics, not visible on VHF.
- Station could be identified and shut down

Final Interpretation of Fictitious Signal

- Full frequency plot showing basic carrier frequency and harmonics



Summary

- DF operating is still challenging and not fully automatic.
- It needs understanding of the signal and radio theory by the operator of the system.
- Special hardware and software on board of the flight inspection aircraft is required to get best results and minimum flight time.
- Algorithms using continuous cross bearing calculation and filter parameter individually matching the aircraft installation are essential for high accuracy
- Pilots should have training to follow Direction Finder Indications on cockpit instruments.
- Finally the interference source (transmitter) must be found by people on ground using the detailed information supplied by the flight inspection DF system.

OSC and SPA Settings GUI

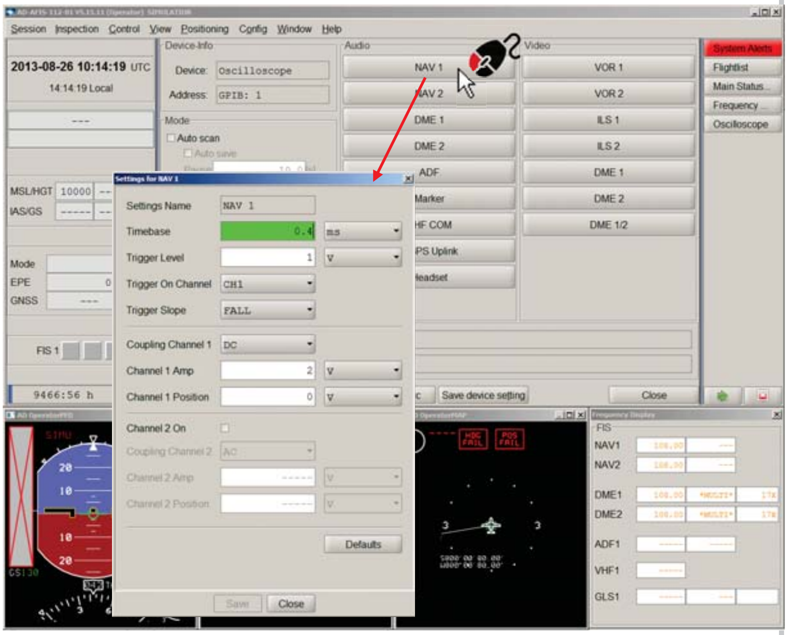
Thomas Hähndel

OSC and SPA Settings GUI

- New Settings GUI for device control is implemented:
  - Settings are adjustable using AFIS Software without direct access to the device
  - All saved settings at first glance for one program
- Support for:
  - Oscilloscope
  - Spectrum Analyzer

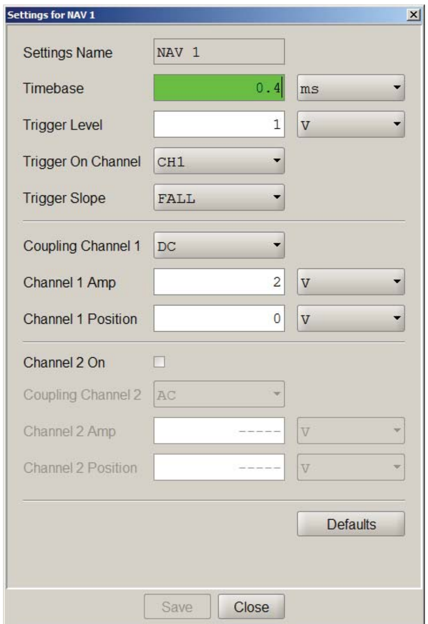
OSC and SPA Settings GUI

- Invoke the Dialog by *right mouse click* on program button
- Display, change and save of setting values and units is now possible



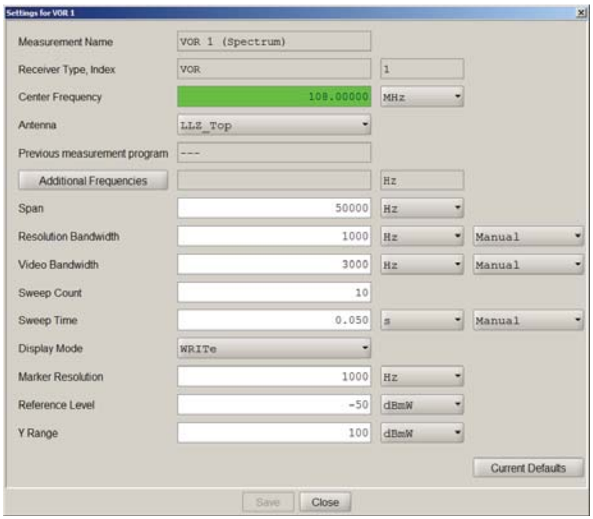
OSC and SPA Settings GUI

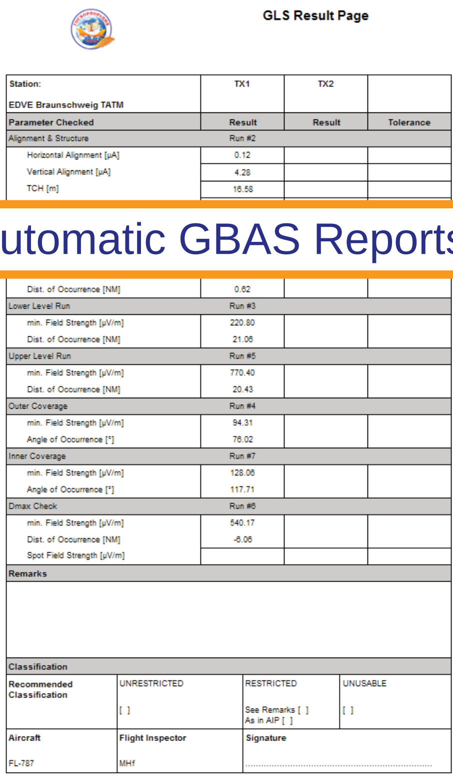
- Oscilloscope settings:
  - Time base
  - Trigger
    - Level
    - Channel
    - Slope
  - Channel
    - Coupling
    - Amplitude
    - Position
  - 2nd Channel if connected



OSC and SPA Settings GUI

- Analyzer settings:
  - Frequency
    - Centre (if not dictated by receiver)
    - Span
    - Bandwidth
  - Sweep
    - Count
    - Time
  - Level
    - Range
    - Reference
    - Display Mode
  - Marker
- Automatic Selection (by analyzer) is possible for some values
- Antenna can be selected (if not dictated by receiver)





GLS Result Page

Station: EDVE Braunschweig TATM	TX1	TX2	
Parameter Checked	**Result**	**Result**	**Tolerance**
Alignment & Structure	Run #2		
Horizontal Alignment [μA]	0.12		
Vertical Alignment [μA]	4.28		
TCH [m]	16.58		
Dist. of Occurrence [NM]	0.62		
Lower Level Run	Run #3		
min. Field Strength [μV/m]	220.80		
Dist. of Occurrence [NM]	21.06		
Upper Level Run	Run #5		
min. Field Strength [μV/m]	770.40		
Dist. of Occurrence [NM]	20.43		
Outer Coverage	Run #4		
min. Field Strength [μV/m]	94.31		
Angle of Occurrence [°]	76.02		
Inner Coverage	Run #7		
min. Field Strength [μV/m]	128.06		
Angle of Occurrence [°]	117.71		
Dmax Check	Run #6		
min. Field Strength [μV/m]	540.17		
Dist. of Occurrence [NM]	-6.06		
Spot Field Strength [μV/m]			
Remarks			
Classification			
Recommended Classification	UNRESTRICTED [ ]	RESTRICTED See Remarks [ ] As in AIP [ ]	UNUSABLE [ ]
Aircraft FL-787	**Flight Inspector** MHf	**Signature**	

- Automatic GBAS Reports (FMu)

- GBAS Report:

Also available with [dBw/m²]

Station: EDVE Braunschweig TATM	TX1	TX2	
Parameter Checked	**Result**	**Result**	**Tolerance**
Alignment & Structure	Run #2		
Horizontal Alignment [µA]	0.12		
Vertical Alignment [µA]	4.28		
TCH [m]	16.58		
mean Distance Error [m]	5.31		
Spot Field Strength @ 6NM [µV/m]	2492.15		
min. Field Strength [µV/m]	1383.67		
Dist. of Occurrence [NM]	9.92		
max. Field Strength [µV/m]	9710.16		
Dist. of Occurrence [NM]	0.62		
Lower Level Run	Run #3		
min. Field Strength [µV/m]	220.80		
Dist. of Occurrence [NM]	21.06		
Upper Level Run	Run #5		
min. Field Strength [µV/m]	770.40		
Dist. of Occurrence [NM]	20.43		

Evaluation like for ILS

New Software Features
GBAS Reports

- GBAS Report (continued)

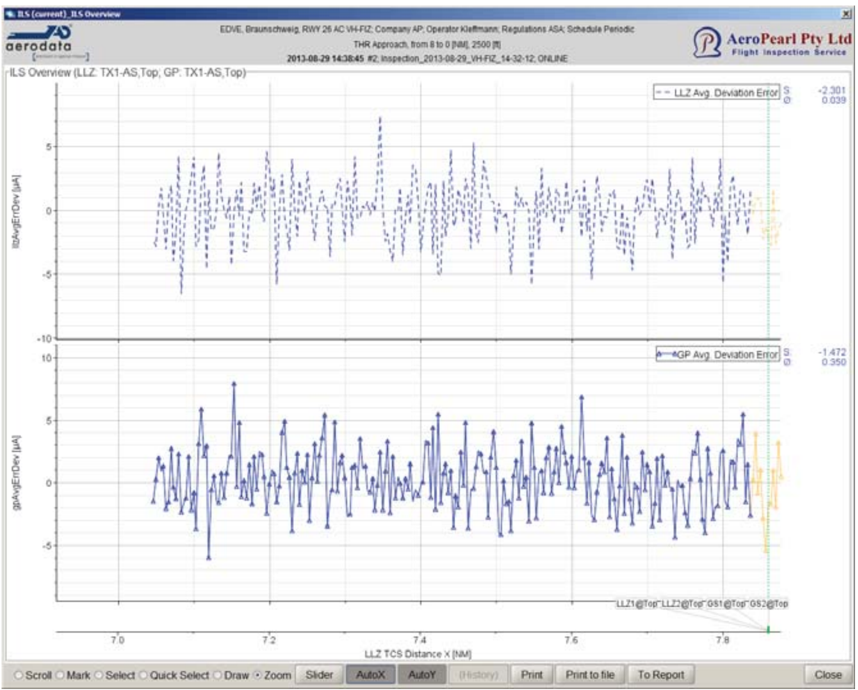
Outer Coverage	Run #4		
min. Field Strength [µV/m]	94.31		
Angle of Occurrence [°]	76.02		
Inner Coverage	Run #7		
min. Field Strength [µV/m]	128.06		
Angle of Occurrence [°]	117.71		
Dmax Check	Run #6		
min. Field Strength [µV/m]	540.17		
Dist. of Occurrence [NM]	-6.06		
Spot Field Strength [µV/m]			
Remarks			
Classification			
Recommended Classification	UNRESTRICTED [ ]	RESTRICTED See Remarks [ ] As in AIP [ ]	UNUSABLE [ ]
Aircraft	**Flight Inspector**	**Signature**	

Is there a demand for further parameter in GBAS Reports?

New Features of the Graphic Editor

Andreas Kleffmann

Graphics Editor



New Software Features
Graphics - Line and Mark Styles

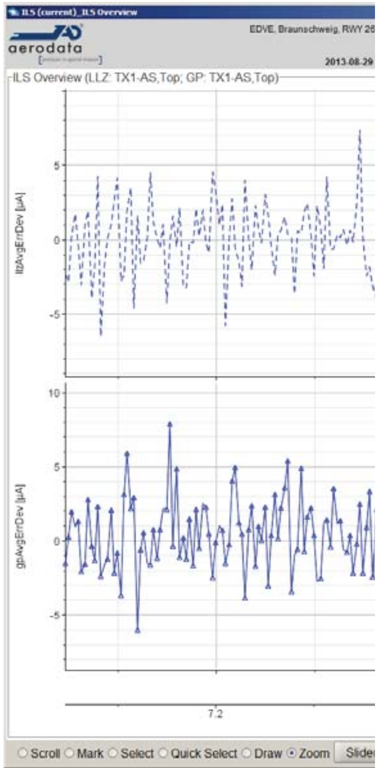
- Line style selectable

  Six different styles available

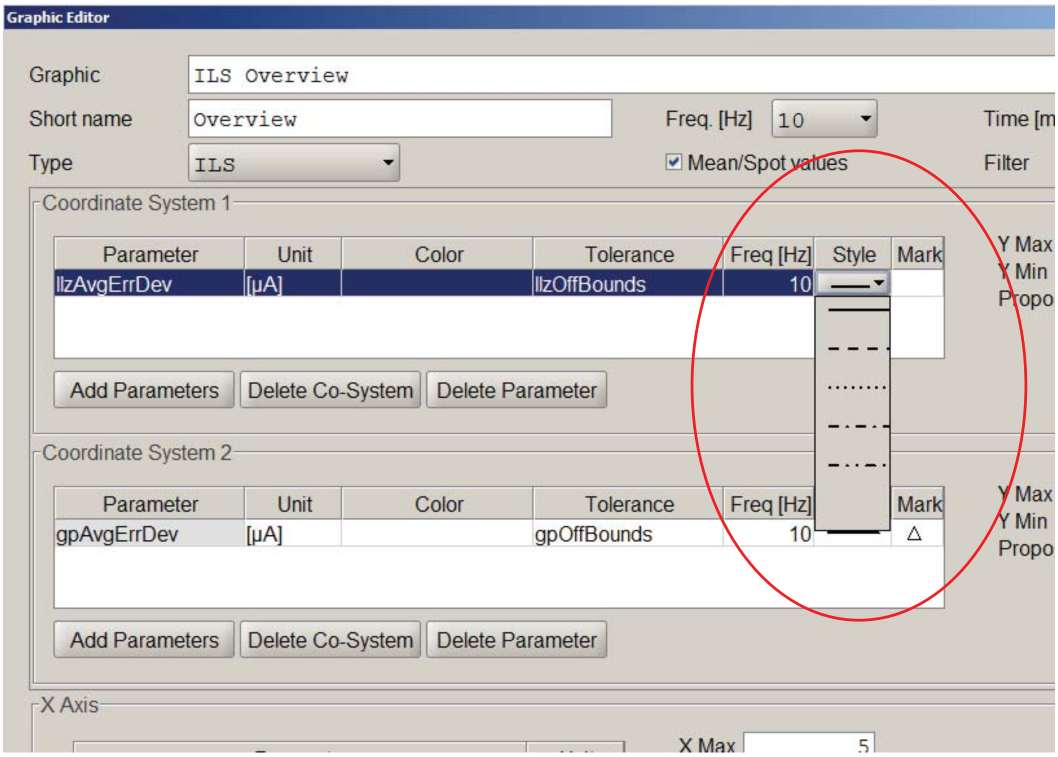
- Mark style for measured points selectable

  Six different marks available

- Configuration via Graphic Editor

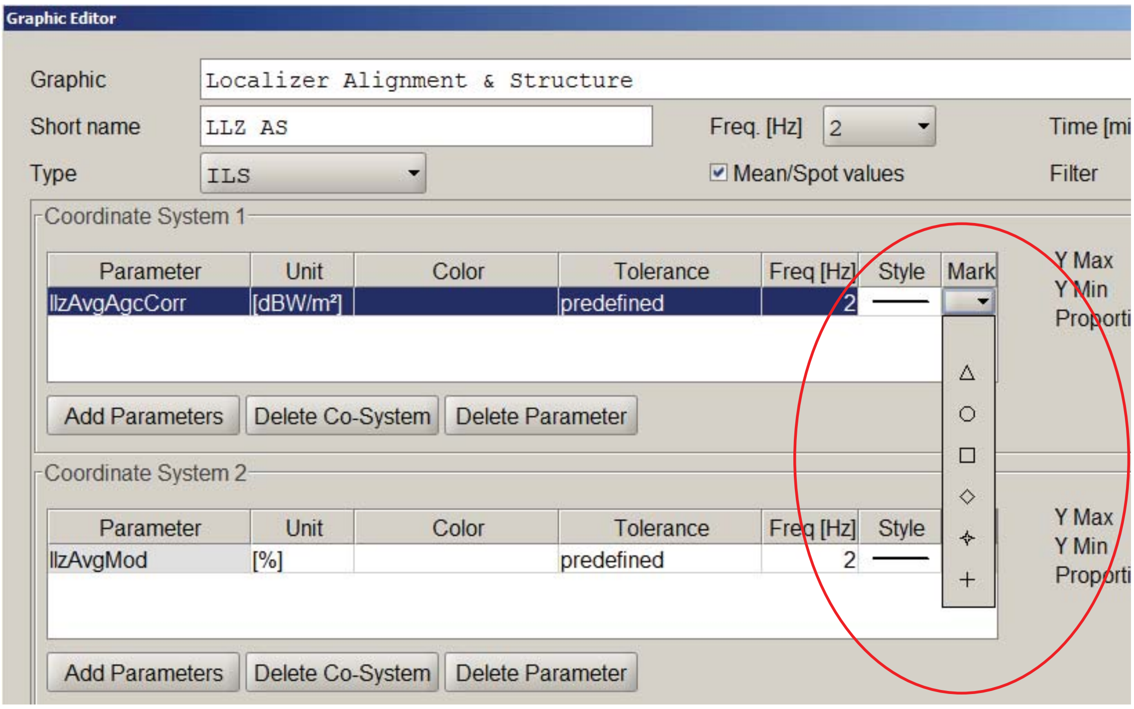


New Software Features
Graphics – Edit Line Style



aerodata [precision in special mission]

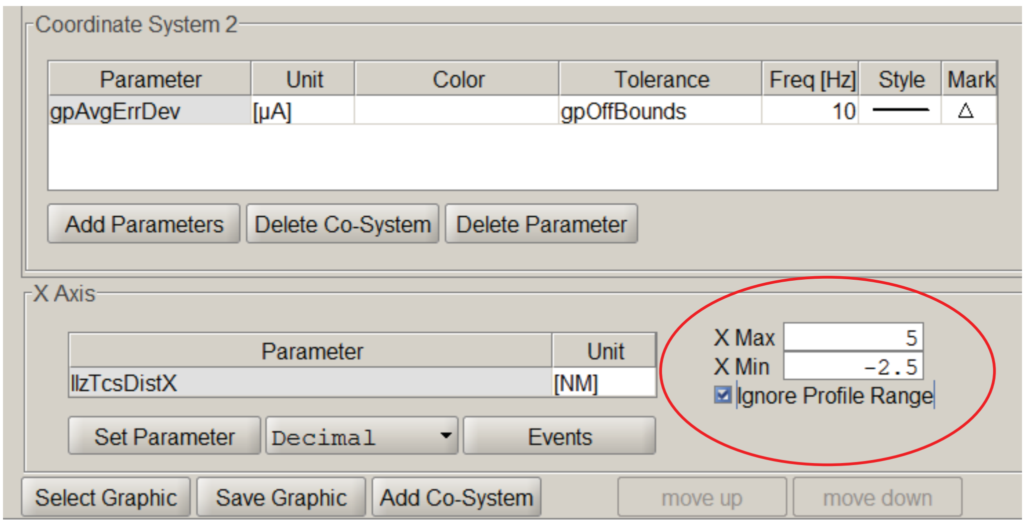
New Software Features
Graphics – Edit Mark Style



aerodata [precision in special mission]

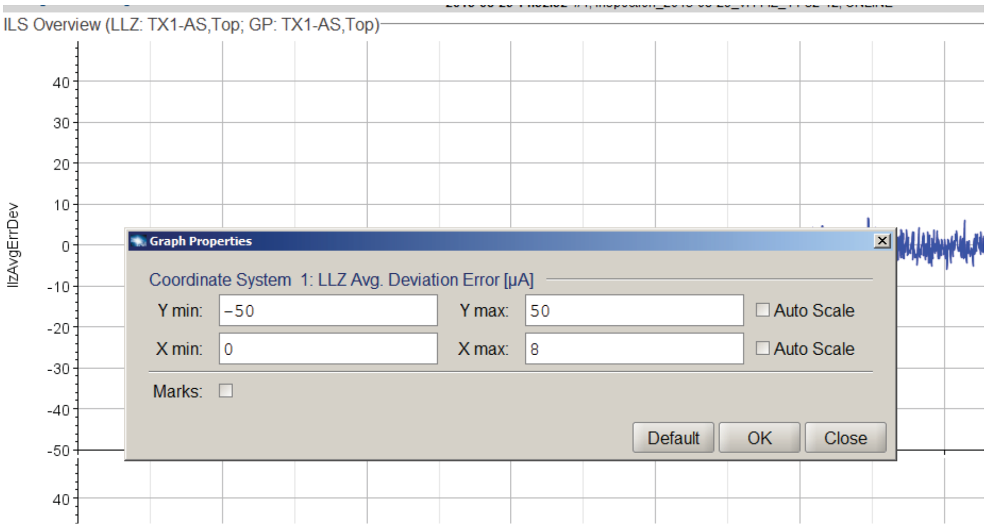
New Software Features
Graphics - Profile Range

- For many profiles the x-axis min and max position is defined by procedure range
- “Ignore Profile Range” marks the user defined range as fixed



New Software Features
Graphics - Graph Properties

- Re- Scaling of Coordinate Systems with Right Mouse Click
- Marks: Show each Data Point (10Hz or 2Hz Sampling rate)
- Property change only temporary

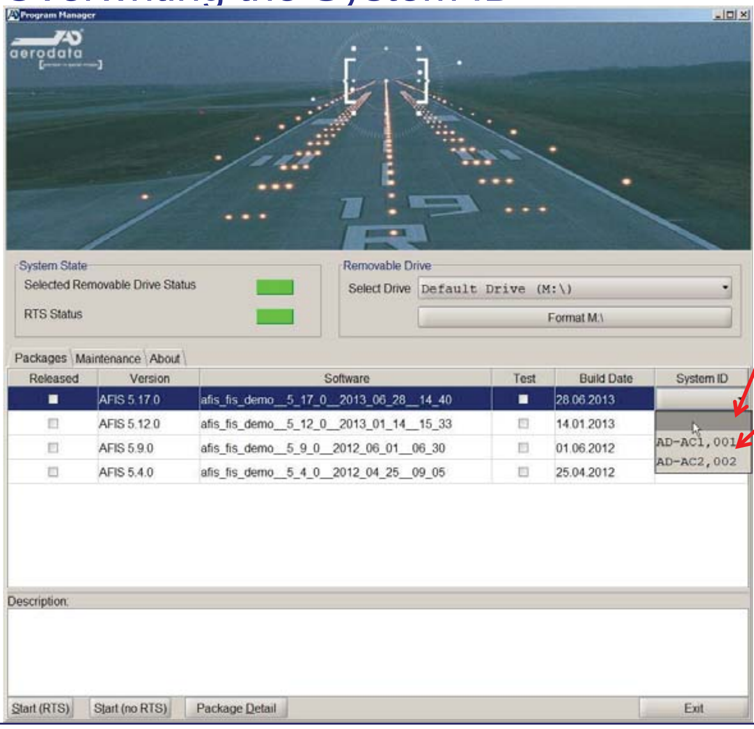


New Software Features

New Features of the Program Manager

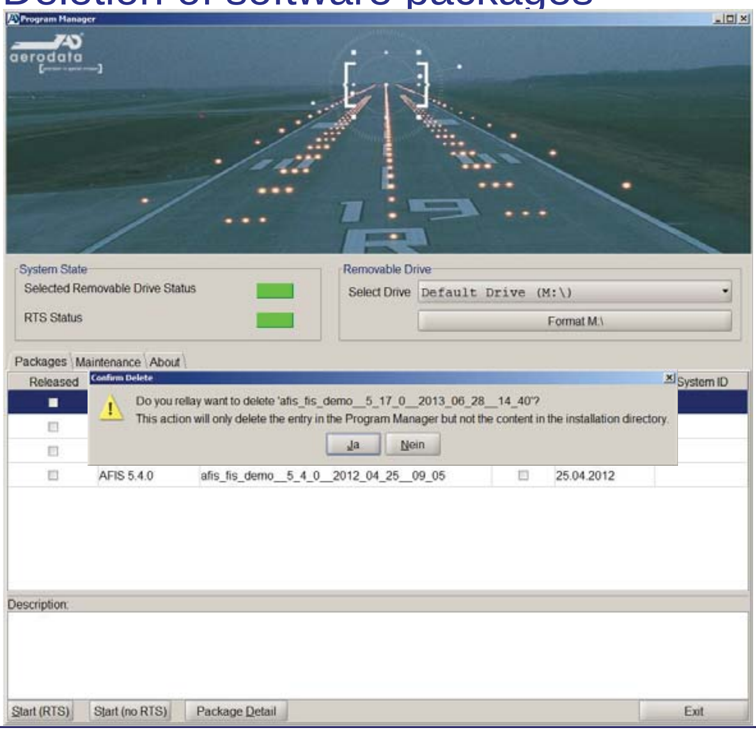
Marcel Hoffmeister

- Overwriting the System ID



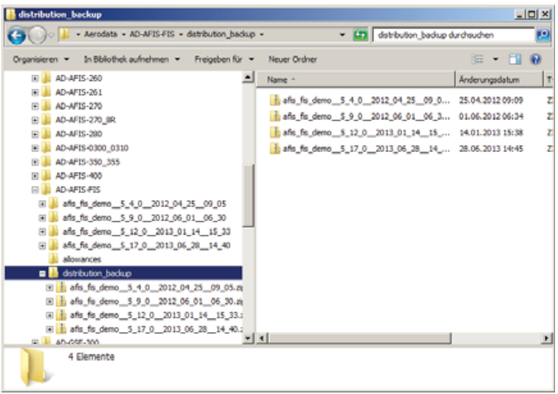
- Automatic detection according to RTS strapping pins
- Overwrite the A/C callsign and System ID
- Administrator settings will be permanent, Operator settings are temporary

- Deletion of software packages



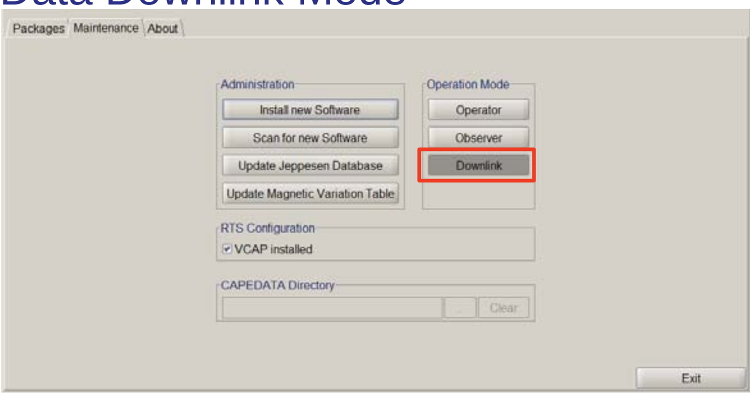
- Delete a entry by pressing the <del> key
- This will only delete the entry in the program manager. The files on the harddisk will not be deleted
- Reinstall the software using Maintenance / Scan for new Software

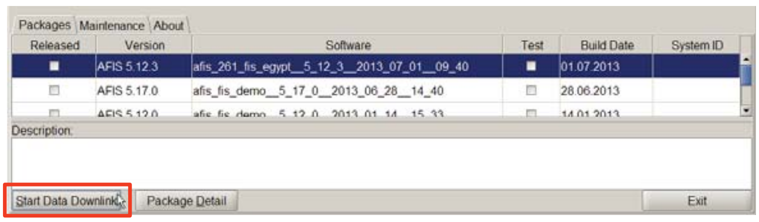
- Backup of distribution *.zip file



  - A copy of the distribution *.zip file will be stored automatically at D:\Aerodata\AD-AFIS-XXX\distribution_backup\

- Data Downlink Mode

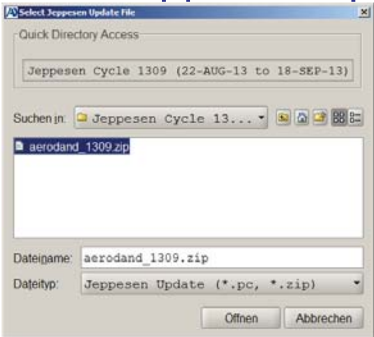




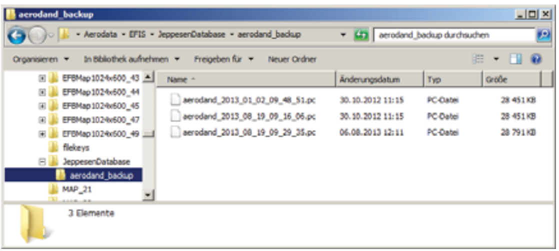
- Data Downlink software is included in the AFIS software distribution
- Data Downlink software can be started from the package table

New Software Features
New Features of the Program Manager

- Improved Jeppesen Update



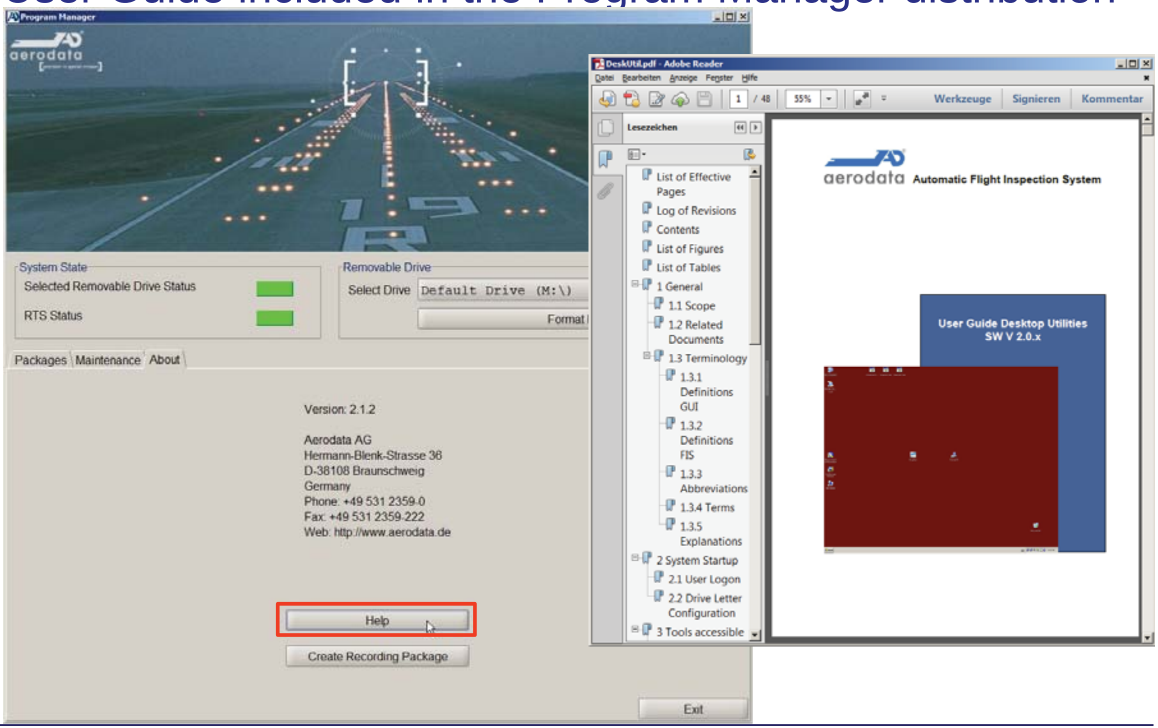
- Support of *.pc and *.zip files
- *.zip files will be unzipped automatically
- *.pc files will be renamed to aerodand.pc



- Backup of old databases (last 3 versions)

New Software Features
New Features of the Program Manager

- User Guide included in the Program Manager distribution



FAA Offset Localizer

Marcel Hoffmeister

- Due to limitations in space and terrain it is sometimes difficult to install an ILS

No space left to install a LLZ

(Matsu Beigan Airport, Taiwan)

- Due to limitations in space and terrain it is sometimes difficult to install an ILS

Solution:
Offset LLZ

- Antenna shifted to the right
- LLZ Course (30.2°) is different than the runway heading (28.1°)

(Matsu Beigan Airport, Taiwan)

What does ICAO say about Offset Localizer?

Annex 10:

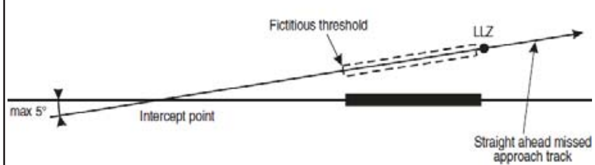
- 3.1.3.10.2 For Facility Performance Category I, the localizer antenna system shall be located and adjusted as in 3.1.3.10.1, unless site constraints dictate that the antenna be offset from the centre line of the runway.
- 3.1.3.10.2.1 The offset localizer system shall be located and adjusted in accordance with the offset ILS provisions of the Procedures for Air Navigation Services — **Aircraft Operations (PANS-OPS) (Doc 8168), Volume II**, and the localizer standards shall be **referenced to the associated fictitious threshold point**.

Doc 8168:

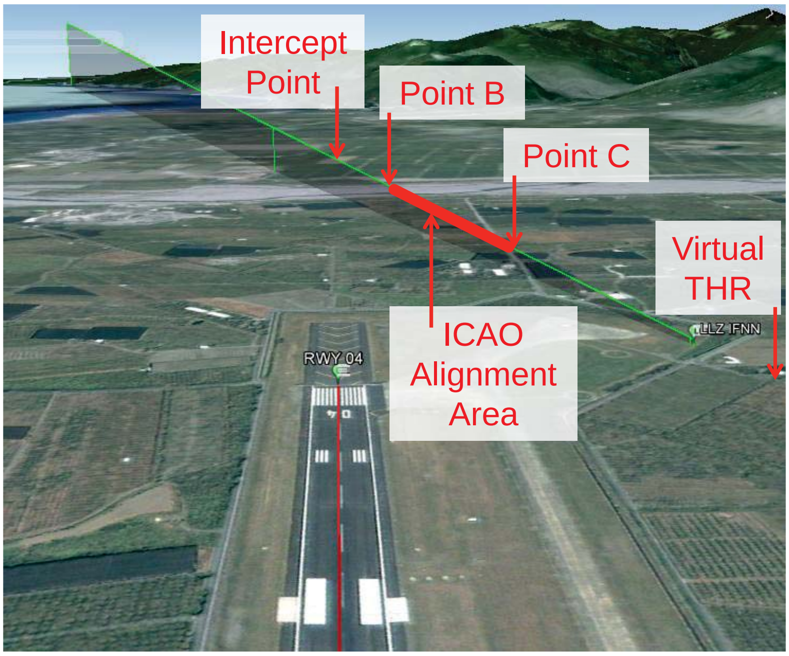
2.1.2 The localizer course line shall intersect the runway extended centre line:

a) at an angle **not exceeding 5°**; and

b) at a point where the nominal glide path reaches a height of at least 55 m (180 ft) above threshold. This is called intercept height.



- Sometimes 5° are not enough (e.g. due to mountains)



- Runway: 38.7°
- LLZ Course: 23.7°
- Difference: 15.0°

According to ICAO:

- Intercept Point is 0.8 NM from THR
- Virtual THR is behind LLZ
- Point B (1050 m) and Point C (580 m @ 3° GP)
- Alignment Area (Point B to C) is "out of interest"

(Taitung Airport, Taiwan)

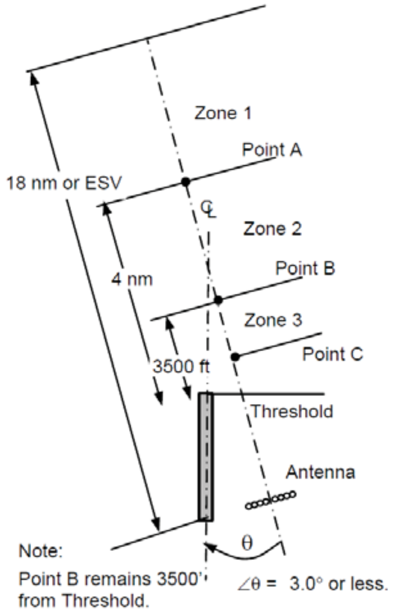
What does FAA say about Offset Localizer?

- United States Standard Flight Inspection Manual (8200.1C) distinguishes between:
  - Default ILS
  - Offset ILS
  - Offset LLZ
  - Different kinds of LDA (Localizer Type Directional Aid)
  - Backcourse LLZ
  - SDF (Simplified Directional Facility)

New Software Features
FAA Offset Localizer

Different ILS Points for different Offset LLZ types (FAA)

Figure 15-1A(2)
TYPICAL OFFSET ILS

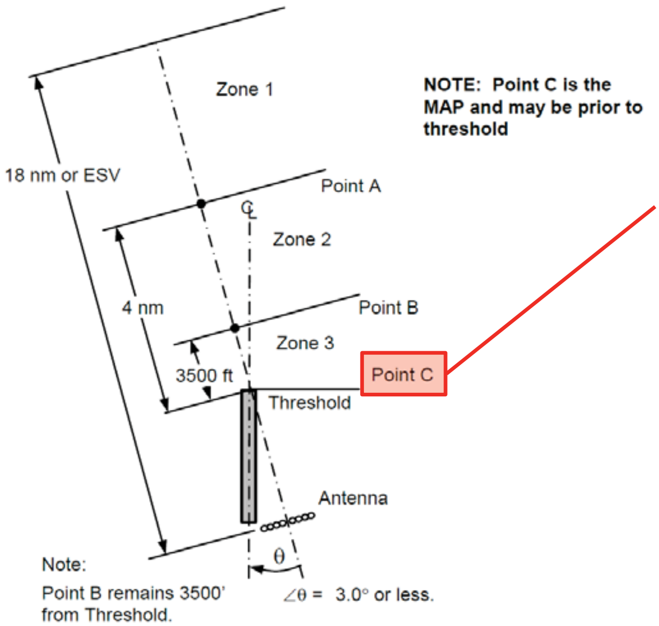


- 3.0° or less
- Like ICAO all Points are calculated from a virtual THR like for a normal ILS

New Software Features
FAA Offset Localizer

Different ILS Points for different Offset LLZ types (FAA)

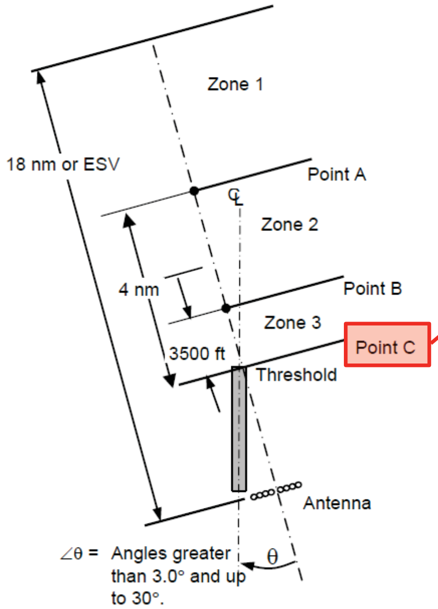
Figure 15-1A(3)
TYPICAL OFFSET LOCALIZER



- 3.0° or less
- No GP
- Point C is the MAPt (defined by the procedure designer)

Different ILS Points for different Offset LLZ types (FAA)

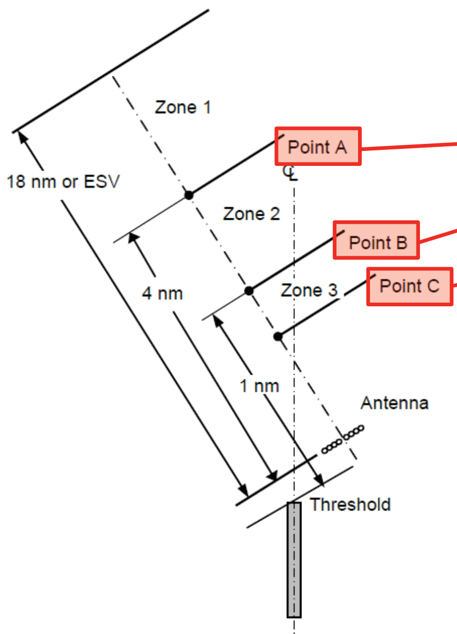
Figure 15-1B(1)
LDA CONFIGURATIONS



- 3.0° to 30°
- Point C is the MAPt (defined by the procedure designer)

Different ILS Points for different Offset LLZ types (FAA)

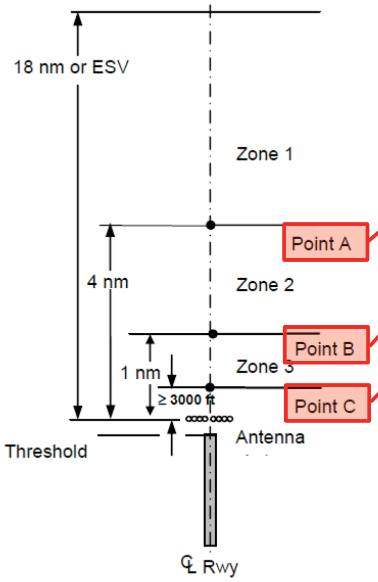
LDA CONFIGURATIONS
Figure 15-1B(2)



- Antenna in front of the THR
- Point A is 4 NM from LLZ
- Point B is 1 NM from THR
- Point C is the MAPt (defined by the procedure designer)

Different ILS Points for different Offset LLZ types (FAA)

Figure 15-1B(3)
Back Course Localizer/ SDF

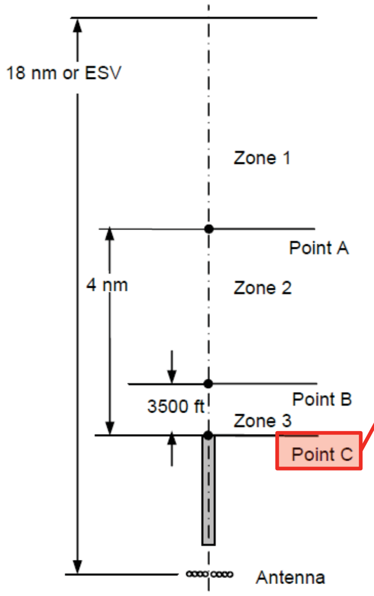


- Antenna in front of the THR
- Point A is 4 NM from LLZ
- Point B is 1 NM from LLZ
- Point C is the MAPt (defined by the procedure designer)

New Software Features
FAA Offset Localizer

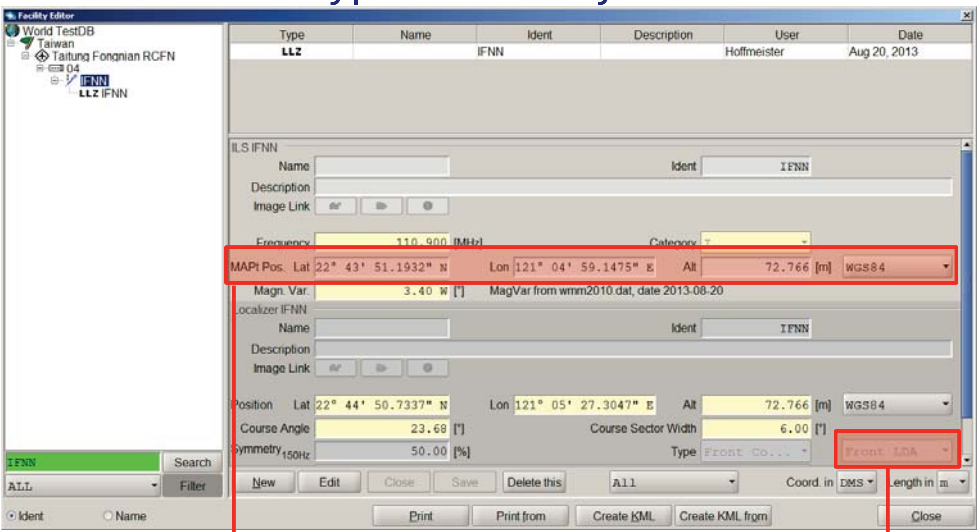
Different ILS Points for different Offset LLZ types (FAA)

Figure 15-1B(3)
Back Course Localizer/ SDF



- Like a normal LLZ without GP
- Point C is the MAPt (defined by the procedure designer)

FAA Offset LLZ types in Facility Database



Note:
Offset type will be detected automatically according to geometry

New input field for MAPt position

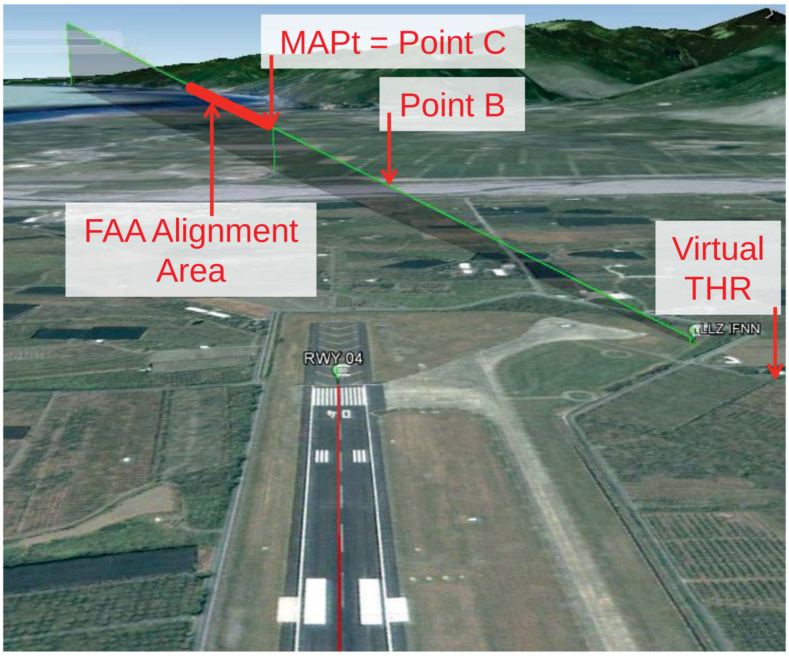
Indicator for FAA Offset Type
(No Offset, Offset ILS, Offset LLZ, LDA, Front LDA, Backcourse SDF, SDF

FAA Alignment Areas

Front Course	From	To
CAT I, II, III	One mile from runway threshold	Runway threshold
ILS Zone 4	Runway threshold	Point D
ILS Zone 5	Point D	Point E
Offset Localizers	One mile from runway threshold	Runway threshold or abeam runway threshold
LDAs and SDFs	One mile from Point C	Point C
Back Course		
All Types of Facilities	Two miles from the antenna	One mile from the antenna

New Software Features
FAA Offset Localizer

- Example from the beginning as FAA "Front LDA"



According to FAA:

- Virtual THR is still behind LLZ
- Point C (MAPt) occurs prior to Point B (1 NM from virtual THR), no Zone 3 exists!
- Alignment will be measured 1NM from Point C to Point C

(Taitung Airport, Taiwan)

New Software Features

New Data Downlink Ground Software

Andreas Kleffmann

New Software Features
New Data Downlink Ground SW

- Online Visualization on Ground
- Easier Communication between Airborne and Ground Personnel
- Effects of Navaid Adjustments immediately visible on Ground

New Software Features
Data Downlink - Airborne Operation

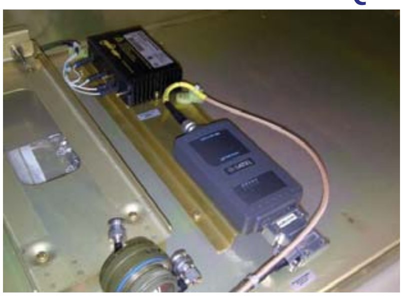
- Cockpit

FIS DATA Downlink enable switch

- FIS Console

TX Enable/Disable Button for easy TX interruption

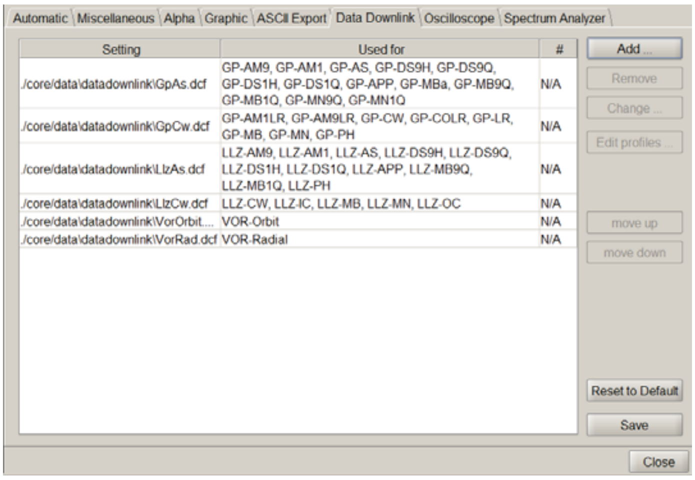
- FIS Installation EQCO



Example:
AD-SATEL Modem/TX
UHF, 9600 Baud

New Software Features
Data Downlink - Airborne Operation

- Software Setup
  - Predefined Configuration for common profiles
  - Transmission starts and stops with procedures
  - Start Automatically (recommended) or Manually



Setting	Used for	#
./core/data\datadownlink\GpAs.dcf	GP-AM9, GP-AM1, GP-AS, GP-DS9H, GP-DS9Q, GP-DS1H, GP-DS1Q, GP-APP, GP-MBa, GP-MB9Q, GP-MB1Q, GP-MN9Q, GP-MN1Q	N/A
./core/data\datadownlink\GpCw.dcf	GP-AM1LR, GP-AM9LR, GP-CW, GP-COLR, GP-LR, GP-MB, GP-MN, GP-PH	N/A
./core/data\datadownlink\LlzAs.dcf	LLZ-AM9, LLZ-AM1, LLZ-AS, LLZ-DS9H, LLZ-DS9Q, LLZ-DS1H, LLZ-DS1Q, LLZ-APP, LLZ-MB9Q, LLZ-MB1Q, LLZ-PH	N/A
./core/data\datadownlink\LlzCw.dcf	LLZ-CW, LLZ-IC, LLZ-MB, LLZ-MN, LLZ-OC	N/A
./core/data\datadownlink\VorOrbit....	VOR-Orbit	N/A
./core/data\datadownlink\VorRad.dcf	VOR-Radial	N/A

New Software Features
Data Downlink – Ground Station

Data Downlink Ground Station (AD-DLGS)

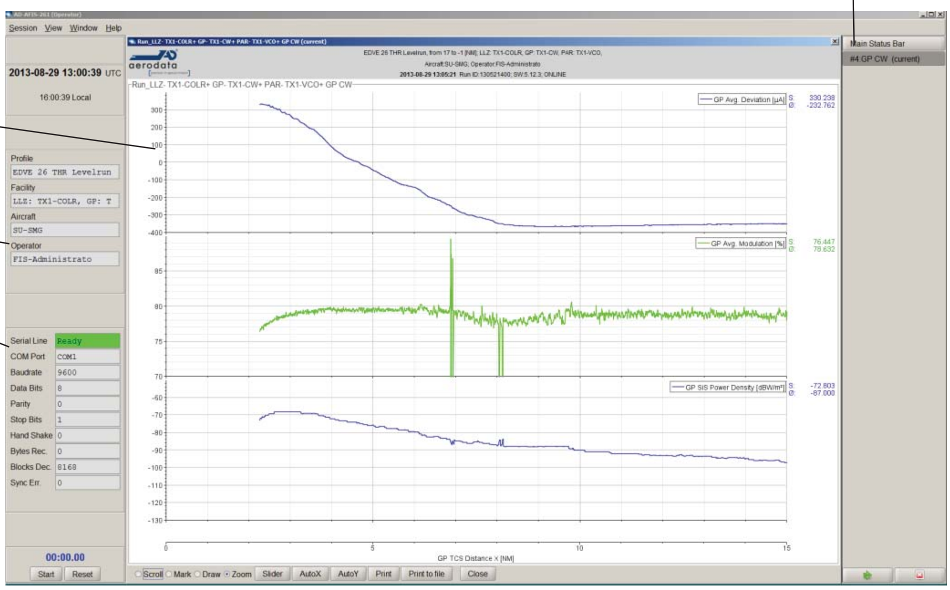
Rugged Case with integrated:
- Downlink telemetry receiver
- Visualization Computer for online display of Flight Inspection Graphs

New Software Features
Data Downlink – Ground Operation

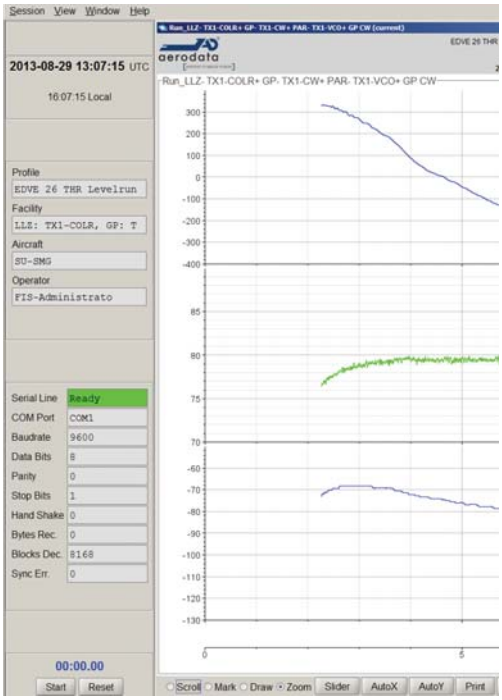
- Hardware Setup

New Software Features
Data Downlink – Ground Operation

- Data Downlink Screen



- Data Downlink Operation
  - Graphics open automatically on received data
  - Previous graphics automatically closed
  - Easy operation
  - Typically only one graphic
  - Graphics stored as PDF file

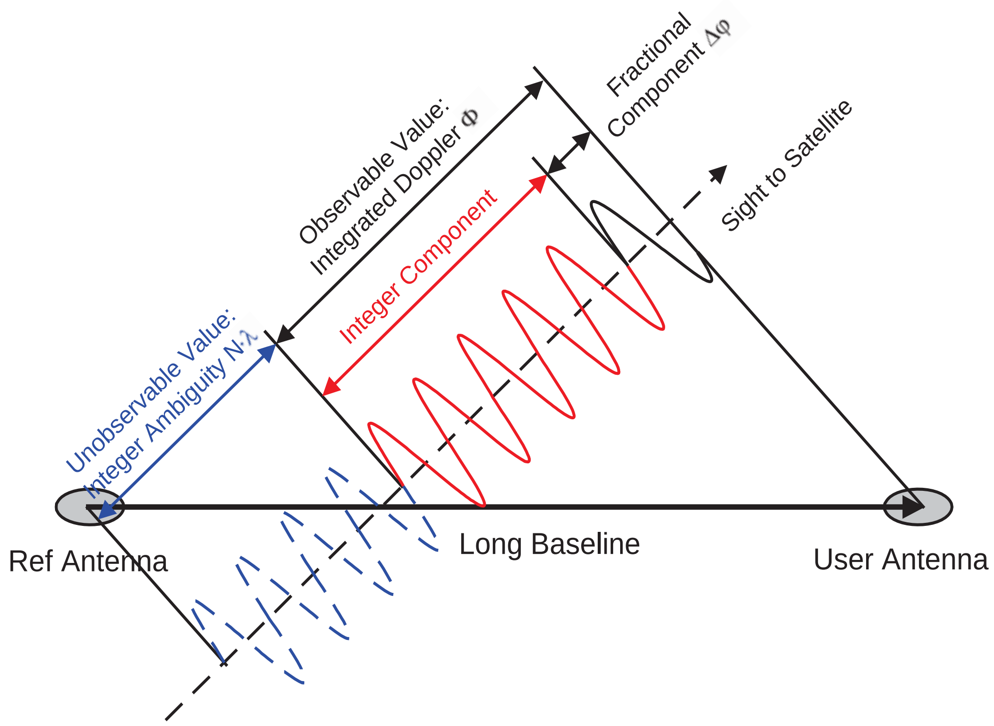


- Ground Data Downlink Software compatible to AFIS Software 4.x
- Since AFIS Software 5.12
  - Improved stability on transmission problems
  - Updated CRC check
  - Continuous transmission of profile configuration
  - Same parameter names as in AFIS

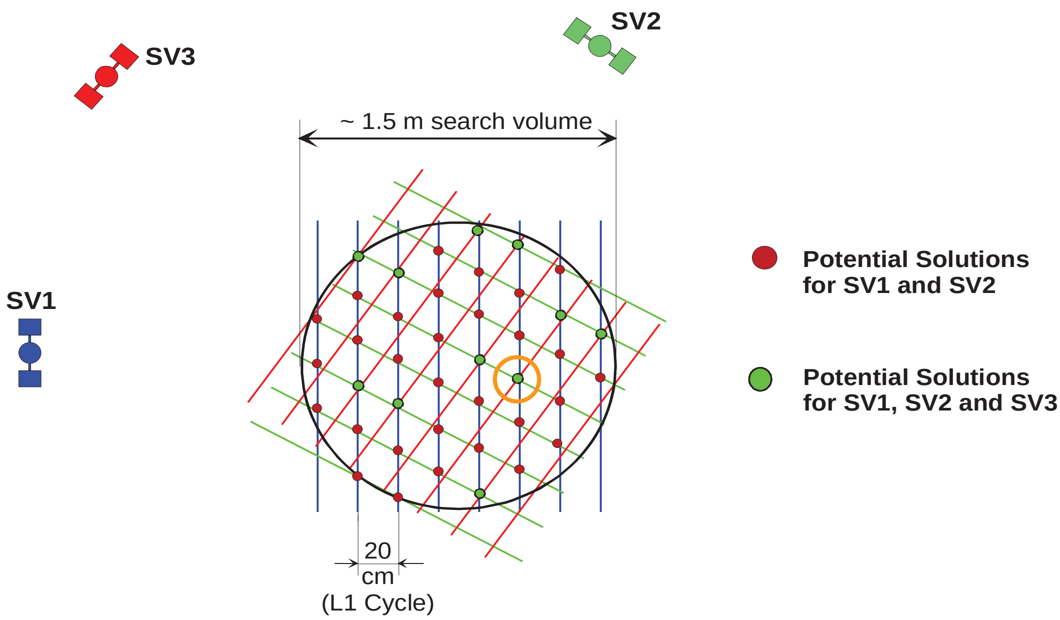
PDGPS Improvements and Evaluation Tools

Claus-Sebastian Wilkens

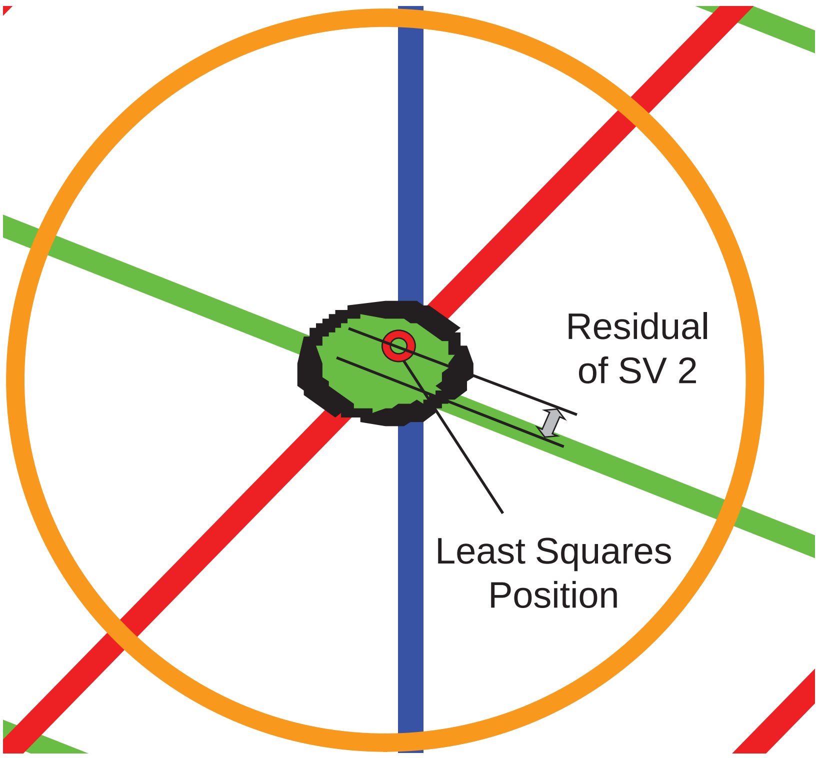
PDGPS Improvements
Carrier Phase Measurement



PDGPS Improvements
Integer Ambiguity Positioning



PDGPS Improvements
Residual



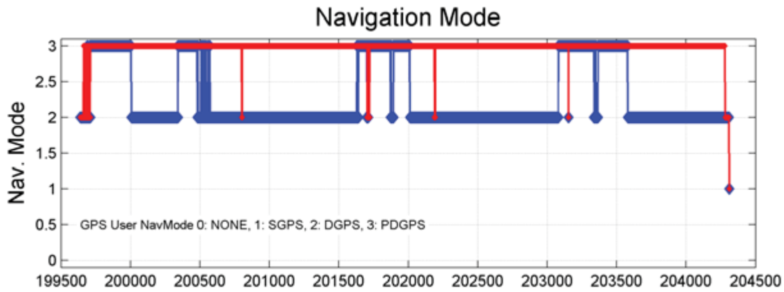
Residual Check

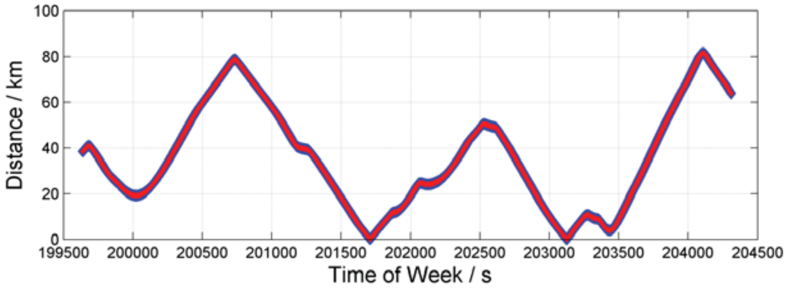
- Compares double difference carrier phase residual to threshold value (L1 only).

- Original Settings:
  - L1 threshold: 3.0 cm
  - Exclusion of a satellite measurements after 3 failed residual checks
  - Detection of incorrect ambiguities with a remaining probability of $p < 10^{-8}$ within 15 minutes.

- Main objective: increase in PDGPS availability
- No decrease in precision and integrity.
- Residual check kicks in too soon and excludes satellites from the solution.
- L1 threshold has been increased to 5.0 cm.
- In order to fulfil the integrity requirements, satellite measurements are excluded if the residual check has failed twice.

PDGPS Improvements
Increased availability





Exemplary flight segment

- Duration: ca. 77 min.

PDGPS availability

- Original : 26.8 %
- Improved : 97.5 %

PDGPS Improvements
Exemplary Flight Trajectory

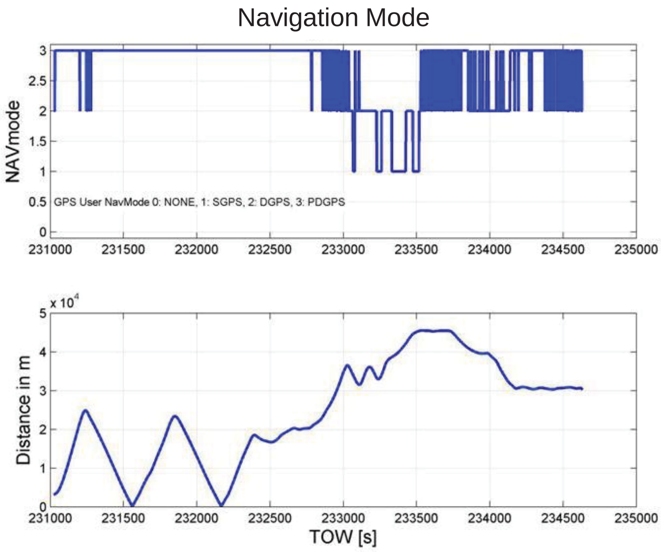
original PDGPS core

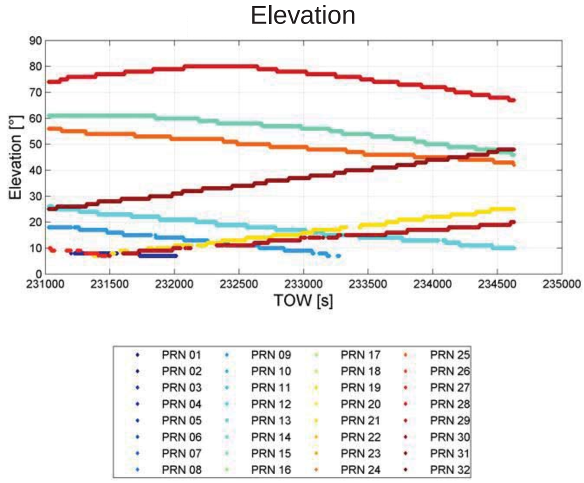
improved PDGPS core

Single GPS
DGPS
PDGPS

PDGPS Improvements
Evaluation Tools

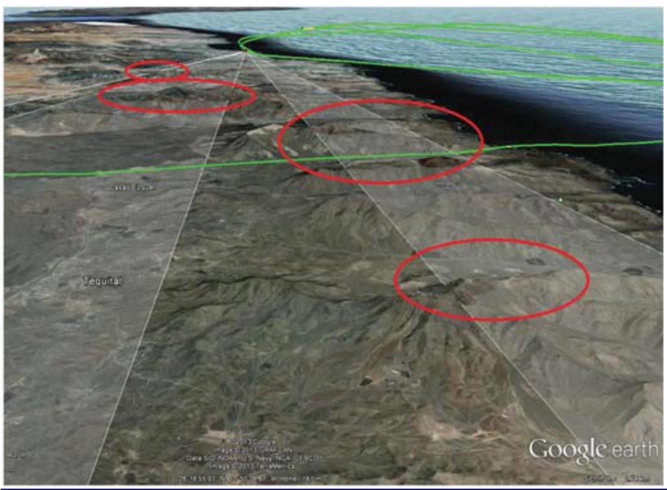
- Matlab®-based evaluation of navigation data.
- Visualisation of specific parameters.

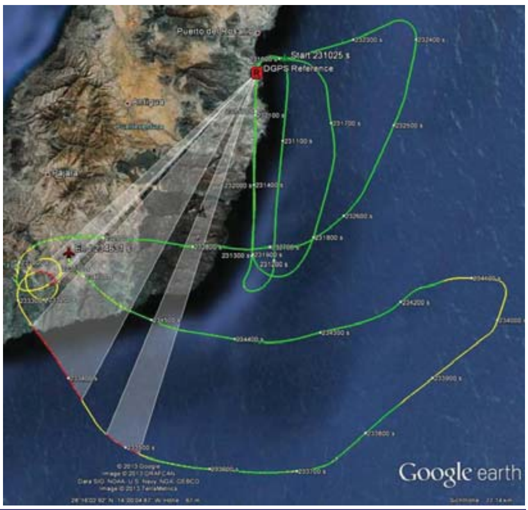




PDGPS Improvements
Visualisation in Google Earth

- Export to Google Earth
- Information on navigation solution type (Single GPS, DGPS, PDGPS) and line of sight between user and reference receiver





PDGPS Improvements Outlook

- Primary objective: increase of availability and integrity
- Integration of GLONASS measurements
  1. Single GLONASS
  2. Differential GLONASS
  3. Carrier Phase Differential GLONASS
- Multi GNSS position reference with GPS and GLONASS
  - “PDGNSS”

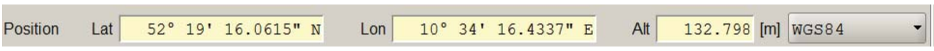
New Software Features

GPS Survey Import to Facility Database

Marcel Hoffmeister

New Software Features
GPS Survey Import to Facility Database

- Typing WGS 84 coordinates manually is a big source of errors



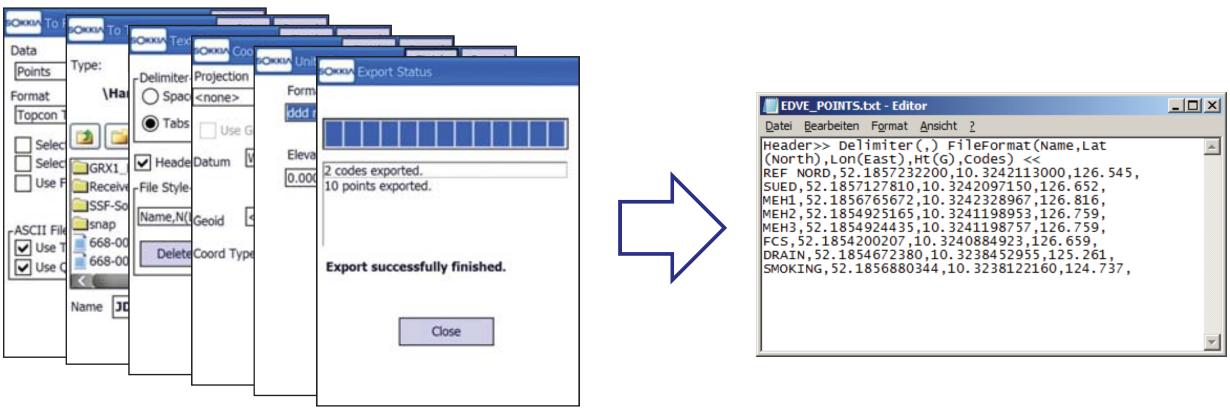
  - High risk of typing wrong numbers or mixing numbers

- Rough errors will be obvious in the flight inspection data and can be detected by Google Earth crosscheck in advanced

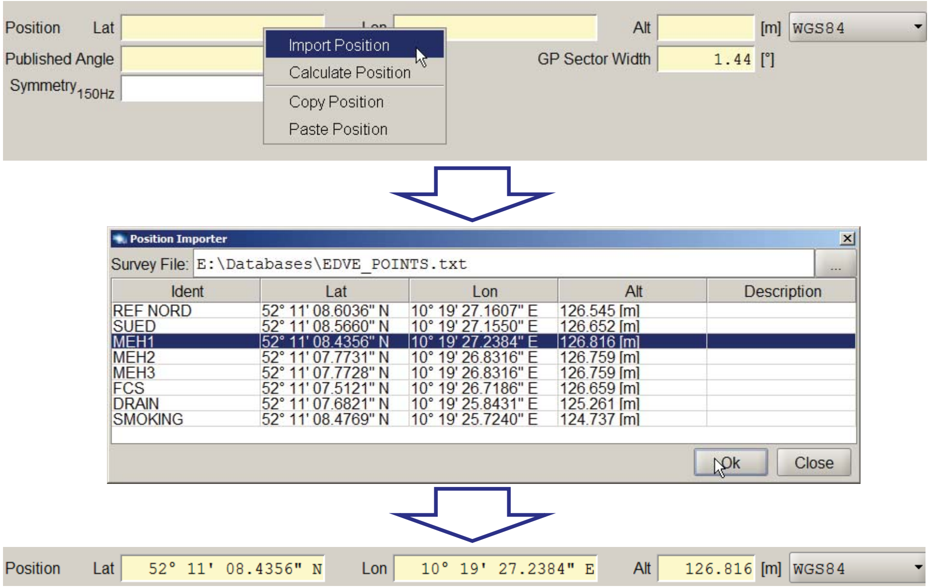
New Software Features
GPS Survey Import to Facility Database

- Small errors are more difficult to detect
- Solution:
  - Avoid the manual transfer of the survey data from the Sokkia equipment to the facility database

- Step 1: Export the survey data to a text file



- Step 2: Create an entry in the facility database
- Step 3: Import the Sokkia export file and select a survey point



Moving Facilities Calibration with AD-AFIS

Knuth Steffens

New Software Features

- The Idea:

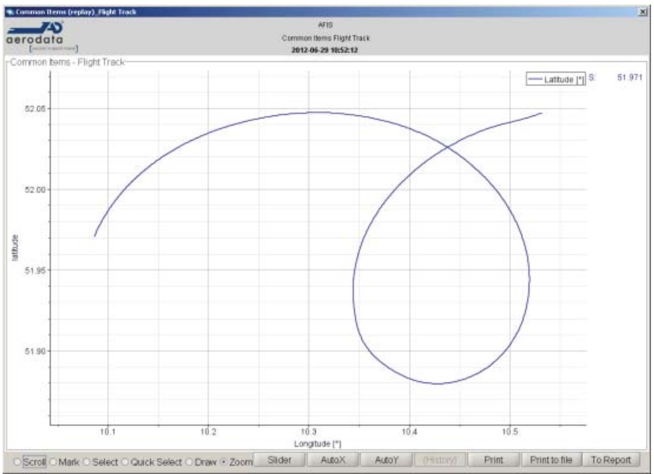
  – Flight Inspection of moving facilities, like TACAN or Radar Stations without placing a reference Station (like GMPU) on the carrier (ship).

  – Calculation of ships movement (Dead Reckoning) by track and speed to provide flight guidance and facility´s relative position

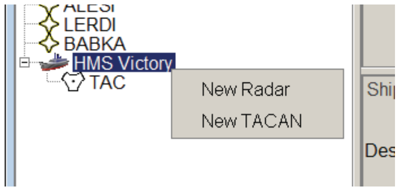
New Software Features

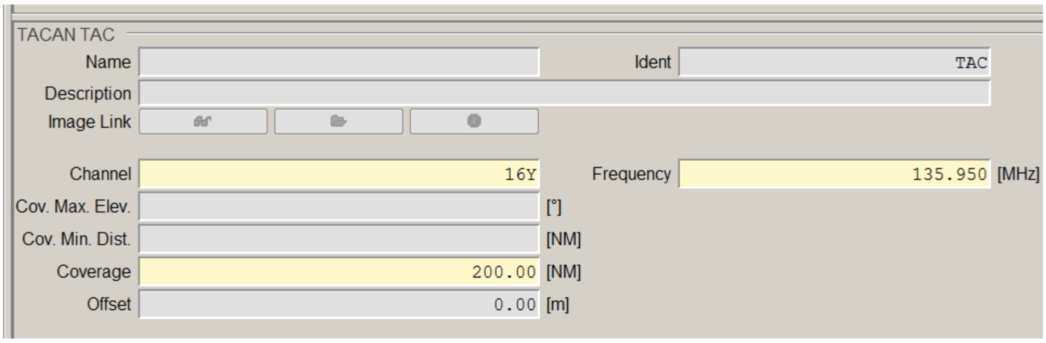
- The AD-AFIS Software:

  – Database
  – Calculations
  – Moving Facility Control
  – Procedure Setup
  – Graphics
  – Results



- Database:
  - Entries allowed for Radar and TACAN
  - No Facility Position is required

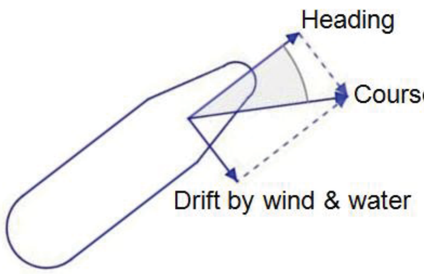




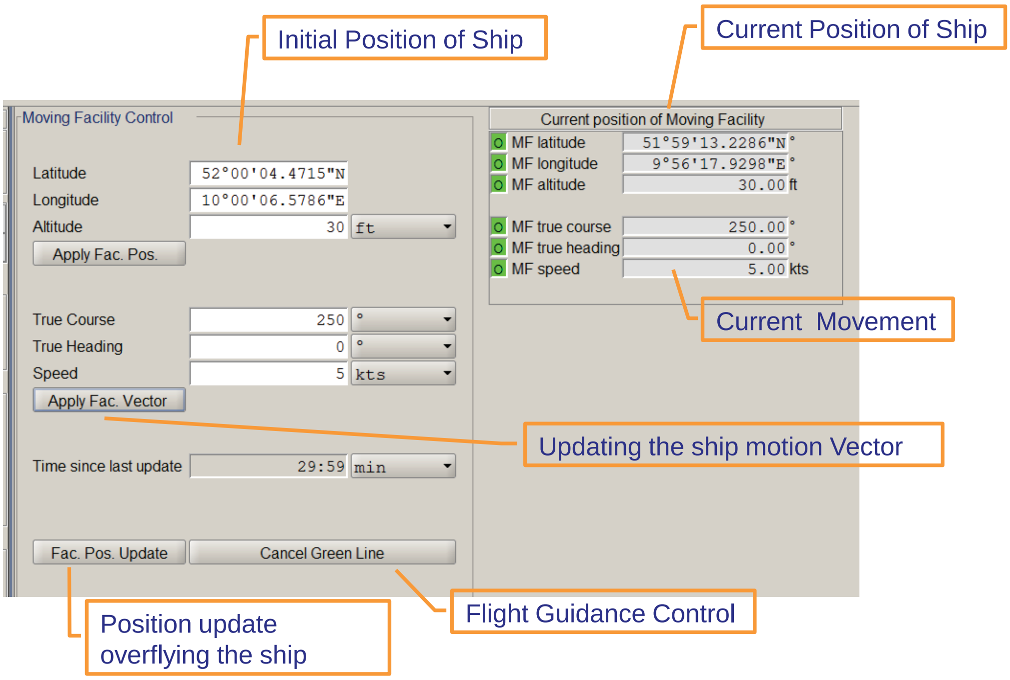
- Calculation:

The DR algorithm

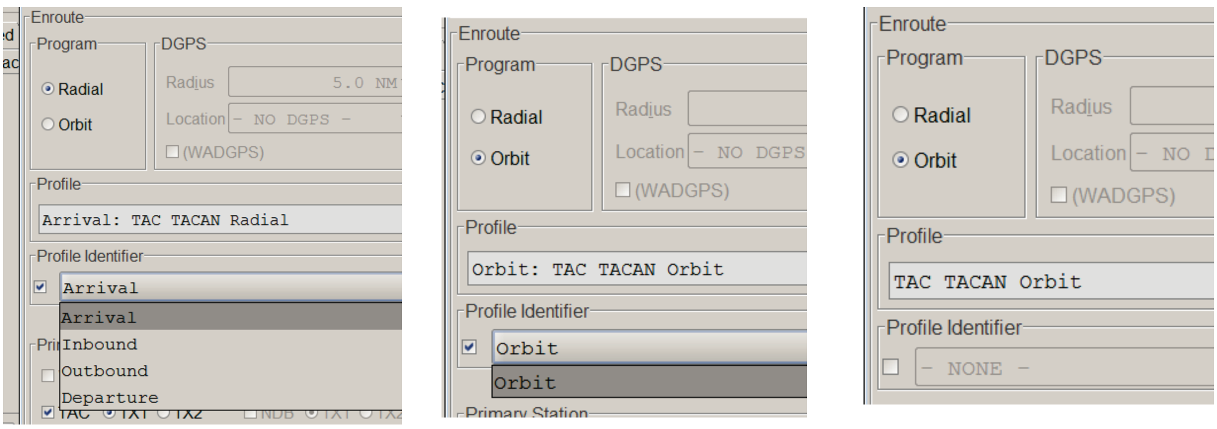
Beginning at a known ship position (manually entered or defined by the aircraft position when an update event is released) the ships position is calculated by integrating the ships speed vector (speed and course above ground). This calculation is done with **10Hz** and provides the current ship position.



- Moving Facility Control:

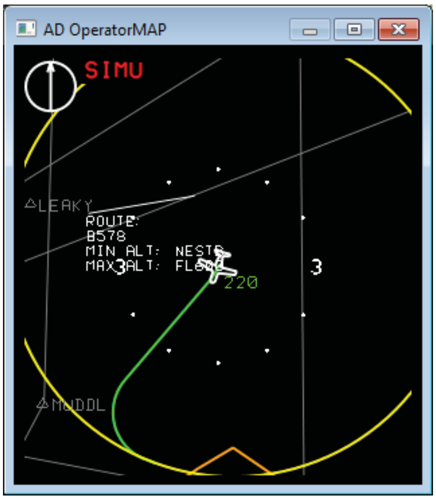


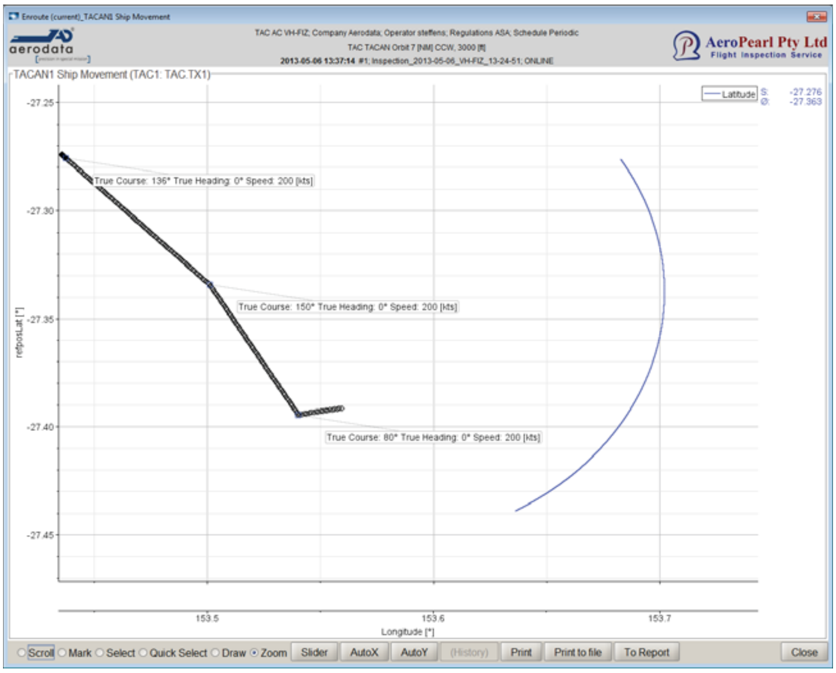
- Procedure Setup:
  - Orbit and Radial Setup
  - Additional Profile Identifier (for Final Report)
    - Radial:
      - Arrival, Inbound, Outbound, Departure, None



New Software Features

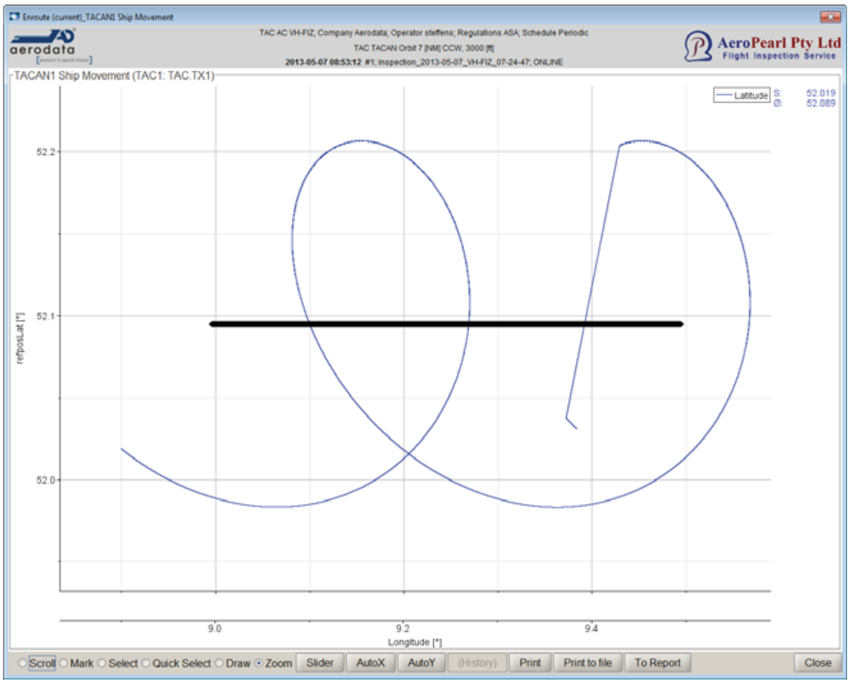
- Graphic (Examples):
  - Ship Track
  - Ship Movment
  - A/C Track





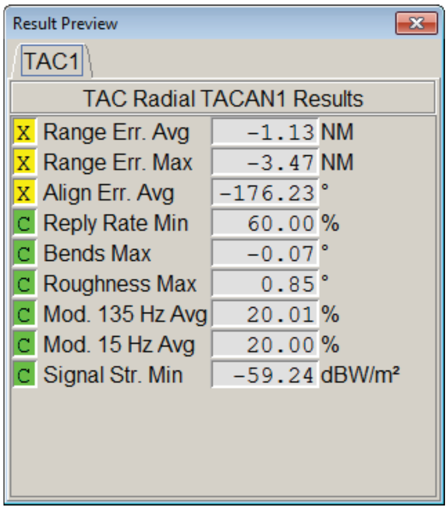
New Software Features

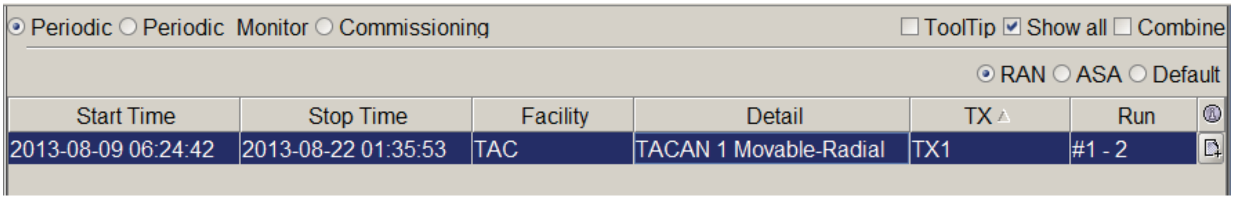
- Graphic (Examples):



New Software Features

- Results / Report:
  - Standard Results are created
  - Customized Reports possible





New Software Features

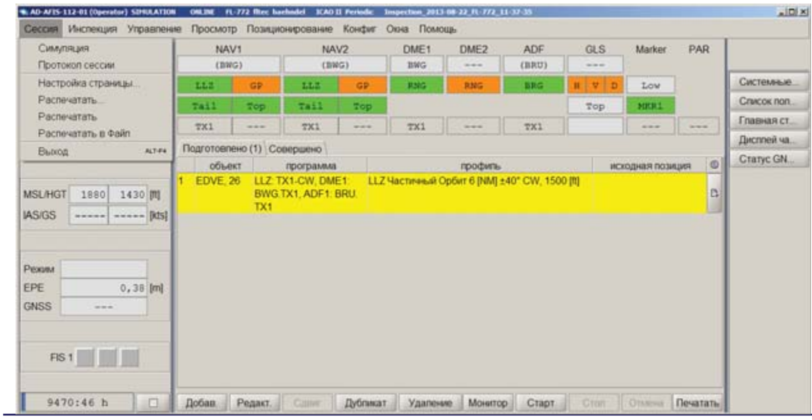
Russian GUI and Reports

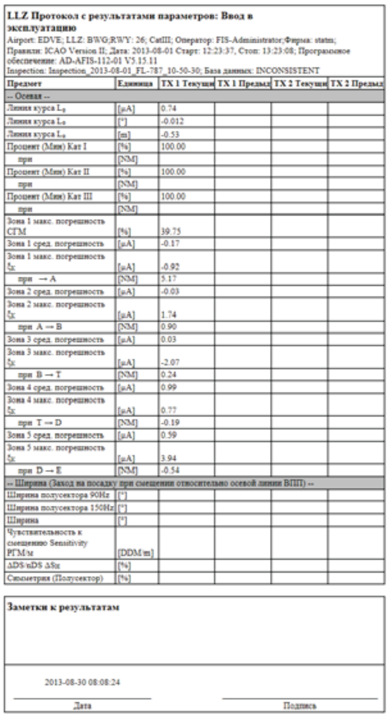
Thomas Hähndel

New Software Features

Russian GUI and Reports

- Extended multilingual AFIS. Available languages are now: English, German, Spanish and **Russian (new)**
- Menus, Dialogs and Reports are supported
- Switching between languages is possible (Alt-F1)





LLZ Протокол с результатами параметров: Ввод в эксплуатацию
Airport: EDVE; LLZ: BWG;RWY: 26; CatIII; Оператор: FIS-Administrator;Фирма: statm; Правили: ICAO Version II; Дата: 2013-08-01 Старт: 12:23:37, Стоп: 13:23:08; Программное обеспечение: AD-AFIS-112-01 V5.15.11
Inspection: Inspection_2013-08-01_FL-787_10-50-30; База данных: INCONSISTENT

Предмет	Единица	TX 1 Текущи	TX 1 Предыд	TX 2 Текущи	TX 2 Предыд
-- Осевая --					
Линия курса L_0	[µA]	0.74			
Линия курса L_0	[°]	-0.012			
Линия курса L_0	[m]	-0.53			
Процент (Мин) Кат I	[%]	100.00			
при	[NM]				
Процент (Мин) Кат II	[%]	100.00			
при	[NM]				
Процент (Мин) Кат III	[%]	100.00			
при	[NM]				
Зона 1 макс. погрешность СГМ	[%]	39.75			
Зона 1 сред. погрешность	[µA]	-0.17			
Зона 1 макс. погрешность ξк	[µA]	-0.92			
при → A	[NM]	5.17			
Зона 2 сред. погрешность	[µA]	-0.03			
Зона 2 макс. погрешность ξк	[µA]	1.74			
при A → B	[NM]	0.90			
Зона 3 сред. погрешность	[µA]	0.03			
Зона 3 макс. погрешность ξк	[µA]	-2.07			
при B → T	[NM]	0.24			
Зона 4 сред. погрешность	[µA]	0.99			
Зона 4 макс. погрешность ξк	[µA]	0.77			
при T → D	[NM]	-0.19			
Зона 5 сред. погрешность	[µA]	0.59			
Зона 5 макс. погрешность ξк	[µA]	3.94			
при D → E	[NM]	-0.54			
-- Ширина (Заход на посадку при смещении относительно осевой линии ВПП) --					
Ширина полусектора 90Hz	[°]				
Ширина полусектора 150Hz	[°]				
Ширина	[°]				
Чувствительность к смещению Sensitivity РГМ/м	[DDM/m]				
ΔDS/nDS ΔSx	[%]				
Симметрия (Полусектор)	[%]				

Заметки к результатам

2013-08-30 08:08:24
Дата　　　Подпись

New Software Features

Receiver Calibration Enhancement

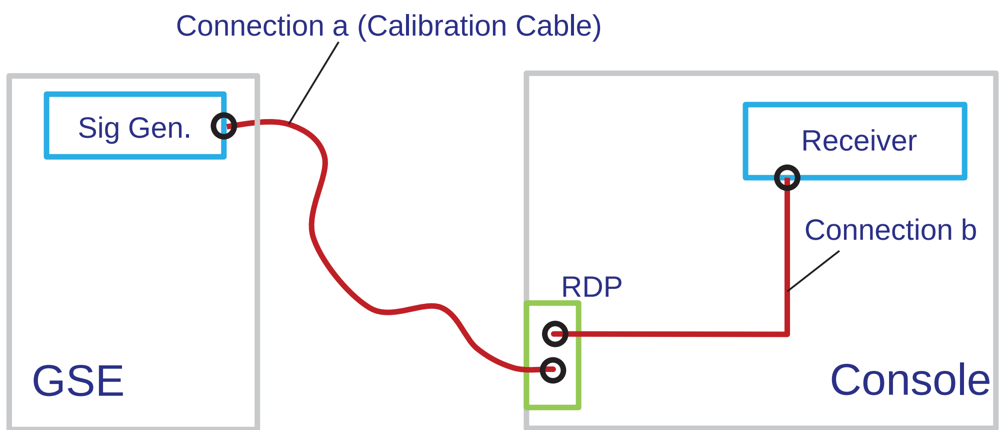
Andreas Kleffmann

Objective for Receiver Calibration:

Improve determination and operation
on cable losses for
fixed and changeable connections

Overview

Calibration using external Signal Generator



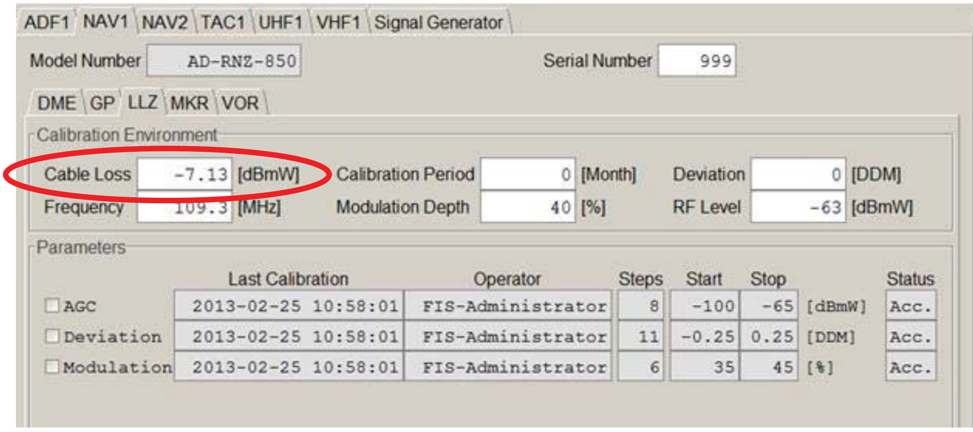
For calibration the cable loss between
Signal Generator and Receiver must be known

Previous Cable Loss Setup:

Only one entry for Cable Loss between

Signal Generator and Receiver

Calibration Loss = Cable Loss (connection a + connection b)

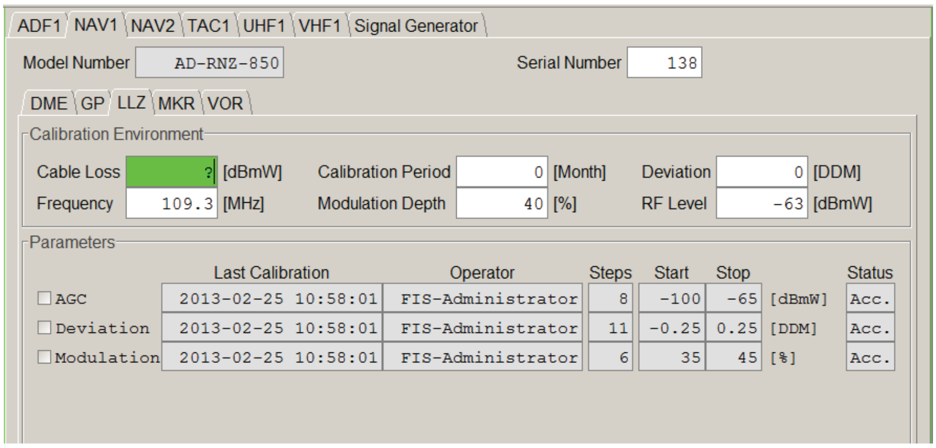


On change of the external cable:

How does the operator determine the

new cable loss?

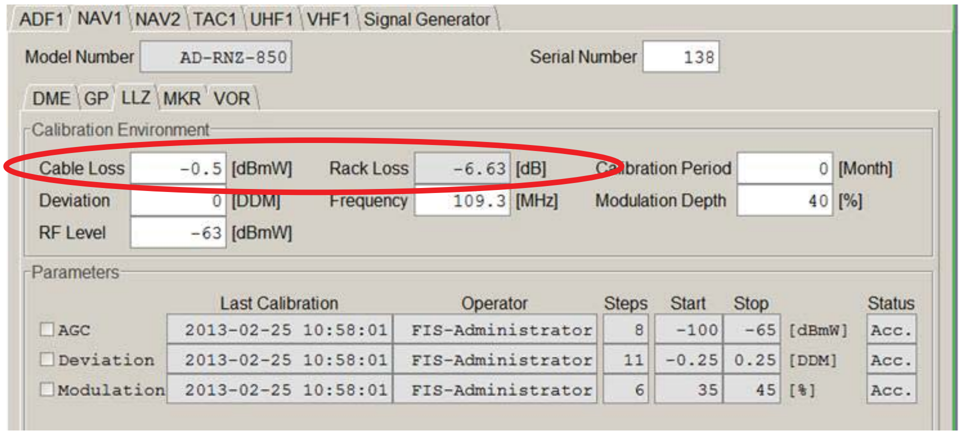
Calibration Loss = Cable Loss (connection a + ?)



Enhanced Cable Loss Setup:

Separated entries for cable loss of calibration cable and fixed rack connection

Calibration Loss = Cable Loss (connection a) + Rack Loss (connection b)



Enhanced Cable Loss Setup

Cable Loss – Loss of the external calibration cable
- Measured by Aerodata for delivered cable
- Part of Calibration Setup
- **Changeable by Operator**

Rack Loss – Loss of fixed connections
- Measured by Aerodata
- Part of Equipment Database
- **Not changeable by Operator**

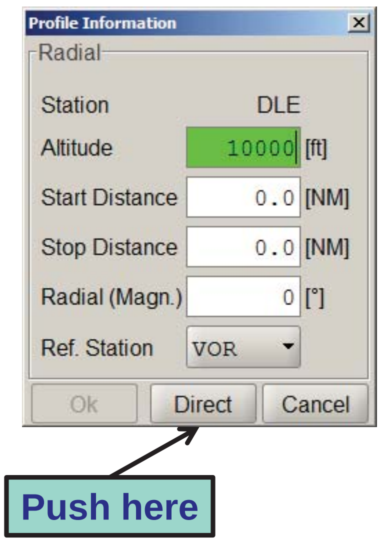
„Direct“ Procedure

From the present A/C position it is possible to automatically set up

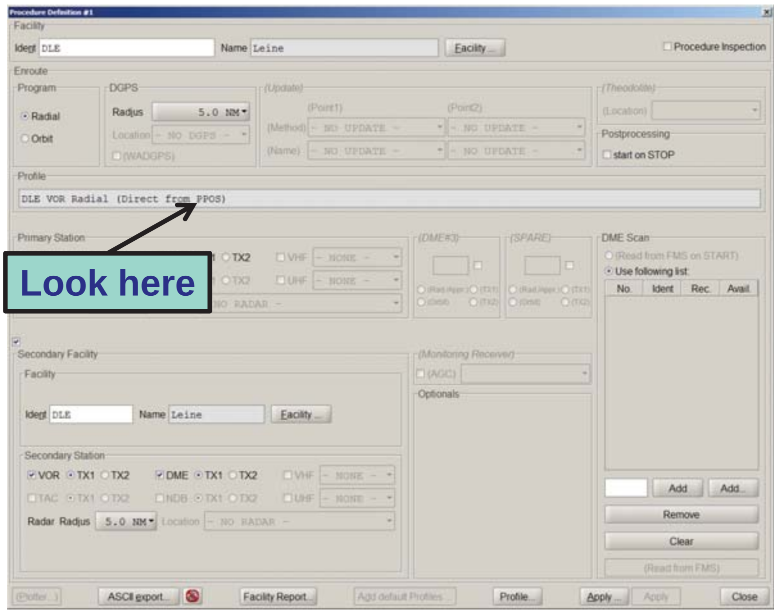
- a **TO** radial towards any type of facility
  - START: Present Position, STOP: Facility
- a **FROM** radial away from any type of facility
  - START: Present Position, STOP: Coverage
- an orbit around any type of facility

- The Start/Stop/Altitude/Radius settings are computed when the procedure becomes active

„Direct“ Procedure

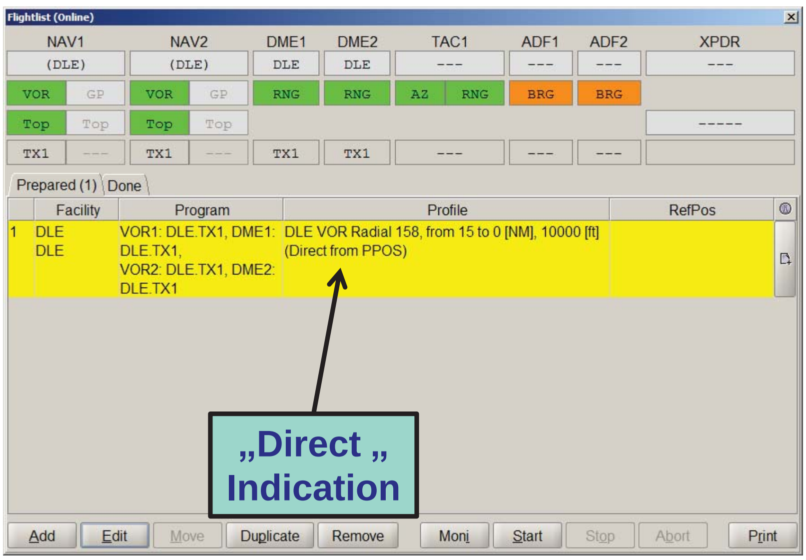


„Direct“ Procedure



„Direct“ Procedure

- Special Entry in Flightlist
- Updated on „Activate“ (yellow)



„Direct“ Procedure

#1 DLE, Leine #2 DLE, Leine AC B-00101; Company TWCAA; Operator Jagieniak; Regulations FAA; Schedule Periodic

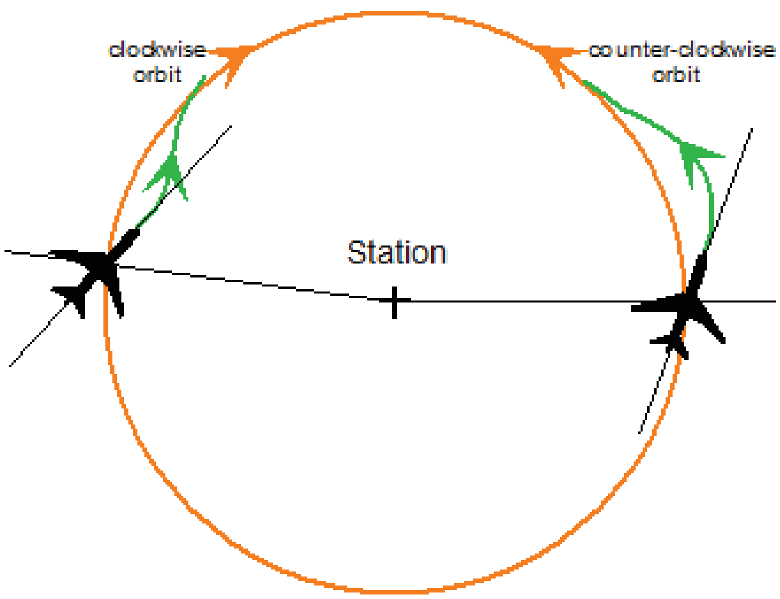
DLE VOR Radial 158, from 15 to 0 [NM], 10000 [ft] (Direct from PPOS)

2013-08-16 09:23:01 #1; Inspection_2013-08-16_B-00101_09-20-21; SIMU; ONLINE

„Direct „ Indication

„Direct“ Procedure

- Example: Automatic Decision for CW/CCW Orbit



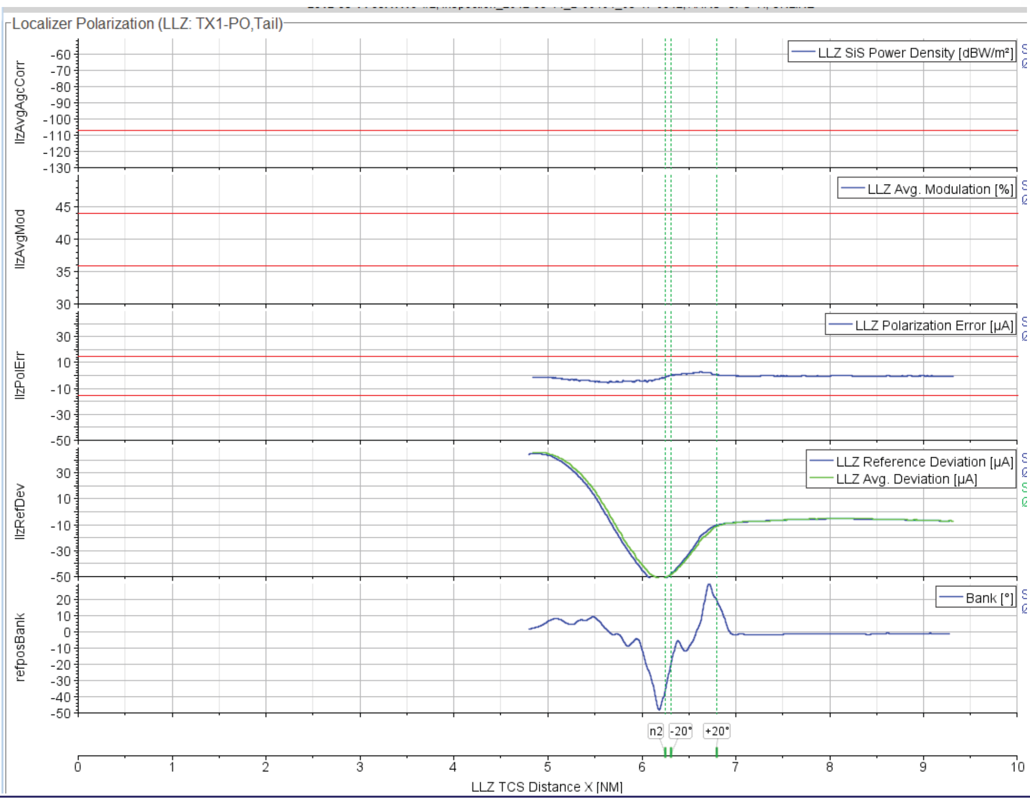
Localizer Polarization

Knuth Steffens

LLZ Polarization

- The LLZ polarization check is conducted to determine the effects of undesired vertically polarized signal components (ICAO Doc 8071)
- The purpose of this check is to determine the effects that vertical polarization may have on the course structure (FAA 8200)
- Flight Inspection Procedure:
  - Bank the Aircraft 20 degrees left and right within the coverage area of the antenna while flying on-course.
  - Monitor the deviation error

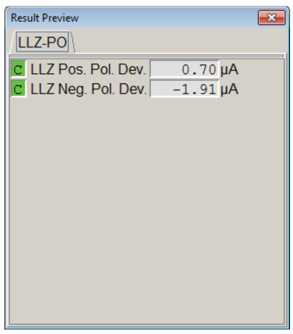
LLZ Polarization



LLZ Polarization

- How to evaluate the data?
  - Use the graphic and do manual check, if values are out of tolerance
  - Do a numerical evaluation, but how?
    - Simple Spot value? Maximum Value?
    - Mean Value calculation?
    - Complex statistics?
  - **First Try: take a mean value around the +-20°**

Coverage 10NM	[dBW/m²]			
Coverage Threshold	[dBW/m²]			
-- Polarization --				
+20° Polarization	[µA]	0.704	0.704	
+20° Polarization	[DDM]	0.001	0.001	
-20° Polarization	[µA]	-1.914	-1.914	
-20° Polarization	[DDM]	-0.002	-0.002	
-- Engineering --				
Modulation Balance	[µA]			



  - But, is it the truth? Any suggestions?

CPDLC

Controller-Pilot Data-Link Communications

Marcel Hoffmeister

- Classic communication between ATC and pilots: voice radio
  - VHF
  - HF
- Problem:
  - Many pilots tuned to one station
    - Maximum of possible A/C on one station
    - Risk of override another pilot
- Classic solution: dividing ATC sector
  - Problem:
    - Increasing “handover traffic”
    - Number of possible voice channels in high density airspace is limited

- Modern solution: CPDLC
  - Air-ground data communication for ATC service
  - Predefined messages (clearance / information / request) + additional “free text” capability
  - DCDU Simulator (Collins FMS 3000): http://www.eurocontrol.int/sites/default/files/content/visuals/mini-sites/link2000/mcdu_rockwellcollins_1_1.html

- Implementations:
  - FANS-1/A
    - Originally deployed in South Pathific and North Atlantic
    - Based on ACARS (Aircraft Communications Addressing and Reporting System) using VHF, HF or satellite
    - Mainly by satellite communication
  - Eurocontrol Link 2000+
    - ICAO Doc 9705 compliant
    - In many European Flight Information Regions (FIRs)
    - VDL Mode 2 (VHF Data Link)
    - All new aircraft operating above FL285 to be equipped since 2011
    - All existing aircraft operating above FL295 to be retroffited by Feb 2015

- Discussion:
  - Flight Inspection necessary?
  - How to flight inspect CPDLC?

Video Camera / Recording in Cockpit:

Frank Musmann

Discussion New Features and Functions
Camera In Cockpit

Video Camera in Cockpit:

Possible Applications:

- Documentation of Approach Light Systems during flight inspection

- Automatic Event Trigger on PAPI Approaches
  (Automatic Detection of Light Transitions)

Discussion New Features and Functions
Camera In Cockpit

Video Camera in Cockpit:

Possible Solutions:

- Small HD Cameras (various models available)
  - Various Mounting Options

<u>Video Recorder:</u>

Possible Solutions:

- HD Solid State Video Recorder
  - HDMI / VGA
  - Recording on Compact Flash

Is there a demand for a Cockpit Camera?

<u>Receiver Calibration Schedule</u>

- Current Procedure for Receiver Calibration
  - Calibrate Receivers according Maintenance Manual
  - Execute calibration without checking of necessity

- Every Receiver Calibration means
  - High workload
  - Blocked Aircraft during calibration
  - Risk of failures

Alternative: Calibration depending on Receiver Check

If all parameters are inside the limits

Is it really necessary to calibrate?