

Synthetic Vision Systems Workshop

Operational Considerations

Presented to: SVS Workshop Attendees

By: Terry Stubblefield, AFS-410

Dick Temple, AFS-410

Ernie Skiver, AFS-410

Date: February 14-16, 2006

Seattle, WA (SVS_Workshop_Feb06.ppt)



Federal Aviation
Administration



SVS OPERATING CONSIDERATIONS (1)

- **Fixed-wing and rotary-wing aircraft**
- **Intended functions (presentations, potential conflicts, informational differences, pilot actions, how situations resolved)**
- **Increased situational awareness (traffic, terrain, obstructions, etc.)**
- **Intuitive (display comprehension, ease of training, etc.)**
- **Primary source of information or independent monitor (ground and airborne operations)**
- **Normal and non-normal operations and procedures (standard airport equipage, airborne and ground procedures, engine inoperative procedures, etc.)**
- **Special environmental considerations (non-operating hours, noise, wetlands, etc.)**
- **Mitigating SMGCS equipment/procedures for less than 1200 RVR operations (taxiway lighting, markings, procedures, surface radar, etc.)**
- **Dispatch planning (rescheduling, reduced divers and fuel load/burn, decreased holding and arrival delays)**

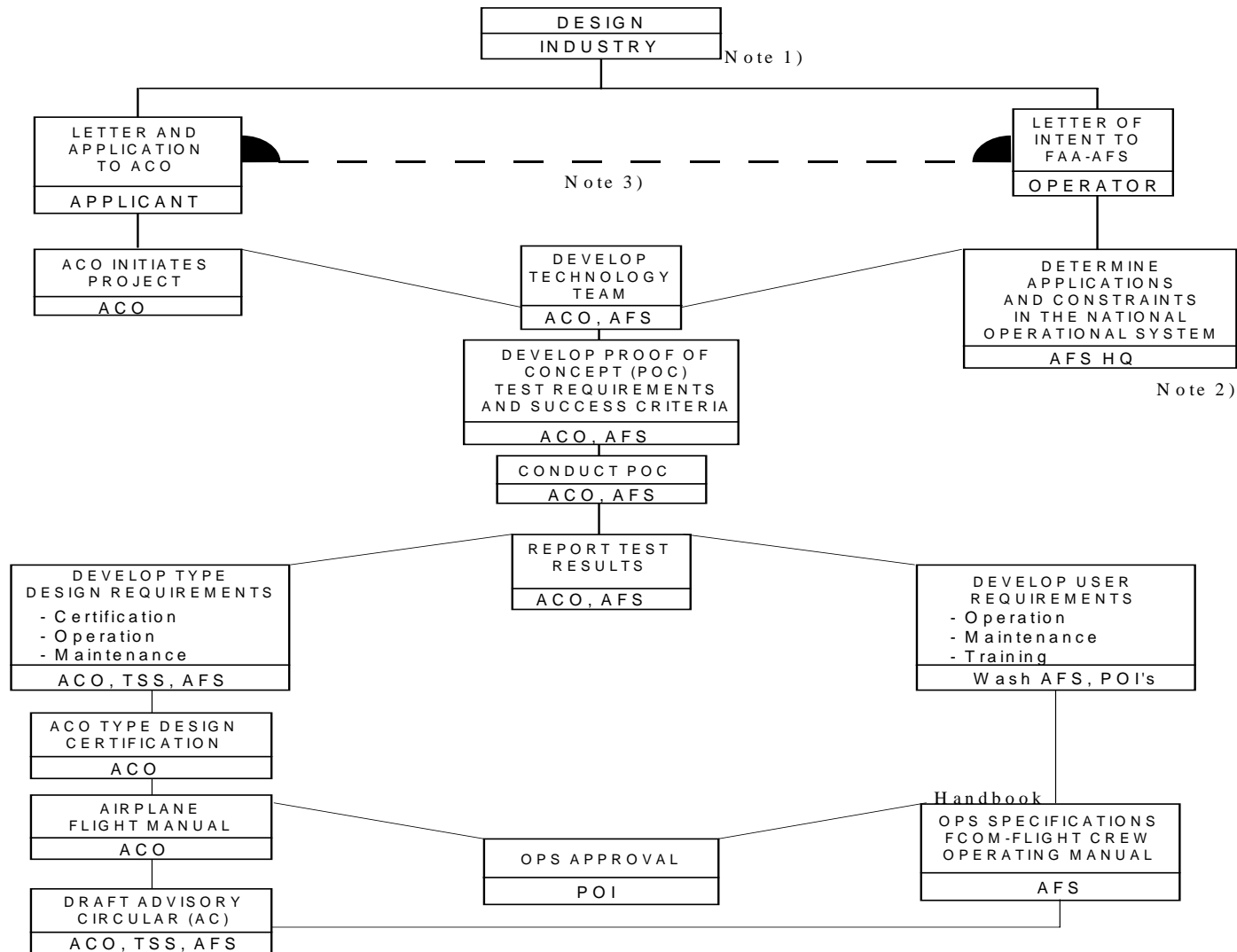
SVS OPERATING CONSIDERATIONS (2)

Proof-of-Concept Evaluation

- **Letter of intent**
- **Test plan**
(system definition, operational procedures, qualification, training, operating environment, normal and non-normal, flight crew, test subjects, test procedures, safety constraints, safety assessment criteria, data collection, analysis, simulator and test aircraft scenarios/requirements, resources, milestones etc.)



TECHNOLOGY DEVELOPMENT PROCESS



- Note:**
- 1) Further modifications to the applicant's original Type Design may require additional technology revisions and/or follow on Proof of Concept testing.
 - 2) The AFS group has the responsibility to coordinate with all Industry technology groups (ALPA, APA, ATA, ADF Industry, manufactures, vendors, DOD, NASA, etc.)
 - 3) Both the FAA ACO and FAA AFS should be contacted to provide certification and operational data to the respective offices.

Index: ACO - Aircraft Certification Office (Including Aircraft Evaluation Group)
 AFS - Washington Flight Standards Policy Office
 TSS - Transport Standards Staff

RRD7/19/94



SVS APPLICATIONS (1)

Operational concept during –

- a. Taxi
- b. Takeoff
- c. Cruise
- d. Approach
- e. Landing and Rollout
- f. Day/night
- g. IMC/VMC
- h. Low visibility conditions



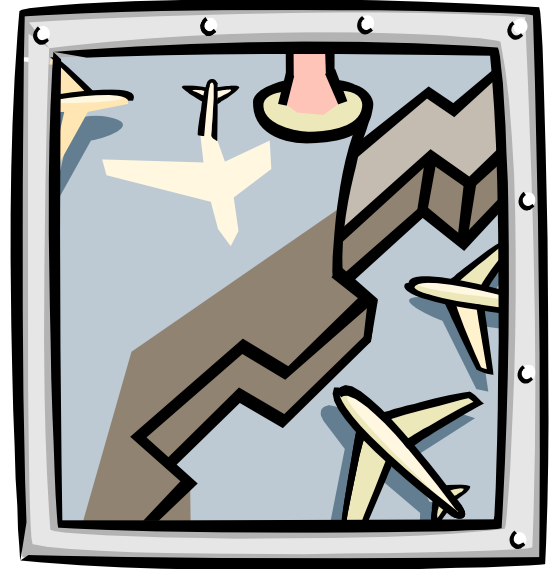
Proposed operational credit --

- a. Non-precision approaches (straight-in , circling, etc.)
- b. Category I, II, III, and CAT II on Type I ILS airborne operations
- c. Taxiing (reduced lighting, inadequate fillets, etc.)
- d. Takeoff (Type I, II, and III ILS ground facilities)
- e. Airport equipment (reduced requirements)

SVS APPLICATIONS (2)

Airport Equipment/Facilities

- a. no ALSF-1 or ALSF-2 approach lights
- b. no touchdown zone lights
- c. no runway centerline lights
- d. unrestricted facility (std CAT I minima, no obstacles, acceptable beam performance, RVR sensors, etc.)
- e. no backup LOC or GS transmitters
- f. no marker beacons or compass locators
- g. no control lines (landline communications for monitoring in ATCT)
- h. no localizer far field monitor
- i. runways flight inspected to point D or E (touchdown zone and 2,000 ft from far end of runway)
- j. ILS reliability
 - Continuity of service (MTBO)
 - Beam performance
 - Monitoring (operating ATCT, critical area protection, etc.)



SVS APPLICATIONS (3)

Category I, II, III operations –

- a. How SVS will be used
- b. Required airborne systems (autothrottles, etc.)
- c. Automatic flight control and landing systems
- d. Flight director systems
- e. Head-up and/or head-down display systems
- f. Hybrid displays (merge with EVS or other sensors/systems)
- g. Required navigation performance (RNP) criteria apply?
- h. Use of Minimum Descent Altitude/Height (MDA(H))
- i. Use of Decision Altitude/Height (DA(H))
- j. Use of Alert Height (AH)
- k. Fail Passive and Fail Operational Landing Systems
- l. Transition from inside/outside cockpit

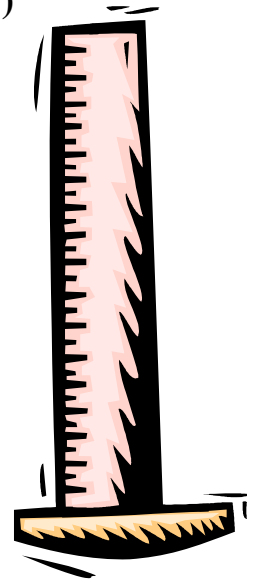


Unusual attitude recovery/Upset maneuvers?

- a. Display presentation (symbology, field of view, etc)
- b. SVS recovery procedures from standard recovery procedures
- c. Crew response and procedures

SVS SYSTEM PERFORMANCE

- **Position information –**
 - a. **Derived from database (comparison, accuracy, integrity, update rate, and real-time monitoring), radar, EVS, sensor information, other information or methodologies)**
 - b. **Location and accuracy of runway end information**
 - c. **Location and accuracy of terrain and obstacle information (detection, assessment, display, and avoidance/separation)**
 - d. **Compatibility or agreement with other systems (TAWS, EGPWS, FMS, etc.)**
 - e. **Crosschecking of aircraft's actual & displayed position (updated and verified by?)**
 - f. **Flight guidance**
- **System Reliability and Repeatability**
- **System failure modes (operational impacts/considerations)**
- **Sensor attributes and limitations (type of sensor, limitations, operating range, etc.)**



SVS CREW TRAINING and QUALIFICATION

- a. **Initial, recurrent, upgrade, differences, requalification training (non-precision, precision, low visibility conditions, etc.)**
- b. **Taxi, takeoff, cruise, approach, landing and rollout (day, night, IMC, VMC, and low visibility conditions)**
- c. **Ground, simulator, and flight training curriculum (maneuvers, procedures, sensor operating ranges, attributes, limitations, etc.)**
- d. **Recency of experience**
- e. **Multiple aircraft type or variant qualification**
- f. **High Limit Captain procedures**
- g. **Special qualification airports**
- h. **Crew briefings, coordination, monitoring, callouts, roles, responsibilities, etc.**



SVS DISPLAY (1)

- **Cockpit or Helmet-mounted**
- **Single or multiple displays**
 - a. HUD
 - b. HDD
 - c. PFD
 - d. ND
 - e. EFB
 - f. Repeater/monitor location
- **“Highway in the Sky” (HITS) tunnel or rail or steps, etc. display (phases of flight)**
 - a. operational concept (IFR/VFR)
 - b. where and when tunnel appears and disappears
 - c. presentation and appearance (clutter, etc.)
 - d. dimensions (ground, airborne)
 - e. guidance to/from tunnel
 - f. tunnel size (taxi, takeoff, cruise, approach (FAF and at minimums), landing and rollout



SVS DISPLAY (2)

Characteristics

- a. Conformal or non-conformal
- b. Egocentric or exocentric
- c. Field of view (cruise 90 deg., approach 45-60 deg., other perspective elements, etc.)
- d. Symbology (basic and optional, flight path vector, guidance cue, course lines, fixes, icons, special-use airspace, TFR's, etc.)
- e. Alerting functions, image brightness, contrast, declutter, resolution, registration, zooming, etc.
- f. Terrain presentation (wire, photo-realistic, texturing, etc.)
- g. Deviation indicator (left/right/above/below)
- h. Trend indicator (10-60 sec. barb/stinger)
- i. Panel location



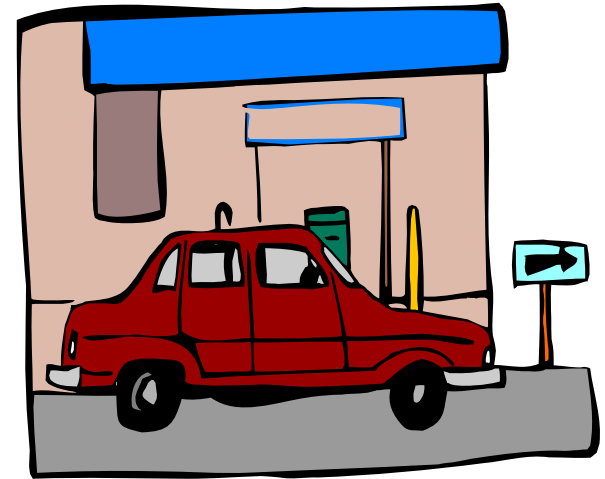
SVS GUIDANCE MATERIAL (develop or revise)

- **Rulemaking (Parts 23 and 25, 91.175, 121.651, and 135.225, 125 and 129 operators, etc.)**
- **Operations specifications (takeoff C078, CAT II C059, CAT III C060, new OpSpec, etc.)**
- **Advisory Circulars**
 - a. **CAT II 120-29A**
 - b. **CAT III 120-28D**
 - c. **Surface Movement Guidance and Control System 120-57A**
 - d. **New SVS AC**
- **Orders, Handbooks, and Policy Letters**
- **RTCA SC develop MOPS and MASPS?**
- **Airplane flight manual (AFM)**
- **Flight operations manual (FOM)**
- **Pilot operating handbook (POH)**
- **Quick reference handbook (QRH)**



SVS MAINTENANCE

- **Reporting procedures**
- **Repair procedures**
- **Downgrading**
- **Return to service**
- **Minimum equipment list**
- **Continued airworthiness evaluation**
- **Training**
- **Record-keeping**



SVS MISCELLANEOUS ITEMS

- **Personnel**
- **Resources**
- **Budget**
- **Timelines**
- **Coordination (other FAA LOBs and aviation organizations)**



Flight Standards Points of Contact

Terry Stubblefield **202-385-4588**

Dick Temple **202-385-4611**

Ernie Skiver **202-385-4616**

