Dukungan BPPT pada Inovasi Teknologi Bidang Kedirgantaraan

FGD Balitbang Kementerian Perhubungan

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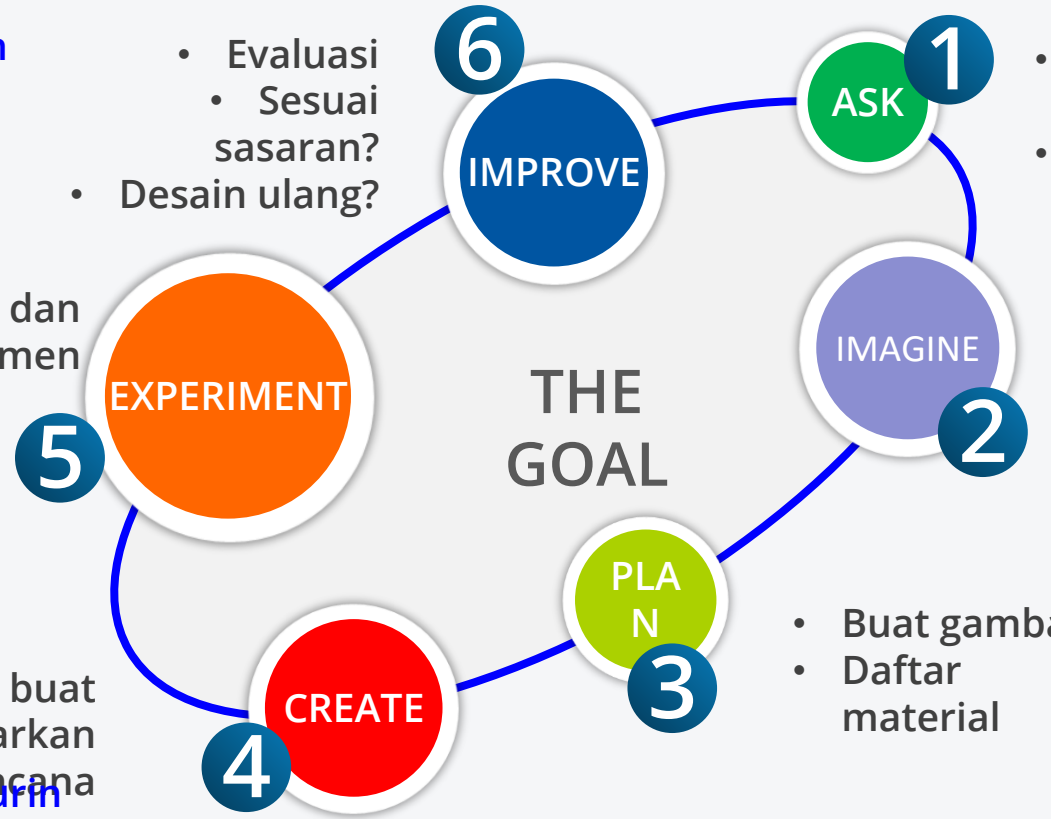
Direktur Pusat Teknologi Industri Pertahanan, BPPT

Surabaya, 25 September 2019

Kerangka

- PROSES DESAIN & REKAYASA
- PERAN DUKUNGAN BPPT
- UJI YANG DILAKUKAN DI BPPT
- PENUTUP

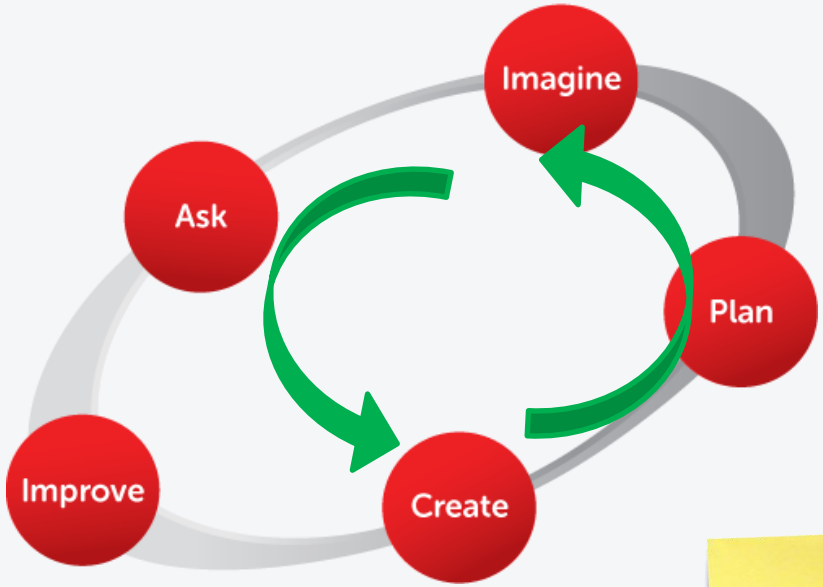
PROSES DESAIN REKAYASA



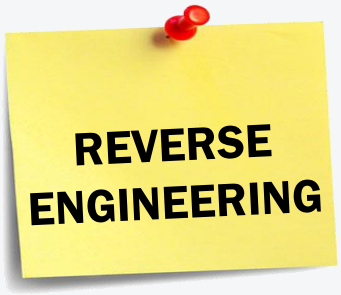
- Design Requirement & Objective (DRO)
- Tentukan masalah
- Tentukan kondisi batas
- Conceptual Design
- Terapkan ilmu
- Curah pendapat (brainstorming)
- Tetapkan solusi
- Basic Design to Detailed Design
- Buat gambar
- Daftar material
- Manufacturing: Prototype to industrial scale
- Coba buat berdasarkan rencana
- Operation Testing & Evaluation (OTE)
- Pengujian dan eksperimen
- Certification
- Evaluasi
- Sesuai sasaran?
- Desain ulang?

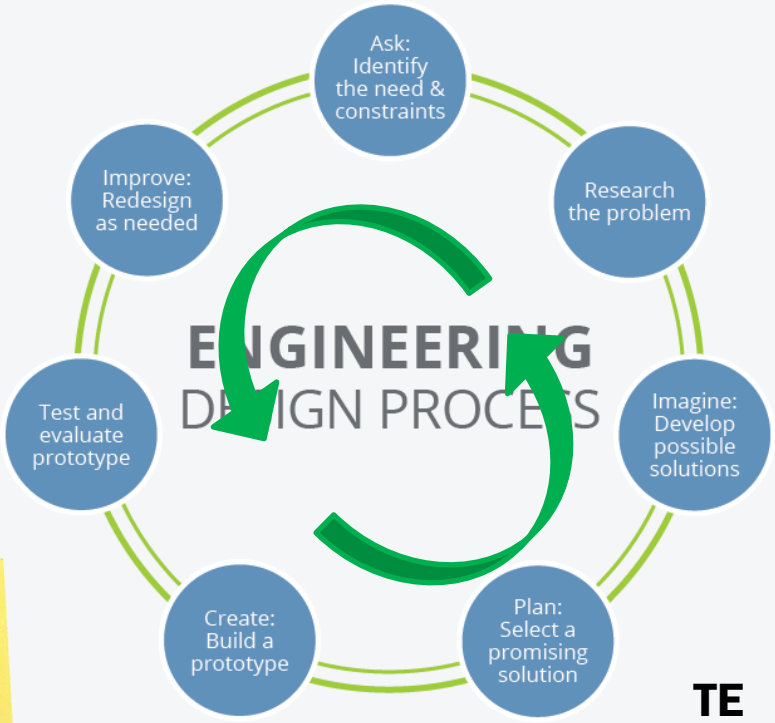
NASA

ALTERNATIF PROSES DESAIN REKAYASA



EIE





TE

Capaian Pembangunan Kemampuan Industri Dirgantara

R & D

Kerja sama BPPT-IPTN , 1976 - 1999

R,D,E & O

D,E & O

E & O

N2130

Tahap 4 : Penelitian Keindustrian

2004

1999

N250

Tahap 3 : Pengembangan Teknologi

Roll out 1994 ,
First Flight 1995

Dua flying prototip PA1 dan PA2, total 800 jam uji terbang.
Program dihentikan sebagai syarat IMF

1989

tahap 2 : Integrasi Teknol

CN235

out , First Flig 983

Merpati , TNI-AU
United Arab Emirates AF
Tentara Udara Diraja Malaysia
Tentara Udara Diraja Brunei Darussalam
Ministry of Agricultures, Royal Thailand
Republic of korea AF
Pakistan AF
Argentina AF
United States Coast Guard

NC 212

1980

Tahap 1: Pengenalan Teknologi

Roll out , First Flight 1976

Merpati , Pelita ,
Deraya, Boulaq
TNI-AU , TNI-AL,
TNI-AD, POLRI

1976

1976 1980 1989 1999 2004

Capaian Pembangunan Industri Dirgantara 1976 - 1997

Sumber Daya Fasilitas

Simulator sistem terpadu Pesawat Terbang

N2130

2004

Tahap 4 : Penelitian Keindustrian

Flight Test Center

Engineering Flight Simulator

Laboratoria Aero- gas dinamika , & Getaran , BPPT

N250

1999

Tahap 3 : Pengembangan Teknologi

Roll out 1994 , First Flight 1995

Lab CFD , ITB

Lab CSD , ITB

Program S3 / Kerja sama riset

Laboratoria Uji Konstruksi BPPT

1989

tahap 2 : Integrasi Teknologi

CN235

Roll out , First Flight 1983

Simulator Sistem Pesawat ITB

NC 212

1980

Tahap 1: Pengenalan Teknologi

Roll out , First Flight 1976

Lab Terbang LIFT , ITB

Kurikulum S2 distandard Internasionalkan

Lab Aerodinamika ITB

Lab Struktur Ringan ITB

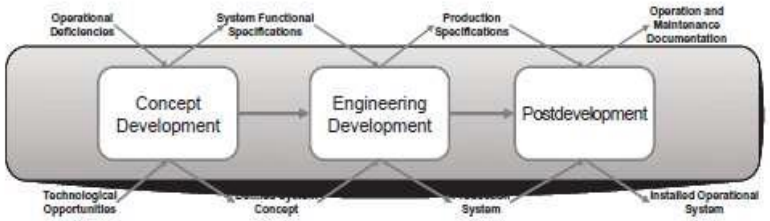
Kurikulum S1 distandard Internasionalkan

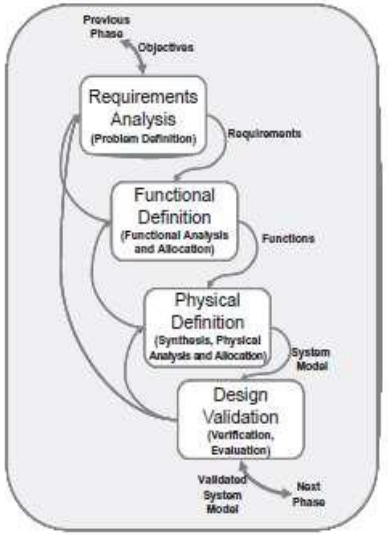
1976

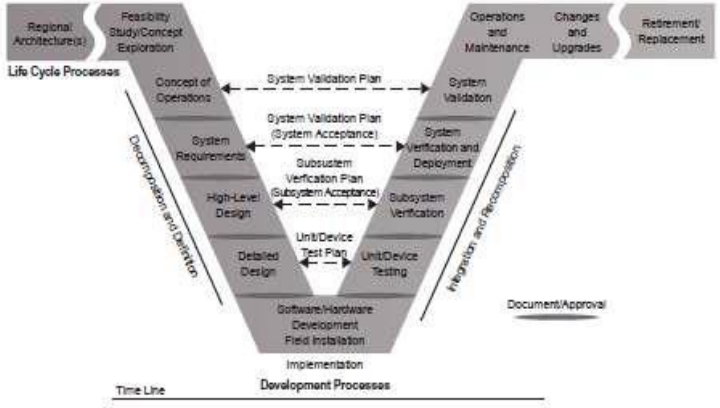
Pembangunan STM dan Politeknik Penerbangan

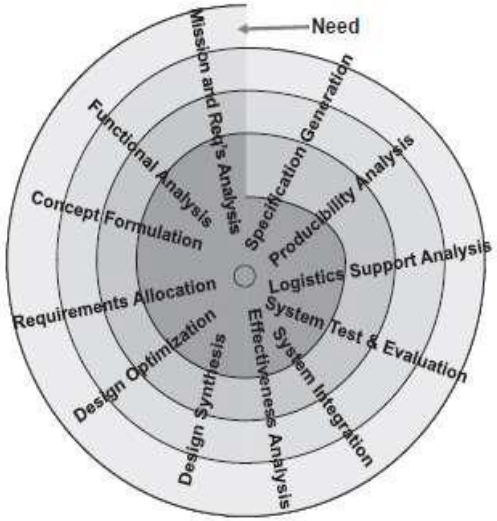
Sumber Daya Manusia

System Engineering Approach

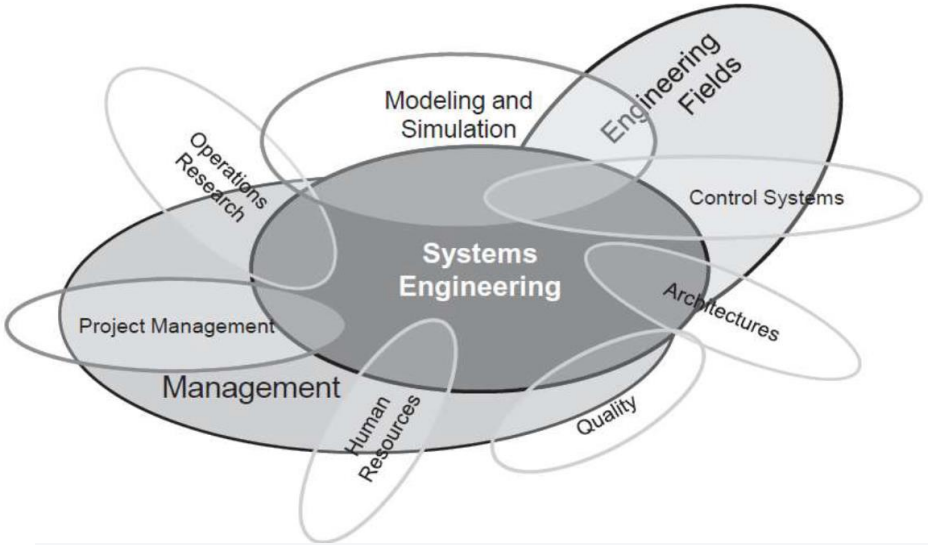








System Engineering Fields

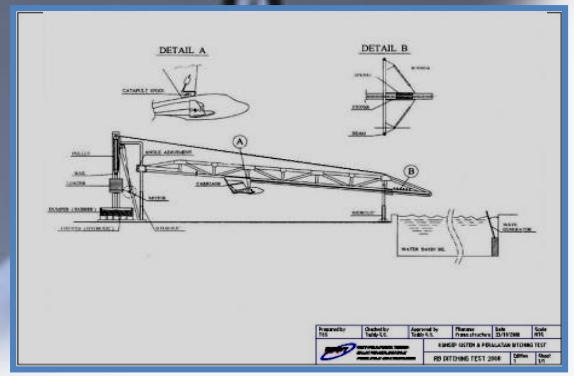


Alternatif Bangkit Kembali dengan Pengembangan Pesawat N-219

N219 is a 19-pax commuter aircraft designed to meet Indonesian geographical conditions (archipelago, mountainous, hilly) and infrastructure in a relatively remote area (short and unprepared runway).

Aerodynamic Wind Tunnel Test

Design and Development of Ditching Test Equipment.
Ditching Test.



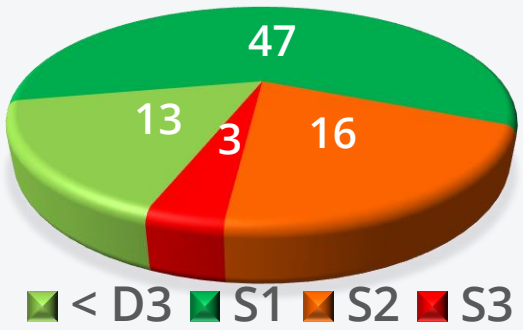
Peran Dukungan BPPT
di dalam Penguasaan Teknologi
Penerbangan

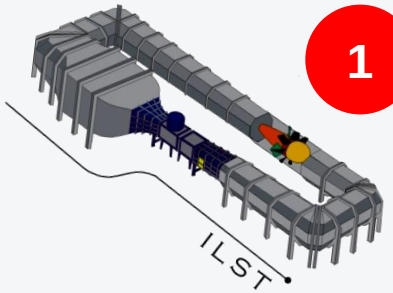
BBTA3 (LAGG)

LABORATORIA UJI PENDUKUNG INDUSTRI DIRGANTARA

BBTA3: SUMBERDAYA

♀ 12 ♂ 67





1

AERODYNAMICS

(30 years of experiences)

ILST, LIWET, LSWT, PIV, Hotwire

2

AEROELASTICS

(20 years of experiences)

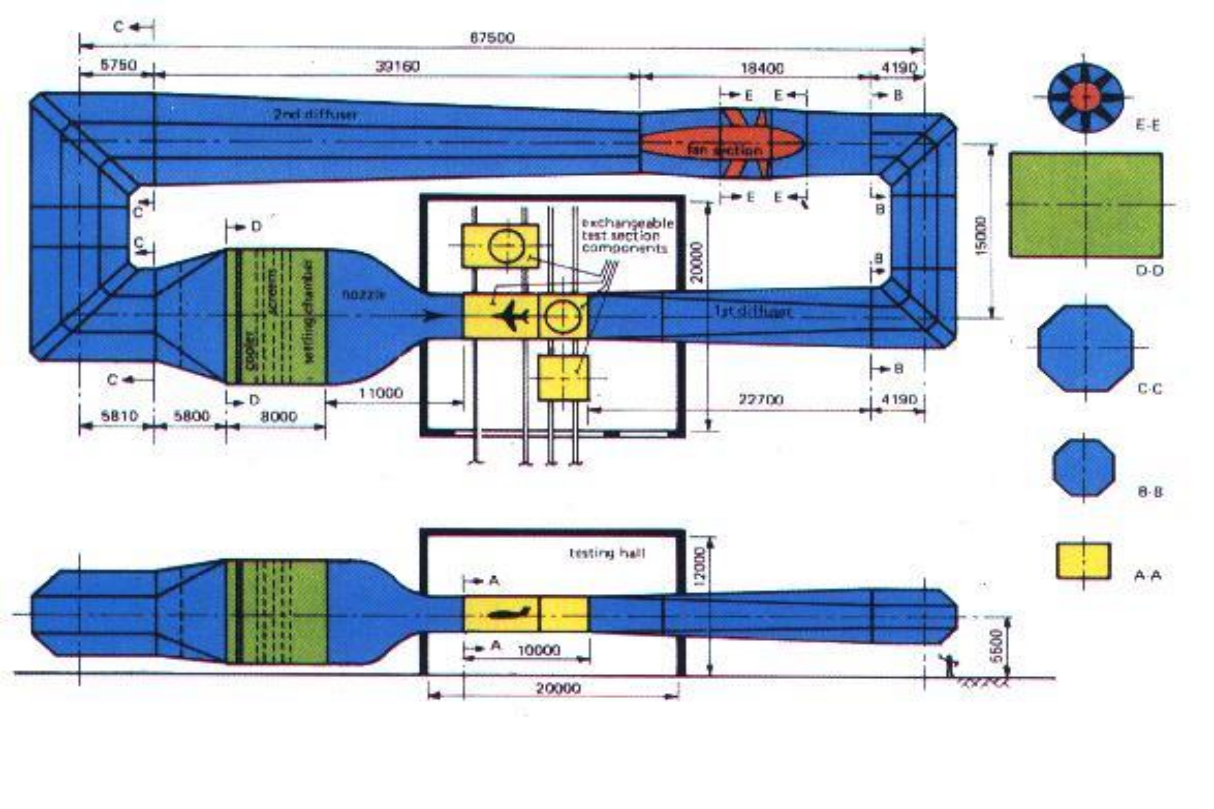
3

AEROACOUSTICS

Masih mengembangkan:

- SDM
- Metoda
- Peralatan

Uji Aerodinamik
di Laboratory Facility
Aero-Gasdynamic and Vibration

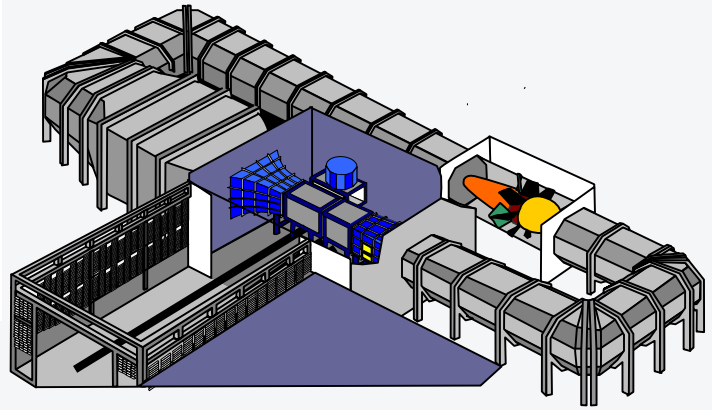


The biggest industrial wind tunnel in Asean – Australia.

Indonesian Low Speed Tunnel (ILST)

Max speed : 400 km/hr

Test section: 4m x 3m x 10m



WIND TUNNEL TEST HOURS

Market data

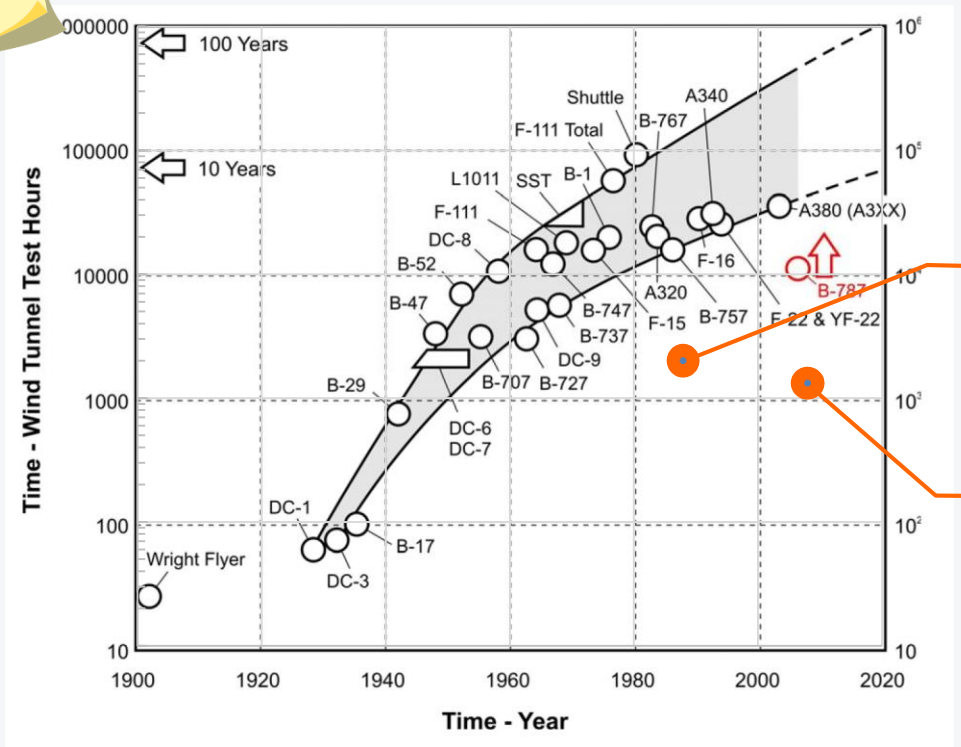


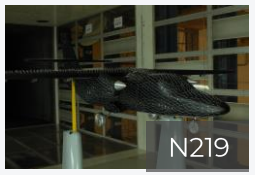
Fig. Peran terowongan angin dalam rancang bangun, riset dan pengembangan pesawat udara (Baals & Corliss, 1981; Rasuo 2012)

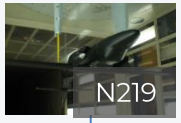
IPTN: N250
1987-1995: 2000 polars lebih

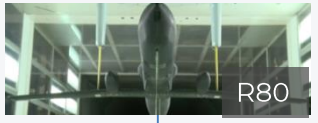
Turkish Aerospace: ANKA (MALE) 2008-2016: 1314 polars

PERIODE 2008-2017

Experience







2008 2009 2010 2011 2012 2013 2014 2015 2016 2017

KEGIATAN UJI BBTA3 2018

Experience




kompressor di anechoic chamber

N219 AMPHIBI

Awal Kegiatan

Pylon Jembatan

Aerodinamika mobil

YFYK ANKA2...

R-122:2

R-80 isolated...

Akhir Kegiatan

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

Perawatan dan Pemeliharaan

Kebisingan atap galvalum

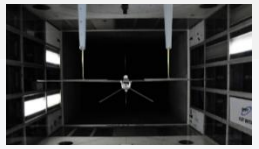
CN-235 FTB

Kebisinga...

R-122:1

Rudal PTIPK BPPT

MALE Konsorsium

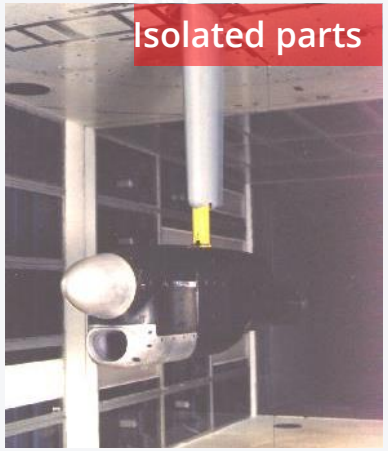


Pengujian Grille


KESIAPAN TEST R-80

ENGINE OFF

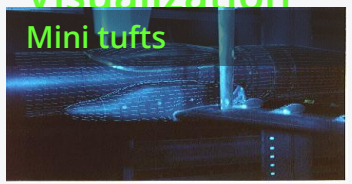
ENGINE

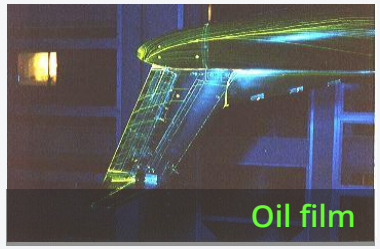


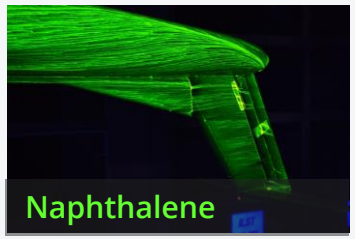
16

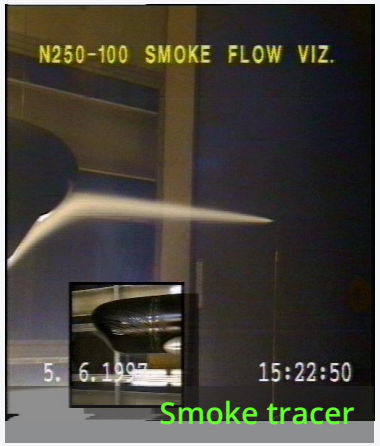
KESIAPAN TEST

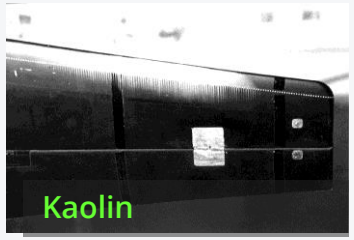
Flow Visualization



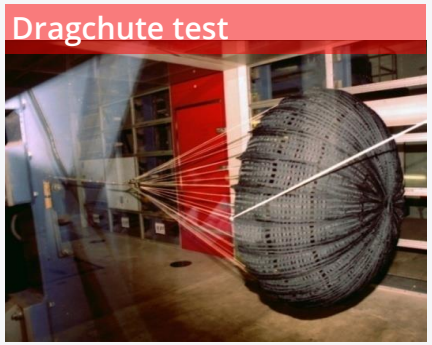








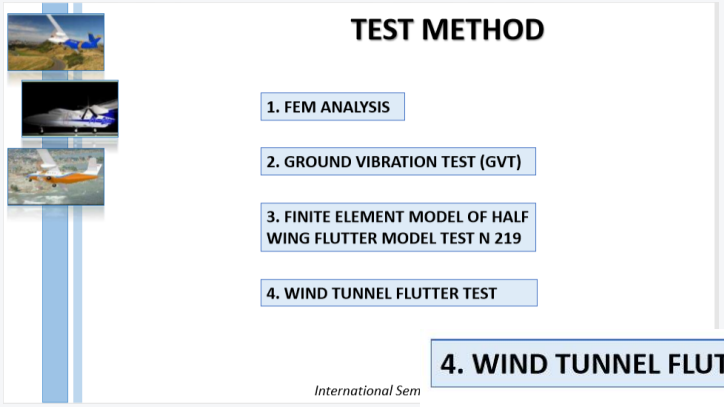
Particular tests



17

Perhitungan dan Analisis

- Flutter test N-219 (Perhitungan FEM, Ground Vibration Test, Wind Tunnel Test)

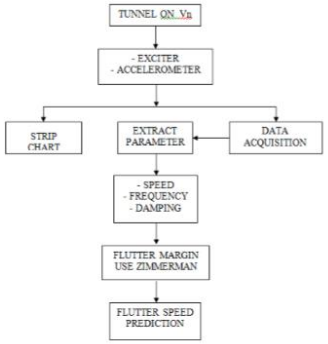


Accelerator No	Coordinate			DOF
	X	Y	Z	
1	0.001	0.277	0.004	Z
2	0.166	0.277	0.004	Z
3	0.458	0.277	0.004	Z
4	0.014	0.782	0.034	Z
5	0.150	0.782	0.034	Z
6	0.390	0.782	0.034	Z
7	0.023	1.162	0.057	Z
8	0.137	1.162	0.057	Z
9	0.338	1.162	0.057	Z
10	0.032	1.542	0.080	Z
11	0.125	1.542	0.080	Z
12	0.287	1.542	0.080	Z

Section	Weight (kg)			Center of Gravity (m)			Moment of Inertia (kg Sq.m)					
	Beam	Segment	Total	X	Y	Z	Ixx	Iyy	Izz	Ixy	Ixz	Iyz
SECTION 0	0.136	0.000	0.136	1.206	0.066	0.621	2.034E-04	1.021E-05	2.079E-04	-1.486E-06	9.071E-10	1.599E-07
SECTION 1	0.086	0.374	0.460	1.213	0.174	0.628	3.862E-04	4.000E-03	4.000E-03	-6.074E-07	-7.217E-07	9.413E-05
SECTION 2	0.118	0.315	0.433	1.210	0.276	0.630	5.909E-04	3.000E-03	3.000E-03	2.225E-05	-1.459E-05	7.408E-05
SECTION 3	0.142	1.181	1.323	1.104	0.416	0.608	3.000E-03	2.400E-02	2.400E-02	2.167E-05	-1.229E-04	-2.000E-03
SECTION 4	0.148	0.350	0.498	1.199	0.589	0.645	2.000E-03	3.000E-03	4.000E-03	6.079E-05	-4.504E-05	6.882E-05
SECTION 5	0.127	0.332	0.459	1.193	0.779	0.655	1.000E-03	2.000E-03	4.000E-03	6.377E-05	-4.185E-05	5.732E-05
SECTION 6	0.108	0.302	0.410	1.197	0.968	0.666	1.000E-03	2.000E-03	3.000E-03	5.732E-05	-3.769E-05	4.533E-05
SECTION 7	0.090	0.262	0.352	1.180	1.158	0.676	1.000E-03	1.000E-03	2.000E-03	4.942E-05	-3.252E-05	3.367E-05
SECTION 8	0.074	0.234	0.308	1.174	1.347	0.686	9.084E-04	1.000E-03	2.000E-03	4.337E-05	-2.859E-05	2.548E-05
SECTION 9	0.047	0.216	0.263	1.168	1.527	0.695	6.228E-04	7.559E-04	1.000E-03	3.097E-05	-5.301E-06	1.879E-05
Total Half Wing Flutter Model N219	1.076	3.567	4.643	1.168	0.653	0.641	7.930E-01	5.300E-02	8.330E-01	4.900E-02	6.000E-03	-4.000E-03

4. WIND TUNNEL FLUTTER TEST

The test model is valid to use on wind tunnel flutter test after confirmed through GVT and validation tests.



Procedure of Wind Tunnel Flutter Test

The half wing model in wind tunnel

SHORT RANGE UAV MODELs

Wulung
Scale 1:2
Re 5.5×10^5

Bilangan Re# 650K (full scale Re#) @V 5m/s. Skala 1:1.6. Landing gear unretractable.

Alap-alap
Scale 1:1
Re 6×10^6

Indonesia Low Speed Tunnel

Model for MALE UAV

Configuration 1

Bilangan sd Re# 750K @ 70 m/s. Skala 1:5

Konfigurasi-1 rancangan awal tanpa bidang control, tanpa HLD, profil sayap konvensional, fuselage bentuk awal, sudut V tail awal,
Konfigurasi-2 ada bidang control dan HLD untuk uji stabilitas dan kinerja, profil laminar flow airfoil, modifikasi fuselage, modifikasi sudut ekor
Konfigurasi-3 modifikasi ekor, menambahkan kamera, landing gear, intake engine

Indonesian MALE UAV Program
(Consorsium of multi institution)
Re 6.0×10^5
118 POLAR of Configuration 3

Indonesia Low Speed Tunnel

BBTKS (LUK)

LABORATORIA UJI PENDUKUNG INDUSTRI DIRGANTARA

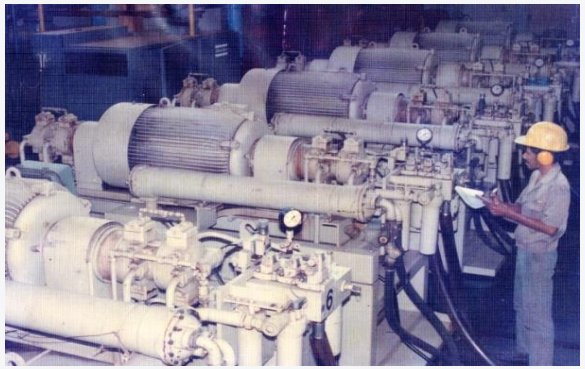
Uji Kekuatan Struktur

- Keputusan Kepala BPPT No.214/KA/BPPT/XI/84 tanggal 9 November 1984
- LUK telah melakukan uji konstruksi pesawat CN235 secara full scale untuk fatigue test pada struktur CN235

Uji Kekuatan Struktur di Laboratory Facility

Structural Strength Technology

Test hall – Strong Floor : (40 x 40) m



Hydraulic Power Pack for Actuator driving

Aircraft Static Test

Specific Rig for Automotive Komponen Test

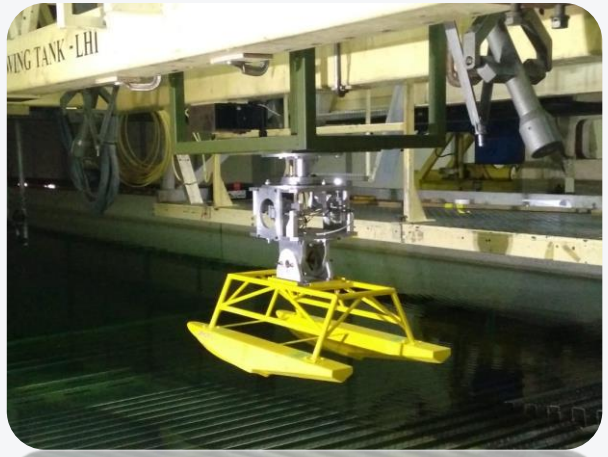
Automobile Test Rig

Rubber Fender Static Test

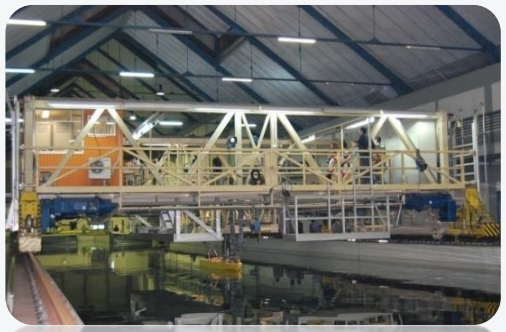
Universal Rig

BALAI TEKNOLOGI HIDRODINAMIKA (BTH)

LABORATORIA UJI PENDUKUNG INDUSTRI DIRGANTARA



FASILITAS PENGUJIAN di BTH



1. Towing Tank

- L = 234.5 m ; W = 11 m ; D = 5.5 m
- Model test s/d 9 m, Kecepatan Carriage ~ 6 m/s
- Jenis Pengujian: Resistance, Self Propulsion Test, Open Water Test, Hydrodynamic Forces & Movement Measurement, Planar Motion Experiment

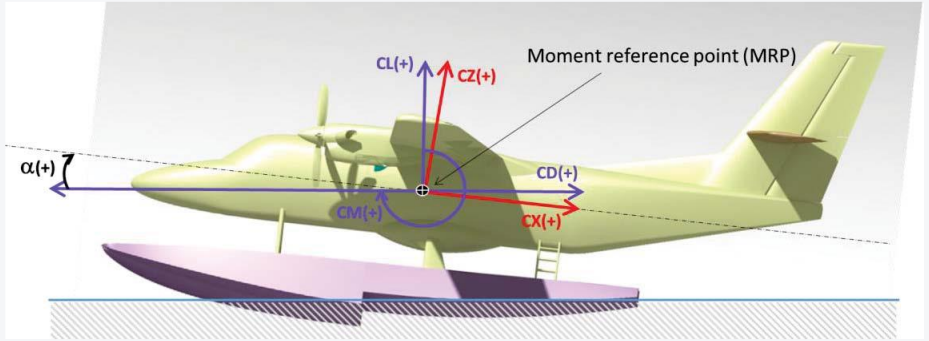
2. Moneouvring Ocean Basin

- L = 60 m ; B = 35 m ; D = 2.5 m
  L = 45 m ; B = 35 m ; D = 1.25 m
- Kecepatan carriage s/d 1.8 m/s
- Jenis Pengujian: Monoevering Test, Seakeeping Test, Offshore Structure, Transport & Launching , Installation Tests, Mooring Tests

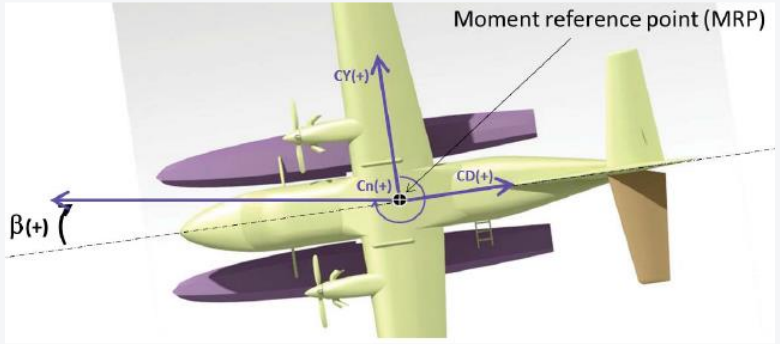
3. Cavitation Tunnel

- Spesifikasi model propeller diameter s/d 300 mm, Variable kecepatan dan tekanan, putaran 30 – 1500 RPM
- Test Section: 0.85m x 0.85m x 4m
- Jenis Pengujian: Cavitation Observation Tests, Cavitation Inception Tests, Propeller Performance Tests, Hull Pressure Fluctuation Test, Force Torque Measurements

Uji Hidrodinamika Floater N219AV



Source: PT DI



Source: PT DI

Gaya dan Momen yang akan diukur dan ditransformasikan pada titik MRP antara lain:

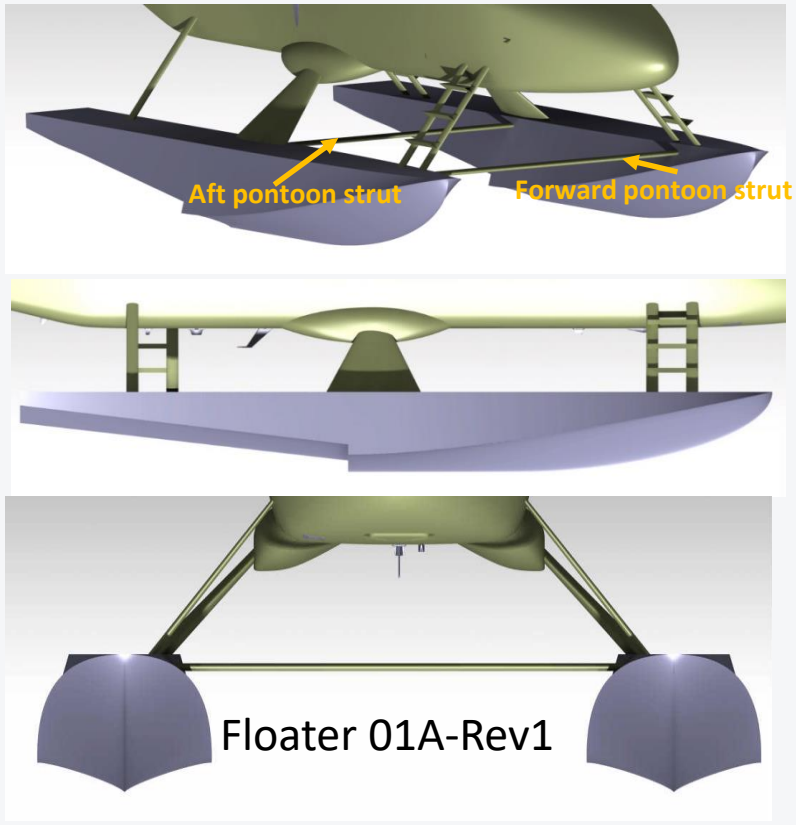
- ❑ Lift Coefficient (CL-t)
- ❑ Drag Coefficient (CD-t)
- ❑ Pitching Moment Coeff. (CL-t)
- ❑ Side force Coeff. (CY-t)
- ❑ Rolling moment Coeff. (Cl-t)
- ❑ Yawing Moment Coeff. (Cn-t)
- ❑ Velocity (V-t)
- ❑ Hull trim angle (Trim-t)

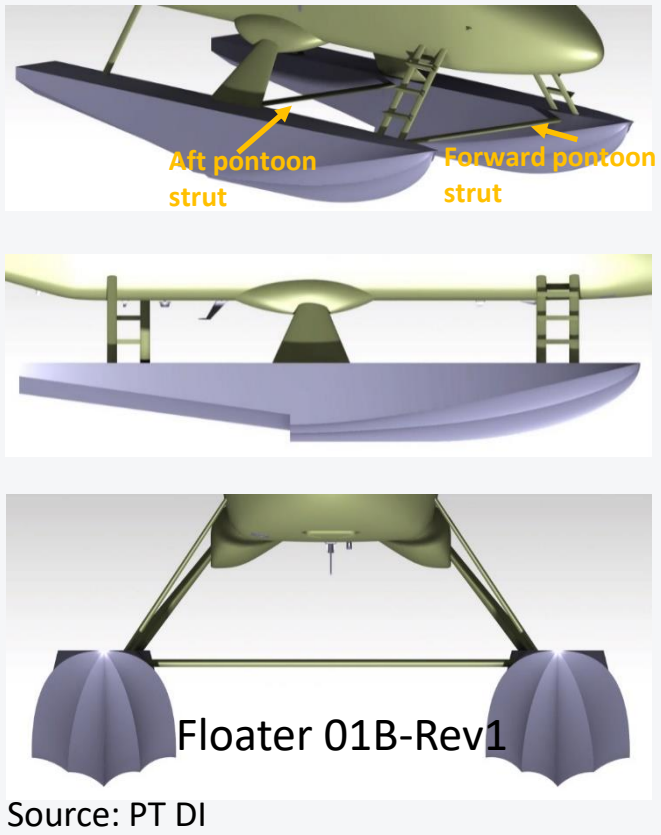
Alat Ukur:

- ❑ Kecepatan carriage (m/s)
- ❑ 6 DOF (Fx, Fy, Fz, Mx, My,Mz)
- ❑ Pengukur sudut trim (deg)
- ❑ Pengukur gerak heave (mm)

Source: BTH

Uji Hidrodinamika Floater N219AV





Source: PT DI

Ada 2 buah model floater akan diuji di kolam uji Towing Tank
Kecepatan pengujian model maksimum: 6 m/s

Source: BTH

Diskusi

Dukungan BPPT dalan Inovasi Teknologi Bidang Kedirgantaraan:

- Fungsi Uji Lab Struktur, Aerodinamika, Hidrodinamika
- Perhitungan dan Analisis
- Rekomendasi dalam pengembangan berdasarkan hasil uji sebagai iterasi dalam desain atau pengembangan produk berikutnya

Proses Rancang Bangun dan Rekayasa:

- Upaya penguasaan menyeluruh dari produk inovasi teknologi
- Sebagai penggerak untuk meningkatkan TKDN produk teknologi

TERIMA KASIH

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